

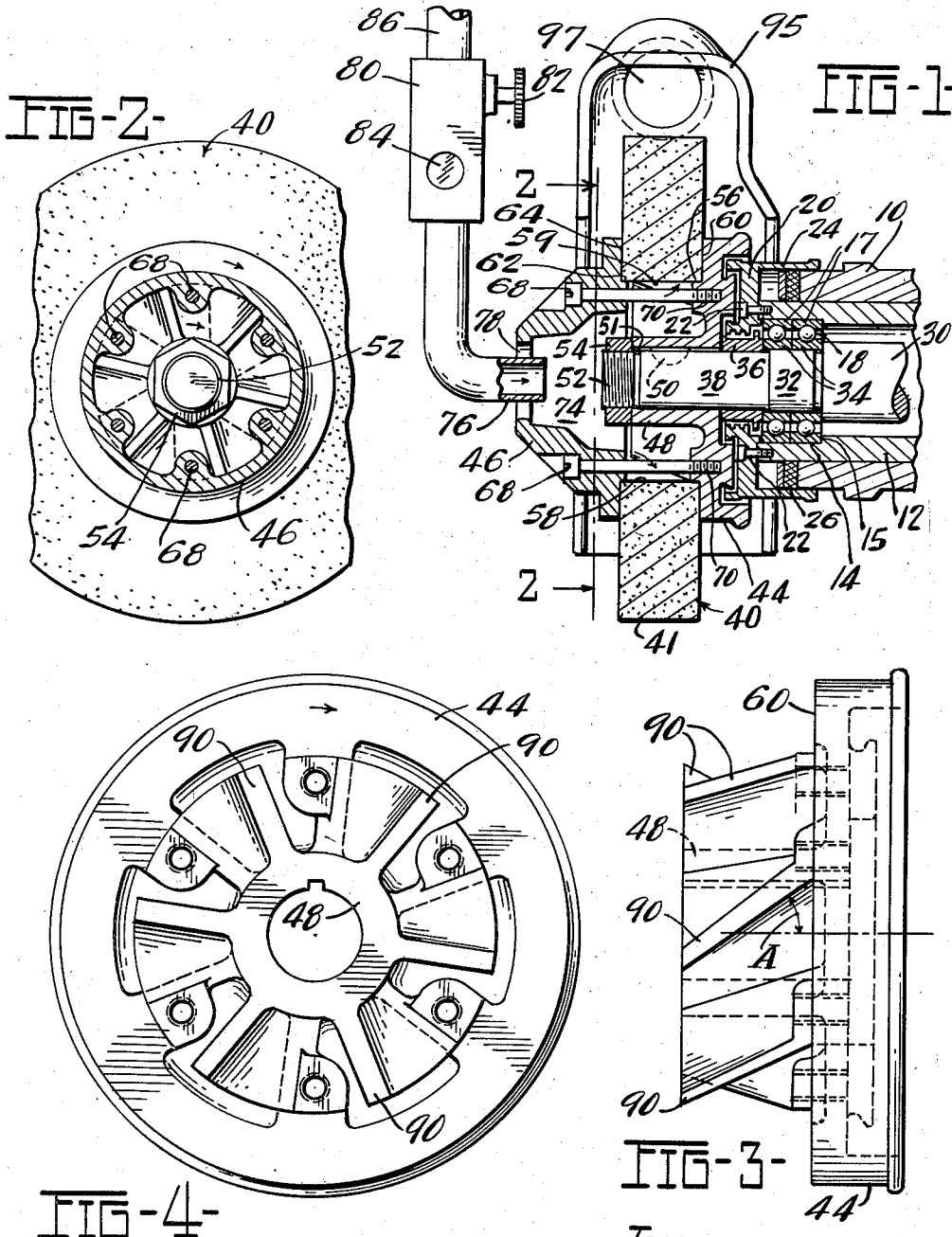
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C. L. GARRISON

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COOLING SYSTEM AND APPARATUS FOR ABRASIVE WHEELS

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INVENTOR:
CLIFFORD L. GARRISON.
BY *Harry O. Ensbarger*
ATTY.

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COOLING SYSTEM AND APPARATUS FOR ABRASIVE WHEELS

Clifford L. Garrison, Adrian, Mich., assignor to Oliver
Instrument Company, Adrian, Mich., a corporation of
Michigan

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This invention relates to a method and arrangement for cooling an abrasive or grinding wheel and more particularly to a system and means of cooling a grinding or abrasive wheel through the delivery of a cooling liquid through the body of the wheel during its rotation.

It has been a usual practice to endeavor to cool a rotating grinding or abrasive wheel through the projection of a stream of cooling liquid such as water against the exterior grinding or abrasive surface of the wheel. Cooling arrangements of this character require comparatively large quantities of water directed against the periphery of the wheel resulting in considerable splashing and ineffective control of the distribution of the water over the periphery of the wheel.

Arrangements have been proposed and utilized to some extent wherein a stream of water or other cooling liquid is introduced axially of the grinding or abrasive wheel wherein centrifugal force of rotation of the wheel moves the liquid radially and outwardly through a limited area of the body of the wheel. An arrangement of this character is shown in applicant's Patent No. 2,560,944 granted July 17, 1951.

The present invention is an improvement upon the arrangement disclosed in applicant's prior patent. In the disclosure of this patent, the water or liquid is introduced axially of the wheel into a chamber adjacent the median plane or central region of the grinding wheel, the centrifugal forces of rotation moving the liquid outwardly through openings in the hub structure of the wheel. In this arrangement it is found that the liquid effectively moves radially outwardly to the peripheral surface of the wheel but that the liquid does not spread laterally of the median plane of the openings but moves in a planar path in a radial direction without any spreading, dispersion or diffusion of the liquid laterally of the median plane in which the liquid is delivered into contact with the inner circular region of the wheel hub. Thus in practical use of the arrangement shown in applicant's patent, the central region of the wheel receives an ample supply of water or cooling liquid at the periphery but no liquid appears at either side of the central region of the wheel at the periphery.

The present invention embraces a system and arrangement wherein a cooling liquid delivered into an axial region of the wheel structure and its support and is caused to be moved axially of the wheel and concomitantly outwardly and radially in a manner distributing the cooling liquid through substantially the entire cross sectional areas or regions of the wheel whereby the cooling liquid reaches the periphery of the wheel throughout the entire area thereof.

Another object of the invention is the provision of an

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arrangement wherein the cooling liquid is moved both axially and radially of the wheel substantially uniform distribution of the liquid is effected throughout the entire width and depth of the wheel structure to continuously provide a uniform film of the cooling liquid throughout the entire peripheral area of grinding zone of the wheel.

Another object of the invention resides in an arrangement for cooling an abrasive or grinding wheel wherein the cooling liquid is continually introduced centrally of the wheel and dispersed substantially uniformly radially throughout the wheel so that all zones of the wheel are substantially uniformly cooled.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

Figure 1 is a longitudinal sectional view through a grinding or abrasive wheel and supporting structure illustrating an embodiment of the invention;

Figure 2 is a sectional view taken substantially on the line 2—2 of Figure 1;

Figure 3 is an elevational view of a wheel supporting component or hub structure for an abrasive wheel formed with liquid moving or distributing means, and

Figure 4 is an end view of the construction shown in Figure 3.

Referring to the drawings in detail and initially to Figure 1, an embodiment of my invention is illustrated mounted or carried upon a frame or supporting means 10. A portion of the frame is of hollow configuration in which is fixedly secured a sleeve or bushing 12 having an interior bore 14 bounded by a ledge or shoulder 15 to accommodate the outer raceways 17 of anti-friction or ball bearings 18.

The raceways 17 of the anti-friction bearings 18 are held in place by means of a member 20 secured to the end of the sleeve by means of bolts 22. The bearing race retaining member 20 is formed with a projecting sleeve portion 24 which telescopes with an end portion of the frame 10, a sealing gasket 26 being disposed in the space between the exterior surface of the sleeve 12 and the interior surface of the sleeve portion 24 of the bearing retainer 20.

The grinding wheel construction is supported upon a shaft, arbor or spindle 30 adapted to be rotated by a motor (not shown). The spindle or shaft 30 is formed with a portion 32 of reduced diameter on which is snugly fitted the inner raceways 34 of the anti-friction bearings 18. A collar 36 surrounding a portion 38 of the shaft 30 engages one of the raceways 34 to hold both raceways 34 in proper position on the shaft.

The grinding or abrasive wheel 40 may be of conventional construction being molded or formed of grains or particles of abrasive material held together by a suitable binder. It is to be understood that any suitable form or type of abrasive or grinding wheel of a porous nature may be satisfactorily used with the invention.

The grinding wheel 40 is supported by a hub construction composed of two principal components or members 44 and 46. The rearmost member 44 is formed with a sleeve portion 48 which is snugly fitted upon the portion

38 of the supporting shaft or spindle 30 and is secured on the shaft through the medium of a key 50 extending into a keyway 51 formed in sleeve 48. The end region 52 of the shaft is threaded to receive a securing nut 54 for holding the collar 36 and the member 44 in fixed driving relation on the shaft 30.

The member 44 is formed with a circular ledge or shoulder 56 engaging an interior surface or bore 58 of the grinding wheel 40, the member 44 having an annular surface 60 engaging a side region of the grinding wheel 40. The other supporting component 46 of the grinding wheel hub construction is formed with a shoulder portion 62 engaging the interior surface 58 of the grinding wheel and an annular surface 64 engaging the opposite side region of the grinding wheel.

The components 44 and 46 of the wheel hub construction are secured together by means of bolts 68 extending through openings formed in the member 46 and having threaded extremities 70 extending into threaded openings formed in the hub component 44.

When the bolts 68 are drawn into position, the hub members 44 and 46 are held in snug engagement with the grinding wheel 40 to support the same for rotating movement about the axis of the wheel supporting shaft 30.

The hub member 46 is formed interiorly with a chamber 74 into which a coolant such as water or other liquid is delivered through a pipe, tube or conduit 76 extending through an opening 78 formed in the foremost portion of the hub member 46. The coolant delivery tube 76 is relatively stationary and is connected with a valve housing 80 provided with a manually controlled valve 82 for regulating the rate of delivery of coolant or liquid to the grinding wheel, the valve housing 80 being provided with a sight opening 84 through which the rate of feed of the liquid may be visually observed. The valve housing 80 is connected by means of a tube or duct 86 with a supply of water or other coolant liquid.

The invention is inclusive of means formed on one of the grinding wheel supporting means or hub members for moving or propelling the coolant or liquid axially of the grinding wheel and its supporting shaft at the same time that centrifugal forces of rotation are acting upon the coolant or liquid to propel or project the coolant radially through the interstices or porous structure of the grinding wheel. It should be noted that the flanges defining the shoulders 56 and 62 on the hub members 44 and 46 respectively are of short length in an axial direction of the wheel so as to provide that substantially the entire circular surface area of the interior surface 58 of the grinding wheel may receive coolant or liquid propelled radially through the wheel by centrifugal forces.

As particularly shown in Figures 3 and 4 the hub component 44 is formed with circumferentially arranged or spaced blades, vanes or coolant propelling means 90. In the embodiment illustrated the vanes or blades 90 are integrally formed with the hub component or member 44, being moulded or joined with the sleeve portion 48 as shown in Figure 4. As illustrated in the drawings, the blades, vanes or members 90 extend outwardly radially of the sleeve portion 48 and are arranged askew or in a generally spiral angle or angular relation to the axis of rotation of the hub member 44. During operation of the grinding wheel, the same is rotated together with the hub components 44 and 46 in a clockwise direction as viewed in Figure 4 whereby the coolant or liquid delivered into the chamber 74 is drawn or propelled axially of the member 44 in a right-hand direction as viewed in Figure 3.

In the embodiment illustrated, the vanes or blades 90 are askew or angularly arranged with respect to the axis of rotation of the hub member at an angle A (indicated in Figure 3) of about 40°. It is to be understood however that the angle or angular position of the vanes 90 with respect to the axis of rotation may be varied dependent upon the speed at which the grinding wheel and

hub supporting structure is to be rotated to secure the most satisfactory axial movement or distribution of the coolant or liquid over the width of the space 59 defined between the shoulder portion 56 and 62 determining the available surface area 58 of the grinding wheel arranged to receive the liquid moving outwardly by centrifugal forces. The peripheral surfaces of the vanes 90 are concentric with the axis and of a diameter to snugly fit the central opening in the wheel 40 providing additional support for the wheel.

During the operation of the arrangement, the grinding wheel and hub supporting structure carried by the shaft 30 are rotated at the desired speed to effect grinding operations and are rotated in a direction whereby the coolant or liquid delivered into the chamber 74 from the tube 76 is drawn in a right-hand direction as viewed in Figures 1 and 3 at the same time that centrifugal forces of rotation are acting or influencing the liquid or coolant to move outwardly and radially from the blades or vanes 90 through the grinding wheel 40 throughout the entire width of the surface area of the grinding wheel.

Due to the askew position of the vanes 90 relative to the axis of rotation, the liquid moving from chamber 74 into the region of the vanes is subjected to compound forces viz. the axial movement caused by rotation of the vanes and the centrifugal forces acting to propel the liquid radially outwardly. As a result of these forces, the liquid is continuously propelled outwardly throughout the full lengths of the vanes 90 and dispersed through the wheel 40.

The cooling liquid is exuded throughout substantially the entire peripheral surface 41 of the wheel 40. In this manner the wheel is cooled uniformly and irrespective of the region of engagement of the work with the grinding wheel. Cooling of the work is effected through the film of water or coolant at the surface 41 of the wheel and the outwardly moving mist or particles of water thrown from the periphery of the wheel during its rotation.

While the angularly arranged vanes or blades 90 are illustrated as carried by or integrally formed with the rearmost hub component 44 of the wheel supporting construction, it is to be understood that the vanes or blades may be carried by or formed upon the hub component 46 or may be formed on a separate member and carried by the shaft 30 or one of the hub members.

A housing or shroud 95 may be provided partially surrounding the grinding wheel and forming a guard therefor. The housing or wheel enclosure 95 may be connected by a conduit 97 with a suction blower or source of subatmospheric pressure whereby the mist or particles of liquid thrown from the grinding wheel are conveyed away from the region of the grinding wheel.

From the foregoing it will be apparent that I have provided a simple, yet effective means and arrangement for accomplishing substantial uniform distribution or dispersion of coolant liquid such as water throughout all regions, areas or zone of a grinding wheel.

I claim:

1. In combination with a shaft journalled for rotation on a support, a hub member carried by the shaft, a grinding wheel associated with the hub member, a plurality of projections on the member disposed in angular relation to the axis of the shaft, means for delivering a liquid cooling medium into the region of the projections whereby during rotation of the projections the liquid cooling medium is moved axially of the member by the projections and radially thereof through the grinding wheel under the influence of centrifugal forces.

2. In combination with a shaft journalled for rotation on a support, a hub member mounted upon the shaft, a grinding wheel carried by the hub member arranged to be rotated by the shaft, a plurality of vanes on the member disposed at acute angles relative to the axis of the shaft, means for delivering a liquid cooling medium into the region of the vanes whereby during rotation of the

vanes the liquid cooling medium is moved axially of the member by the vanes and outwardly thereof by centrifugal forces throughout substantially the full width of the wheel.

3. In combination with a shaft journalled for rotation on a support, a hub member mounted upon the shaft, a grinding wheel associated with the member, a plurality of radially extending vanes on the member disposed at generally spiral angles relative to the axis of the shaft, means for delivering a liquid cooling medium into the region of the vanes whereby during rotation of the vanes the liquid is moved axially of the member by the radially extending, spirally disposed vanes and outwardly thereof by centrifugal forces through the grinding wheel.

4. In combination with a shaft journalled for rotation on a support, a hub structure carried by the shaft, a grinding wheel formed with a central opening supported on the hub structure for rotation about the axis of the shaft, said hub structure including a pair of members, one of said members being mounted on the shaft, means securing the members together, means including a tube arranged to deliver a cooling liquid into the region of the hub structure, and a plurality of radially extending spiral vanes associated with one of said members and disposed in the opening in the wheel adapted to move the liquid longitudinally of the axis of the shaft and concomitantly therewith centrifugal forces of rotation propelling the longitudinally moving liquid outwardly through substantially the entire grinding wheel to cool the same.

5. In combination, a shaft journalled for rotation on a support, a grinding wheel arranged to be rotated by the shaft and having a central opening formed therein, a hub structure carried by the shaft, said hub structure being secured to and directly supporting the grinding wheel, a plurality of vanes disposed in the opening in the wheel and rotatable with the wheel, said vanes being angularly arranged relative to the axis of the wheel, means for delivering a cooling liquid in the region of the vanes, the rotation of the vanes moving the liquid lengthwise of the shaft and centrifugal forces of rotation changing the direction of movement of the liquid and propelling the liquid outwardly through the grinding wheel, and means for regulating the rate of delivery of liquid into the region of the vanes.

6. In combination, a shaft journalled for rotation on a support, a grinding wheel adapted to be rotated by the shaft, a hub structure for the grinding wheel carried by the shaft, said hub structure being secured to the grinding wheel, a plurality of blades associated with the hub structure, said blades being angularly arranged relative to the axis of the shaft, means for delivering a cooling liquid in the region of the blades, the rotation of the hub structure and blades moving the liquid lengthwise of the shaft and centrifugal forces of rotation changing the direction of movement of the liquid and expelling the liquid outwardly through substantially the entire width of the grinding wheel.

7. In combination, a shaft journalled for rotation on a support, a grinding wheel adapted to be rotated by the shaft, a hub structure carried by the shaft, said hub structure being secured to and directly supporting the grinding wheel, a plurality of vanes associated with the hub structure, said vanes being angularly arranged relative to the axis of the shaft, means for delivering a cooling liquid in the region of the vanes, the rotation of the hub structure and vanes moving the liquid lengthwise of the shaft and centrifugal forces of rotation changing the direction of movement of the liquid and propelling the liquid outwardly through substantially the entire width of the grinding wheel, and means for regulating the rate of delivery of liquid into the region of the vanes.

8. In combination, a shaft journalled for rotation on a

support, a grinding wheel arranged to be rotated by the shaft having a central opening formed therein, a hub structure carried by the shaft, said hub structure including a pair of members, a plurality of rotatable vanes disposed in the opening in the wheel, said vanes being of a dimension substantially spanning the width of the grinding wheel, said members being formed with portions engaging the side walls of the grinding wheel, means for securing the members in engagement with the grinding wheel, means including a tube adapted to deliver a stream of liquid into the region of the vanes from a supply, means for regulating the delivery of liquid to the vanes, the vanes being shaped to propel the liquid axially of the wheel, the centrifugal forces of rotation projecting the axially moving liquid in radial directions substantially throughout the width of the grinding wheel whereby the liquid is dispersed through the cross-sectional area of the grinding wheel.

9. In combination, a shaft journalled for rotation on a support, a grinding wheel arranged to be rotated by the shaft, a hub structure carried by the shaft, said hub structure including a first member, a plurality of vanes associated with the first member and being spirally disposed relative to the axis of the shaft, a second member formed with a chamber adjacent the vanes, said members being formed with portions engaging the grinding wheel, means for securing the members in engagement with the grinding wheel, said second member having an opening formed in a wall thereof, a tube extending through the opening for delivering cooling liquid from a supply into the chamber, the angularity of the spiral shape of the vanes being such that rotation of the vanes propels the liquid axially of the vanes and centrifugal forces of rotation project the axially moving liquid in radial directions substantially through the width of the grinding wheel whereby the liquid is dispersed throughout the cross-sectional area of the grinding wheel.

10. In combination, a shaft journalled for rotation on a support, a grinding wheel arranged to be rotated by the shaft, a hub structure carried by the shaft, said hub structure including a first member formed with a hollow sleeve portion receiving the shaft, a plurality of vanes formed on the sleeve portion of the first member, said vanes being of a dimension substantially spanning the width of the grinding wheel, a second member formed with a chamber adjacent the vanes, said members being formed with portions engaging the side walls of the grinding wheel, means for securing the members in engagement with the grinding wheel, said second member having an opening formed in a wall thereof, a tube extending through the opening for delivering a liquid from a supply into the chamber, the vanes being shaped whereby rotation of the vanes propels the liquid axially of the shaft and centrifugal forces of rotation project the axially moving liquid in radial directions substantially throughout the width of the grinding wheel whereby the liquid is dispersed through the grinding wheel.

11. In combination, a shaft journalled for rotation on a support, a grinding wheel arranged to be rotated by the shaft, a hub structure carried by the shaft, said hub structure including a first member formed with a hollow sleeve portion receiving the shaft, a plurality of vanes formed on the sleeve portion of the member and being spirally arranged relative to the axis of the shaft, said vanes being of a dimension substantially spanning the width of the grinding wheel, a second member formed with a chamber adjacent the vanes, said members being formed with portions engaging the side walls of the grinding wheel, means for securing the members in engagement with the grinding wheel, said second member having an opening formed in a wall thereof, a tube extending through the opening for delivering cooling liquid from a supply into the chamber, and valve means for regulating the delivery of liquid into said chamber, the angularity of the spiral configuration of the vanes being such that rotation of the vanes

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propels the liquid axially of the shaft and centrifugal forces of rotation project the axially moving liquid in radial directions substantially through the width of the grinding wheel whereby the liquid is dispersed throughout the cross-sectional area of the grinding wheel.

12. In combination, a grinding wheel construction including a circular grinding member formed of abrasive material and having an axial opening, a hub supporting the grinding member, said hub being formed with a plurality of radially extending vanes disposed in the opening in the grinding member and arranged generally in spiral

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angles relative to the axis of the hub, and means securing the hub to the grinding member.

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