

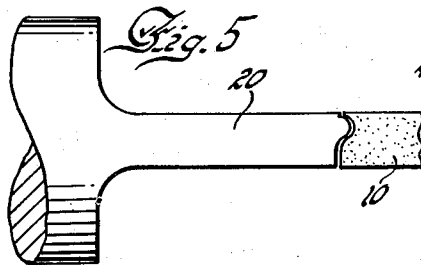
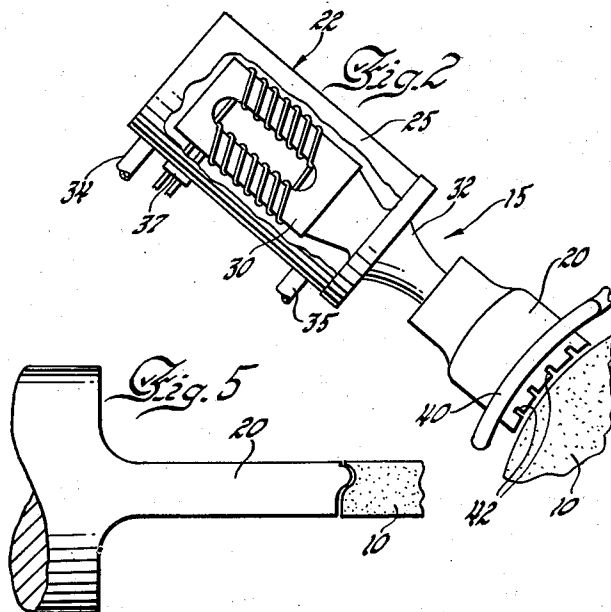
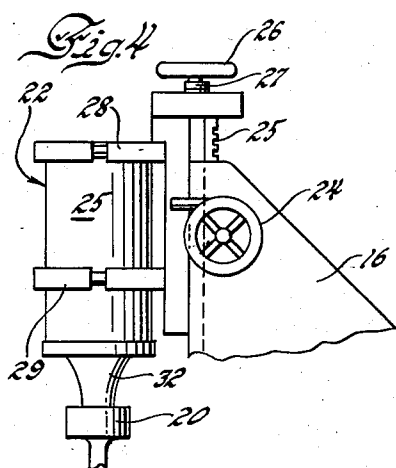
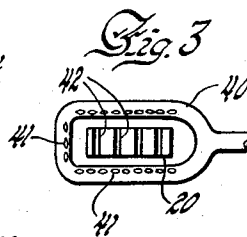
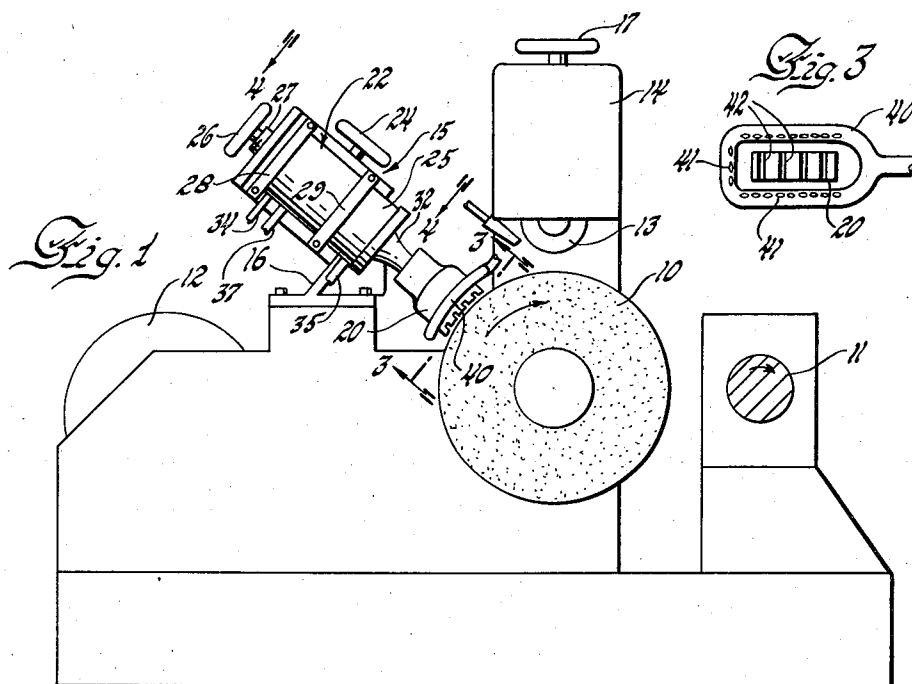
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J. J. LUTHMAN ET AL

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MACHINE TOOL DEVICE

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INVENTORS
James G. Duthman
Richard N. Roney
BY Ernest J. NY
ATTORNEY

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MACHINE TOOL DEVICE

James J. Luthman and Richard N. Roney, Dayton, Ohio,
assignors to The Sheffield Corporation, Dayton, Ohio,
a corporation of Delaware

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8 Claims. (Cl. 51—267)

This invention relates to grinding devices and, more particularly, to an apparatus for application to the surface of grinding wheels.

It is an object of this invention to provide an apparatus for improving the operating efficiency of grinding wheels and the like and increasing the effective service life thereof.

It is a further object to provide an apparatus for removing work material from the operating surface of a grinding wheel or the like during rotation or movement thereof to increase the effective work material removal rate of the wheel and improve its operating characteristics.

It is a further object to provide such an apparatus wherein an operating member is oscillated at high frequencies and minute amplitudes while in close association with the wheel surface at an area flooded with a liquid, whereby, through cavitation effects within the liquid and between the operating member and wheel, work material is removed from between the abrading grains of the wheel so as to clean the entire operating surface of the wheel and improve or maintain the operating characteristics thereof.

Other objects and advantages of the invention will be apparent from the following description, the appended claims and the accompanying drawing, in which,

Figure 1 illustrates an exemplary grinding machine including an apparatus embodying the present invention,

Figure 2 is an enlarged illustration of a portion of Figure 1 with the housing of the driving unit of the apparatus partially broken away,

Figure 3 is a fragmentary illustration of the liquid supply means taken generally on line 3—3 of Figure 1,

Figure 4 is a view taken on line 4—4 of Figure 1, and

Figure 5 illustrates the edge of the operating member and a fragment of the grinding wheel periphery.

While the present invention is capable of wide application and embodiment in other forms, an exemplary application and apparatus is illustrated as applied to the removal of work material from the periphery of a grinding wheel in a cylindrical grinder.

Grinding wheels during operation accumulate particles of material from the work between the abrasive grains of the wheel. This accumulation, or "loading-up" decreases materially the effectiveness of the wheel because it reduces the effective projection and sharpness of the grains in the wheel surface. This condition occurs in all grinding operations but especially where porous wheels and soft work materials are involved. No method of fully restoring the grinding wheel surface to its optimum effectiveness except by removing the loaded surface by dressing away a portion of the wheel is thought to have been previously employed.

With the present invention an operating member oscillating at high frequencies and minute amplitudes in association with a liquid flooding the wheel surface produces concentrated cavitation along the surface to be treated. In the exemplary application shown an operating member conforming to a portion of the wheel periphery is oscil-

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lated generally toward and from the wheel surface at ultrasonic frequencies to produce intense cavitation in the close spacing between the member and wheel. The violent collapse of the vacuous pockets formed within the liquid due to the intense cavitation provided by the present invention provides energy and agitation for removal of work material from the wheel surface without decreasing the effectiveness of the abrasive grains themselves.

Referring more particularly to the drawing, the exemplary grinding machine illustrated in Figure 1 includes a grinding wheel 10 rotated in a clockwise direction for removing material from a workpiece 11 driven clockwise during operation of the machine. An electric motor mounted at 12 serves to rotate the grinding wheel. A dressing unit 14 for forming the wheel surface includes a formed crushing roller 13 movable into pressure engagement with the wheel surface by a handwheel 17 in this application.

An apparatus 15 embodying the present invention is mounted by a support 16 on the base of the machine. The exemplary illustrated unit includes an operating member 20 conforming arcuately to a portion of the grinding wheel periphery and transversely to the wheel form (see Figure 5). A driving unit 22 which supports and drives member 20 is carried on support 16 for adjustment relative to the periphery of wheel 10. Hand-wheel 24 operates through rack 25' for rapid advancing and retracting of member 20, and hand-wheel 26 through screw 27 provides a slow adjustment.

The driving unit 22 includes a housing 25 clamped at 28 and 29 to the adjustable support. Housing 25 encloses a magnetostrictive transducer 30 attached through connecting body 32 to operating member 20. A cooling liquid is supplied through conduit 34 to housing 25 and is exhausted through conduit 35. An electrical connection is provided at 37 for transducer 30 for excitation thereof for oscillation of member 20 at ultrasonic frequencies and through minute amplitudes toward and from the surface of wheel 10.

The operating surface of member 20 can be readily shaped to an exact duplicate of the wheel surface by grinding tool 20 with the formed wheel while ultrasonically driving the tool.

A portion of the periphery of wheel 10 at one side of the wheel axis between the operating surface of member 20 and the wheel is flooded with a liquid, preferably the work coolant fluid, supplied through conduit means 40. This conduit means has openings 41 surrounding the operating area for full flooding thereof. Passage means are provided through the operating surface of member 20 to insure that the area between this surface and the wheel periphery is fully flooded with liquid. As illustrated, these passage means are provided by transverse slots 42 across the operating surface of the member.

During operation, through adjustments 24 and 26, the operating surface of member 20 is placed in close association with a portion of the periphery of wheel 10. Spacings of a few thousandths of an inch have been found most advantageous. For example, in one use the clearance was maintained so that the operating surface of member 20 came no closer than one or two thousandths of an inch to the surface of the wheel driving operation. Through energization of transducer 30 and the high frequency oscillations of member 20, intense cavitation of the liquid supplied through conduit means 40 between the operating surface of member 20 and the wheel periphery is effected. Due to the intense energy and agitation provided through the cavitation work material is effectively removed from between the abrasive grains of the operating surface of the wheel and, as the wheel rotates relative to member 20, the desired surface is treated.

Thus, it is seen that an apparatus has been provided for improving the efficiency of grinding wheels or the like in a non-destructive manner and during their movement or rotation. The intense cavitation effect provided insures proper treatment of the wheel surface with most effective grinding operations resulting.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention, which is defined in the appended claims.

What is claimed is:

1. An apparatus for removing work material from between the abrading grains of a grinding wheel or the like, comprising supply means for flooding at least a portion of the wheel surface with liquid, an operating member in association with said liquid and closely spaced relative to the wheel surface to be treated, and a high frequency drive unit connected to said member for oscillation thereof at high frequencies and minute amplitudes relative to said liquid and to the wheel surface to cause cavitation of the liquid along the wheel surface being treated in the close spacing between member and wheel for removal of work material from the wheel surface.

2. Apparatus for removing work material from between the abrading grains of a grinding wheel or the like during rotation thereof, comprising conduit means for flooding a portion of the wheel surface at one side of the axis of rotation thereof with liquid, an operating member for location in close association with the wheel surface at the flooded area, a drive unit connected to said member for oscillation thereof toward and from the surface being treated at high frequencies and minute amplitudes, whereby cavitation of the liquid between the member and the wheel surface occurs for work material removal and the desired surface is progressively treated during wheel rotation.

3. Apparatus for removing work material from between the abrading grains of a grinding wheel or the like during rotation thereof comprising an operating member having a surface conformed to the configuration of the effective grinding surface of the wheel at one side of the axis thereof, means mounting said member closely adjacent the wheel surface, a drive unit connected to said member for oscillation thereof relative to the wheel surface at high frequencies and minute amplitudes at the area of material removal, conduit means in association with said area for supplying liquid thereto, said mounting

means including adjustable means for relatively positioning the wheel and member to maintain a desired minute clearance therebetween during operation of the member.

4. Apparatus for removing work material from between the abrading grains of a grinding wheel or the like during rotation thereof comprising conduit means for flooding an area of the wheel periphery at one side of the axis of rotation thereof with liquid, an operating member conformed arcuately to a portion of the wheel periphery and to the general transverse configuration of the operating portion thereof, a driving unit connected to said member for oscillation thereof at high frequencies and minute amplitudes toward and from the wheel surface, and support means carrying said unit and member disposing said member with a minute clearance relative to the wheel periphery at the flooded area for concentrated cavitation of the liquid between the member and area for progressive removal of material from the wheel periphery as the wheel is rotated.

5. An apparatus as set forth in claim 4 wherein said support means includes adjustable means for maintaining a predetermined close spacing between the member and wheel periphery.

6. An apparatus as set forth in claim 4 wherein the operating surface of said member has liquid conducting passage means therein for full flooding of the space between the member and wheel.

7. An apparatus as set forth in claim 6 wherein said passage means are provided by grooves across the operating surface of the member.

8. Apparatus for removing work material from between the abrading grains of a grinding wheel or the like during rotation thereof comprising an operating member having an operating surface conformed to a portion of the wheel periphery at one side of the axis of rotation thereof, a magnetostrictive transducer connected to said member for oscillation of the operating surface thereof toward and from the wheel surface at ultrasonic frequencies and through minute amplitudes, liquid supply means for supplying a liquid between said operating surface and the wheel periphery during rotation of the wheel relative to the member, and support means for said transducer and member supporting said operating surface with a minute clearance relative to the wheel periphery, whereby work material is progressively removed from the wheel in a non-contact manner through intense cavitation between the operating surface and wheel as the wheel rotates.

No references cited.