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SUPPORT FOR ABRASIVE DISKS
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This invention relates to supports adapted to carry abrasive disks for surface finishing and the like and more particularly to such supports for use on power operated tools.

It is a general object of my present invention to provide an improved support for abrasive disks which promotes better wearing qualities and longer life for the supported abrasive disks by providing for the effective cooling of the abrasive disks during use.

Another object of the invention is to provide an improved support for abrasive disks comprising a somewhat flexible laminated type of abrasive disk backing structure made up of a series of relatively thin backing disks of varying diameters assembled in stepped relationship with the largest disk in position to underlie the abrasive disk and wherein the backing disks have radially and circumferentially spaced openings therein for the passage of cooling air to the back of the abrasive disk.

The invention has for another object the provision of an improved support for abrasive disks in which the abrasive disk backing members have passages therein for the flow of cooling air and a spacer is provided normally to separate the abrasive disk from the adjacent backing member when and on the side where no pressure is applied in grinding so as to further facilitate the flow of cooling air over the back of the abrasive disk.

As another object, my invention comprehends the provision of a support for abrasive disks having passages therein for the "flow of cooling air to the abrasive disk, which passages are angularly disposed in relation to the direction of movement in use to induce the flow of the air. It is also within the purview of my invention to provide a support for abrasive disks having air passages therein for the flow of cooling air to the abrasive disk and adjacent air scoops disposed for inducing the flow of the cooling air during use.

My invention further comprehends the use of air flow passages in a support for abrasive disks which are so disposed relative to one another and to the direction of motion in operation that a flow of the cooling air results.

Another object of the present invention is to provide a support for abrasive disks incorporating one or more of the features outlined thus far and incorporated in an assembly adapted to mounting as a unit.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawing in which similar characters of reference indicate similar parts throughout the several views.

Referring to the single sheet of drawings:

Fig. 1 is a top plan view of a support for abrasive disks which embodies my invention in a preferred form;

Fig. 2 is a side sectional view of the abrasive disk support shown in Fig. 1 with the section taken substantially on a line 2-2 of Fig. 1 and showing the mounting of the support relative to a driving spindle;

Fig. 3 is a fragmentary and radial sectional view of a modified form of my invention;

Figs. 4 and 5 are fragmentary and radial sectional views each indicating modifications of my invention with the sections for each taken substantially as indicated by the stepped section lines 5-5 in Fig. 7. Fig. 4 being a view of the modification shown in Fig. 3;

Fig. 6 is a fragmentary sectional view similar to Fig. 2 but illustrating a modification of my invention; and

Fig. 7 is a fragmentary plan view illustrating a portion of the abrasive disk support structure shown in Fig. 5.

In the exemplary embodiment of my invention depicted in Figs. 1 and 2, the support for abrasive disks includes a hub 10 which is adapted to be mounted in driven relation upon a projecting threaded stud 12 at the end of a driving spindle 13; the hub 10 having an axial threaded bore 16 screwed onto the stud. On its forward face the hub 10 has a relatively flat surface 15 projecting radially from an integrally formed shoulder 16. The shoulder 16 projects forwardly from the flat surface 15 and is concentric with respect to the axis of the spindle 13 and stud 12. Near the periphery an edge portion 17 of the hub is desirably rounded away from the flat surface 15.

To provide a relatively stiff but flexible backing for the outer portion of an abrasive disk, a plurality of backing disks 18, 19 and 20 of different radii are disposed in face-to-face and stepped relationship. Each of the backing disks has a central opening 22 adapted to fit over the shoulder 16. The abutment of the backing disks against the shoulder 16 not only serves to locate the backing disks concentrically with respect to the hub and spindle, but also provides reinforcement for the absorption of radial forces.

Although there are various materials of which the backing disks might be made to function in accordance with the principles of my invention, I have found phenol fiber disks to be light, dur-
able and satisfactory for providing the desired support and flexibility. The different radii and stepped relationship of the disks provides greater flexibility of the abrasive disk support near the outer edge of the abrasive disk. Although various numbers and thicknesses of backing disks are feasible for backing an abrasive disk of a given diameter, the number is also somewhat dependent upon the diameter of the abrasive disk to be used and the desired rigidity of the backing. In the present instance I have shown three superimposed backing disks with the smallest disk mounted adjacent the flat surface of the hub and projecting somewhat radially beyond the edge of the hub. With this arrangement of the disks the largest disk provides the backing surface for an abrasive disk.

In accordance with my invention and in order to improve the operation and prolong the life of the abrasive disk, I have provided each disk with at least one series of circumferentially separated air passages for the passage of cooling air to the back surface of the abrasive disk during operation. The air passages through the adjacent superimposed backing disks are aligned in the assembled relationship of the backing disks so that together they form series of radially and circumferentially spaced air passages.

In the form of my invention disclosed in Figs. 3 and 4, the air passages extend axially through the backing disks and the flow of cooling air therethrough is induced by the rotation of the backing and its accompanying abrasive disk in use.

Further to improve the flow of cooling air across the back surface of the abrasive disk, a relatively thin ring-like spacer plate is mounted against the backing face provided by the backing disk near the locating shoulder and inwardly from the first series of air passages. Desirably the assembled backing disks and spacer plate are removably secured to the hub by fastening means such as a series of screws.

As indicated in Fig. 2, the spacer plate serves normally to space the abrasive disk from the backing face when there is no pressure applied to the surface of the abrasive disk in use or over the area to which there is no pressure applied in use. The abrasive disk of course flexes to a position against the backing surface when operating pressure is applied to the abrasive disk surface. Although the spacer plate is relatively thin, the normal separation between the abrasive disk and the backing face provides for the circulation of cooling air across practically the entire back surface of the useful area of the abrasive disk.

With the type of hub disclosed in Fig. 2, the portion thereof which is radially inward of the shoulder and adjacent the bore is cupped axially as at 27 and has a recess 28 at the outer end of the bore to accommodate an abrasive disk having 29 which is threaded onto the end of the stud 12. Desirably the end surface of the nut is not project beyond the plane of the surface of the abrasive disk and thus does not interfere with the grinding operation. For adaptation to the mounting disclosed, the abrasive disks have a central opening 30 which fits over a flange 32 on the nut 28. The inner portion of the abrasive disk underlies the nut and is gripped and deformed between that nut and the adjacent surface of the hub.

In the modified form of my invention which is illustrated in the sectional views of Figs. 3 and 4, the backing disks 18a, 19a, and 20a are similar to those depicted and described with reference to Fig. 2 and may be similar to those of Fig. 3. However, in these backing disks the air passages 24a are disposed angularly with reference to the direction of rotation of the spindle and abrasive disk so as to induce the flow of air therethrough and across the surface of the abrasive disk. Although it is understood that all of the air passages might very well be similarly disposed with reference to the direction of rotation and so that the cooling air would flow inwardly toward the abrasive disk through those passages and exhausted at the edges of the abrasive disk, I have illustrated a disposition of passages such that air flows inwardly toward the abrasive disk through a part of the passages and flows outwardly from the surface of the abrasive disk through others of the passages.

To effect air flow in the direction depicted by the arrows in Fig. 4, when the direction of movement of the disk is as indicated, the air passages through which the cooling air flows to the abrasive disk are sloped away from the direction of movement of the disk from back to front while the passage for the flow of air from the abrasive disk is sloped away from the direction of movement from front to back. It may be understood that the slope of the air passages in each instance is substantially transverse to a tangent at a radius disposed outwardly from the axis of rotary movement.

Further to enhance the flow of air in the form disclosed in Figs. 3 and 4, air scoops such as 33, 34 and 35 are disposed adjacent the air passages and on one side thereof in relation to the direction of motion. In the disclosed form the air scoops are integrally formed on the back surfaces of the backing disks. Since the scoops project from those surfaces and are disposed with reference to the direction of rotation, they tend to increase the induced flow of cooling air through the passages.

In the modified form of my invention disclosed in Figs. 5, the structure of the backing disks 18b, 19b and 20b is similar to the structure of the disks 18a, 19a and 20a of Figs. 3 and 4 except that the air scoops have been omitted. The angular disposition of the air passages 24b is similar to that depicted and described with respect to Figs. 3 and 4.

In Fig. 6 I have depicted a modified type of hub and a mounting assembly adapted to use therewith. The mounting assembly disclosed is adaptable to connection with a spindle having a relatively flat front surface. In this instance the spindle is provided with a flexible flange 38 which is made of a material such as rubber. For mounting thereon, the assembly including the backing disks 18, 19 and 20 and the spacer plate is secured by fastening means such as the screws 26 to a mounting plate 37. At its center the mounting plate has a bore 38 which fits the flange 32 of the nut 29 to center the backing structure with reference to the spindle stud as 31. As in the previous form, the nut 29 is threaded onto the stud 12 and grips the inner portion of the abrasive disk to hold it in place.
backing disks of the type disclosed and which advantageously utilize the flow of cooling air through appropriate air passages, and either with or without the accompanying spacer plate 26, are adaptable to the various types of mounting hubs which are presently in use.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A support for an abrasive disk adapted to be mounted on a spindle and comprising, in combination, a hub having a central spindle receiving opening and a flat face portion extending radially outwardly from a locating shoulder, the portion of said hub inwardly of the shoulder being cupped around the spindle receiving opening, a plurality of normally flat backing disks having different radii and placed face-to-face in stepped relationship with the smaller disks adjacent said flat face of the hub, said disks having central openings adapted to fit over said shoulder and series of radially and circumferentially spaced air passages therein, the air passages of adjacent disks being aligned for the flow of cooling air therethrough, a flat and relatively thin ring-like spacer plate mounted against the face of one of the disks opposite said flat surface of the hub, means for holding said disks and ring-like plate together and in place against the flat surface of the hub, and means adapted to engage said spindle and fit into the cupped portion of said hub for holding an abrasive disk in place upon the support, and said ring-like spacer plate normally holding the abrasive disk away from the adjacent fiber disk.

2. A support for abrasive disks adapted to be mounted on a spindle and comprising, in combination, a plurality of normally flat backing disks of relatively flexible material having different radii and superimposed in face-to-face and stepped relationship with the larger disk forming a backing face for the abrasive disk, said disks having central mounting openings and series of radially and circumferentially spaced air passages extending therethrough from face to face, the air passages of adjacent backing disks being aligned for the passage of cooling air therethrough, a flat and relatively thin ring-like spacer plate mounted against said backing face and adjacent the central opening therein, and means for securing said backing disks and spacer plate together in concentric relationship for mounting in driven relationship upon the spindle.

3. In a support for abrasive disks, the combination comprising a plurality of normally flat backing disks of relatively flexible material having different radii and superimposed in face-to-face and stepped relationship with the larger disk forming a backing face for the abrasive disk, series of radially and circumferentially spaced air passages extending through said backing disks from face to face, the air passages of adjacent disks being aligned for the passage of cooling air therethrough, and a relatively thin spacer plate concentrically disposed against said backing disks radially inside of said air passages for normally holding the abrasive disk in spaced relationship to the backing face.

4. In a support for abrasive disks, the combination comprising a plurality of normally flat backing disks of relatively flexible material having different radii and superimposed in face-to-face and stepped relationship with the larger disk forming a backing face for the abrasive disk, means for spacing the central portion of the abrasive disk from the backing face, series of radially and circumferentially spaced air passages extending through said backing disks from face to face and the air passages of adjacent disks being aligned for the passage of cooling air therethrough.

5. In a support for abrasive disks adapted to be rotated about a central axis, the combination comprising a plurality of normally flat backing disks of relatively thin fiber material having different radii and superimposed in face-to-face and stepped relationship with the larger disk forming a backing face for the abrasive disk, series of radially and circumferentially spaced air passages extending axially through the backing disks, and means for holding the air passages of adjacent disks in axial alignment for the passage of cooling air therethrough to the abrasive disk.

6. In a support for abrasive disks adapted to be rotated for use, the combination comprising a plurality of normally flat backing disks having different radii and superimposed in face-to-face and stepped relationship with the larger disk forming a backing face for supporting the abrasive disk, said backing disks having series of radially and circumferentially spaced air passages extending therethrough from face to face, the air passages of adjacent disks being aligned for the passage of cooling air therethrough to the abrasive disk, and said air passages being angularly disposed in relation to the direction of rotation to induce the flow of cooling air.

7. In a support for abrasive disks adapted to be rotated for use, the combination comprising a plurality of normally flat backing disks having different radii and superimposed in face-to-face and stepped relationship with the larger disk forming a backing face for supporting the abrasive disk, said backing disks having series of radially and circumferentially spaced air passages extending therethrough from face to face, the air passages of adjacent disks being aligned for the passage of cooling air therethrough to the abrasive disk, and said air passages being angularly disposed in relation to the direction of rotation of the abrasive disk to induce the flow of cooling air across the surface thereof, a part of said air passages being angularly disposed to induce the flow of air to the surface of the abrasive disk, and a part of the air passages being angularly disposed to induce the flow of cooling air away from the abrasive disk.

8. In a support for abrasive disks adapted to be rotated for use, the combination comprising a plurality of normally flat backing disks having different radii and superimposed in face-to-face and stepped relationship with the larger disk forming a backing face for supporting the abrasive disk, said backing disks having series of radially and circumferentially spaced air passages extending therethrough from face to face, the air passages of adjacent disks being aligned for the passage of cooling air therethrough to the abrasive disk, and air scoops projecting from the faces of the backing disks adjacent the air passages and disposed in relation to the direction of rotation to induce the flow of cooling air through the passages to the abrasive disks.
9. In a support for abrasive disks adapted to be rotated for use, the combination comprising a plurality of normally flat backing disks having different radii and superimposed in face-to-face and stepped relationship with the larger disk forming a backing face for supporting the abrasive disk, said backing disks having series of radially and circumferentially spaced air passages extending therethrough from face to face, the air passages of adjacent disks being aligned for the passage of cooling air therethrough to the abrasive disk, and air scoops projecting from the faces of the backing disks adjacent the air passages and disposed in relation to the direction of rotation to induce the flow of cooling air through the passages and across the surface of the abrasive disk, some of said air scoops being disposed to induce the flow of air toward the abrasive disk, and some of said air scoops being disposed to induce the flow of air from the abrasive disk.

10. In a support for abrasive disks adapted to be rotated in use, the combination comprising a backing disk having a normally flat abrasive disk backing portion, said backing disk having therein a series of circumferentially spaced air passages for the flow of cooling air to the abrasive disk during rotation, and a spacer ring adjacent the backing disk and radially inside said series of air passages for normally spacing the abrasive disk from the backing disk for the flow of air between said disks.

11. In a support for abrasive disks adapted to be rotated in use, the combination comprising a backing disk having a normally flat abrasive disk backing portion, said backing disk having therein a series of circumferentially spaced air passages for the flow of cooling air to the abrasive disk during rotation, and said air passages being angularly disposed in relation to the direction of rotation to induce the flow of cooling air across the surface of the abrasive disk.

12. In a support for abrasive disks adapted to be rotated in use, the combination comprising a backing disk having a normally flat abrasive disk backing portion, said backing disk having therein a series of circumferentially spaced air passages for the flow of cooling air to the abrasive disk during rotation, and air scoops on the abrasive disk adjacent said air passages and disposed in relation to the direction of rotation to induce the flow of cooling air to the abrasive disk.

13. In a support for abrasive disks adapted to be rotated in use, the combination comprising a circular backing disk having an abrasive disk backing surface, and a relatively thin spacer ring adjacent and concentric to the backing surface, said spacer ring being smaller in diameter than the backing disk so as normally to separate and provide space for cooling air between the outer portion of an abrasive disk and the backing surfaces.

14. In a support for abrasive disks adapted to be rotated in use, the combination comprising a relatively flat backing disk having an abrasive disk backing surface, and means concentrically disposed on said backing surface and spaced inwardly of the periphery of the backing disk for normally separating the outer portion of an abrasive disk from the backing surface to provide for the passage of cooling air therebetween.

15. In a support for abrasive disks adapted to be rotated in use, the combination comprising a backing disk having an abrasive disk backing surface, and means secured to and covering the central portion of the backing surface for normally separating the outer portion of the abrasive disk from the backing surface.

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