

[54] **ABRASION TOOLS**

[75] Inventor: **Lazare Scandalestos, Paris, France**

[73] Assignee: **S. P. A. M., D'Avray, France**

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Primary Examiner—Donald G. Kelly
Assistant Examiner—Howard N. Goldberg
Attorney—Ernest A. Greenside

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[58] Field of Search..... 51/356, 266, 358;
15/230.1

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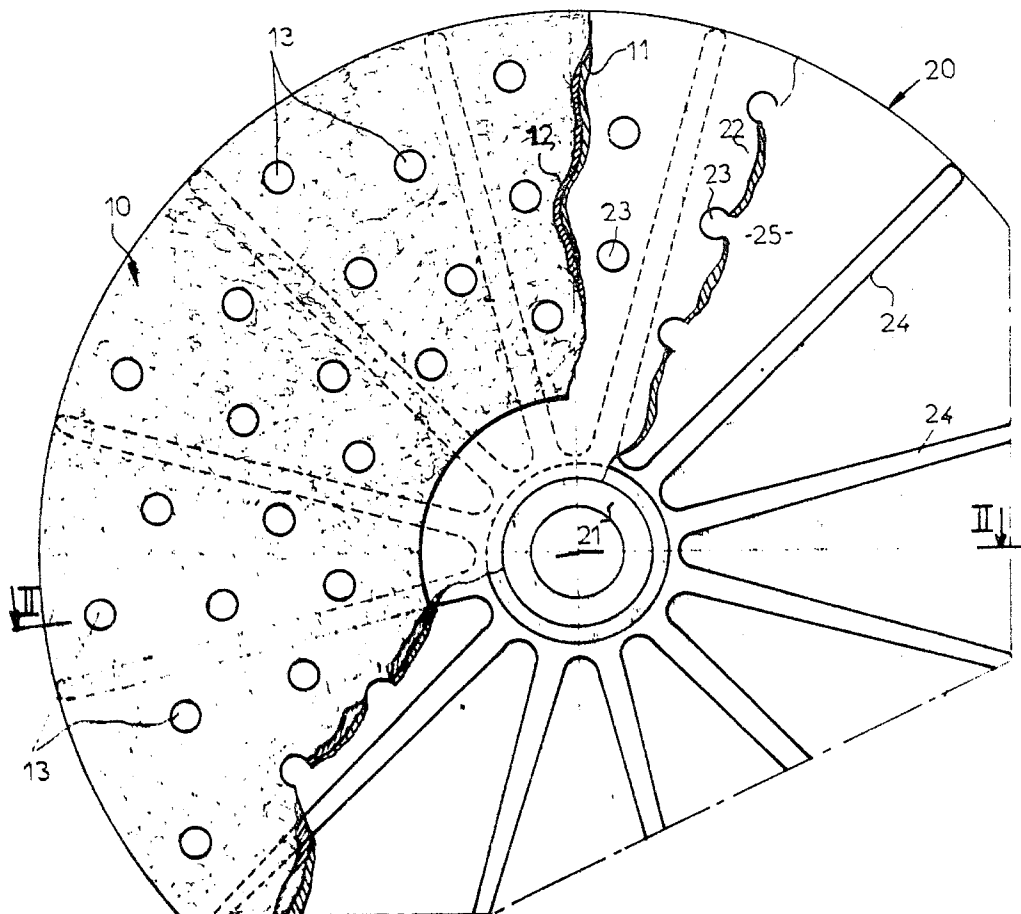
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[57] **ABSTRACT**

An abrasion tool consists in the combination of a perforated flexible disk covered with an abrasive/adhesive complex and of a generally annular support plate provided with a central hub portion and with a plurality of radially extending channels communicating with the perforations of the disk, whereby centrifugal action causes air to flow and cool the work and the tool, and to remove the dust produced by abrasion.

9 Claims, 6 Drawing Figures



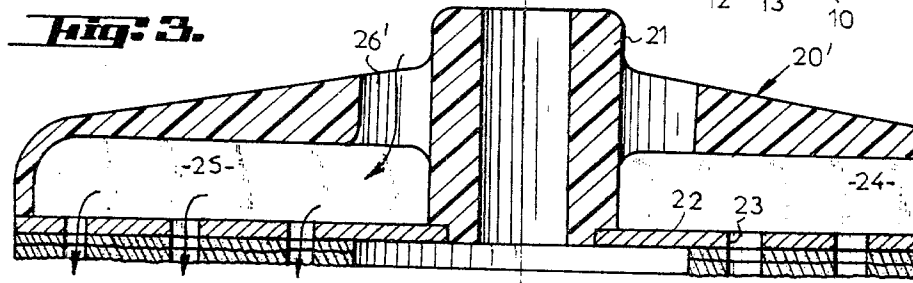
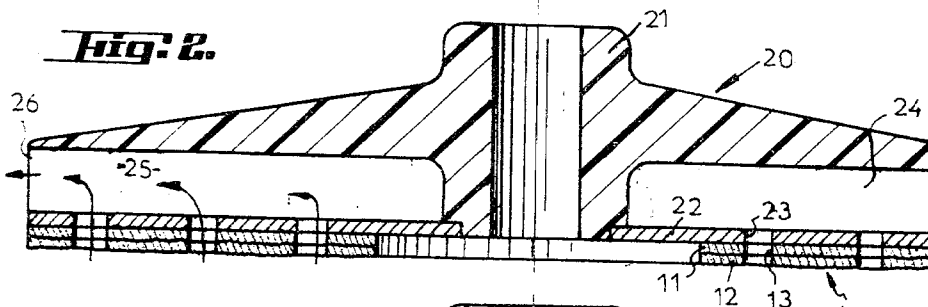
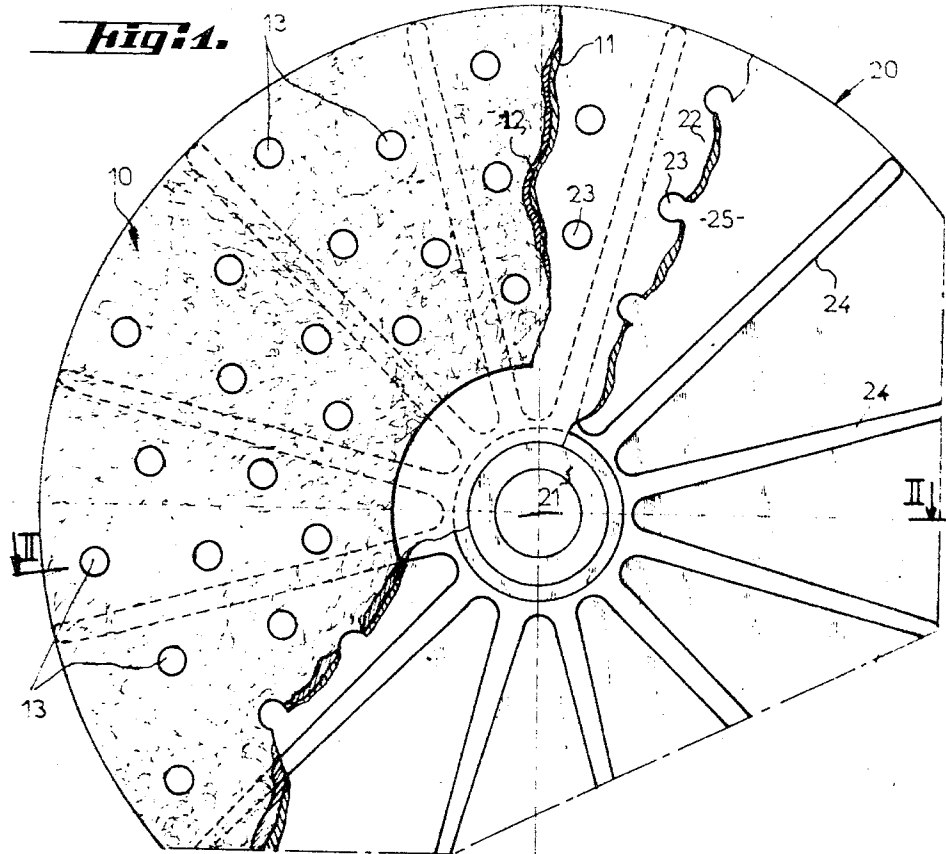


Fig. 4.

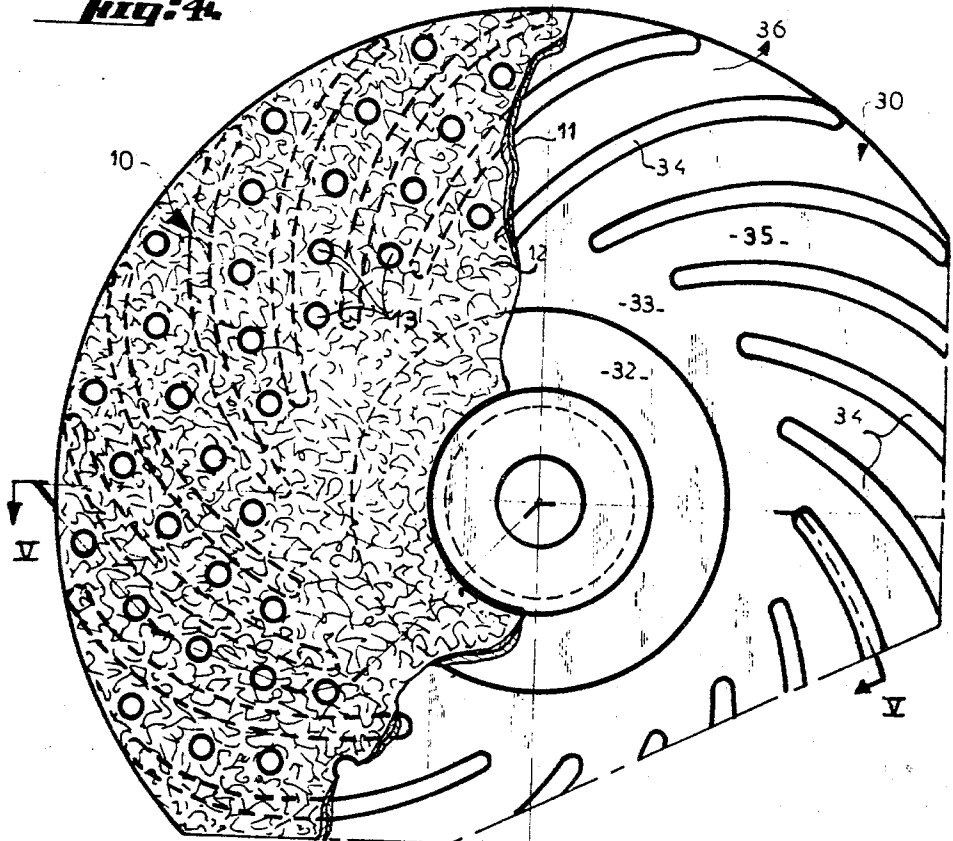


Fig. 5.

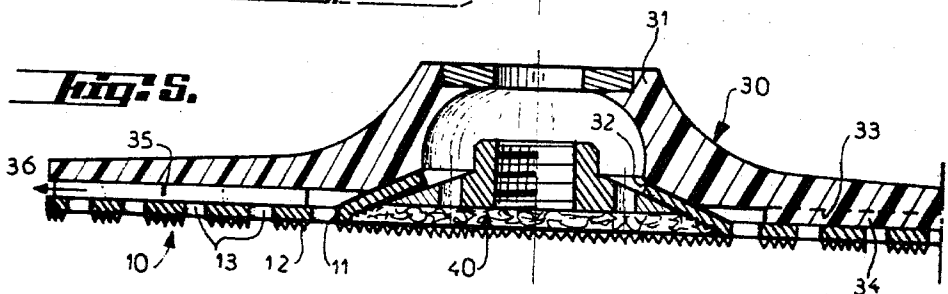
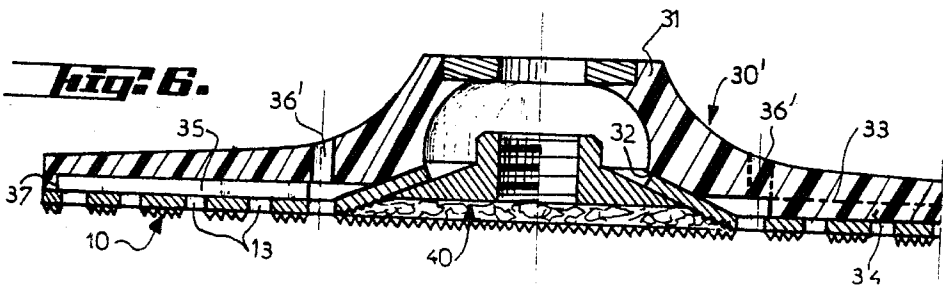


Fig. 6.



ABRASION TOOLS

The present invention relates generally to abrasion tools of the type comprising an interchangeable flexible disk or wheel, the working face of which is covered with an abrasive-adhesive complex and the other face of which takes its bearing on a plate provided with a hub for its mounting at the end of a shaft rotating at a high speed.

Tools of this type are, in most cases, mounted at the end of a flexible shaft or on the spindle of a portable machine, and are guided manually to effect snagging, de-burring, fettling, dressing, cleaning or polishing operations on generally uneven surfaces. This means that such tools operate under varying and, moreover, non-uniform conditions and are therefore liable to become rapidly deteriorated when used by unskilled persons. The high rotational speed of the tool, the considerable working pressure applied and the resulting excessive heating of the abrasive disk, and its glazing by the dust resulting from abrasion, are the most important factors which prematurely terminate service.

As a matter of fact, the evolution of techniques in the use of abrasive disks has led to the practise of mounting them on pneumatic or electric polishing or grinding machines rotating in most cases at high speeds, ranging about 6,000 to 8,000 rpm.; the large amount of heat evolved during work at such speeds requires the use of an adhesive/abrasive complex whose mechanical resistance and heat conductivity are considerable. However, in most cases, undue heating of the adhesive resin leads to abrasive grain disembedding. This drawback, and rapid tool wear resulting therefrom, may be avoided by creating during work a permanent circulation of fresh air through the disk and on the surface being worked, in order to, on the one hand, constantly cool the latter and expel therefrom the fragments resulting from abrasion and, on the other hand, prevent the absorption of an excessive amount of heat by the disk. Thus, the small increase in disk temperature enables the abrasive grains to be held perfectly embedded in the adhesive resin, in contradistinction to the noted disembedding of grains with conventional non-perforated and non-aerated disks.

In connection with the various considerations just set forth, it is known to provide the abrasive disk with holes enabling the tool and the surface being worked thereby to be ventilated to a certain extent for the double purpose of cooling and of removing the dust produced by abrasion. However, this solution is inefficient where the bearing plate of the flexible disk must extend over a considerable portion of the surface of the latter and even over its whole surface, as is the case with large-diameter flexible disks. In such cases, the abrasive disk holes are closed, thus preventing ventilation to the detriment of tool performances and life.

The present invention has for its object to remedy the above-mentioned drawbacks by providing an abrasion tool comprising a flexible abrasive disk supported by a bearing plate extending over its whole surface and which, however, is ventilated more energetically and more efficiently than in priorly known arrangements.

The present invention is also directed at increasing the duration of service and the stock-removing capacity of the disk as compared with those of a similar disk used on a conventional felt, fibre or rubber support.

To this end, the abrasion tool according to the invention is characterized in that the abrasive disk is pro-

vided over its whole surface with perforations communicating with substantially radial channels formed within the plate and opening into free air at one of their ends.

The channels may open either on the outer periphery of the plate or on its rear face in proximity to its hub. In both cases, the plate behaves as a centrifugal ventilating means by which an air flow is constantly sucked or blown through the perforations of the abrasive disk, thus efficiently ensuring the cooling of the tool and of the surface being worked as well as the removal of the fragments resulting from abrasion.

According to a preferred form of embodiment of the tool according to the invention, the said channels are defined by ribs radiating from the hub towards the plate periphery, the said ribs being either straight or curvilinear.

Such an abrasive disk may take its bearing on the said ribs either directly or through the medium of a perforated plate covering them.

Other features and advantages of the invention will appear more clearly from the following detailed description of several nonlimitative examples of carrying out of the invention, diagrammatically illustrated by the appended drawings wherein:

FIG. 1 is a front view, with parts broken away, of a tool according to the invention;

FIG. 2 is a sectional view upon the line II—II of FIG. 1;

FIG. 3 is a view similar to that of FIG. 2, illustrating a first modified form of embodiment of the tool; and

FIGS. 4, 5 and 6 are views similar to those of FIGS. 1, 2 and 3 respectively, illustrating two other modified forms of embodiment of the tool.

The tool shown in FIGS. 1 and 2 is constituted by the combination of an abrasive disk 10 and a plate 20 comprising a plane bearing face having the same diameter as disk 10, on which the latter is laid flat and secured by fastening means (not shown) enabling a worn disk 10 to be readily replaced.

The abrasive disk 10, annular in shape, is constituted by a core 11 of thin and flexible material such as vulcanized fibre, cloth board, metal or plastics, whose working face is covered with an abrasive/adhesive complex 12 adapted to the nature of the work to be carried out. For reasons which will appear hereinafter, the disk 10 is provided with a great number of perforations 13 distributed uniformly over its whole surface.

The plate 20 is constituted by a light-alloy member having the general shape of a disk and the same diameter as the abrasive disk 10. The plate 20 is provided with an axial hub 21 enabling it to be mounted by means which are known per se, for instance at the end of a flexible shaft or on the spindle of a portable machine-tool, the said means including a ring or disk by which the inner periphery of the abrasive disk 10 is maintained applied on the bearing surface of the plate 20. The said bearing surface is constituted by an additional annular plate 22 provided with perforations 23 distributed in the same manner as the perforations 13 of the disk 10, so that the said perforations coincide with one another, as shown in FIG. 2, when the disk 10 occupies predetermined relative positions.

The plate 22 forming the bearing surface of the plate covers straight ribs 24 extending radially from the hub 21 up to the outer periphery of the said plate; thus, channels 25 are formed within the plate 20, each of the

said channels being defined by two adjacent ribs 24 and by the corresponding portion of the plate 22; each channel 25 opens, on the one hand, on the working surface of the tool through the aligned perforations 13, 23 of disk 10 and plate 22 and, on the other hand, at 26, on the outer periphery of the plate 20. This means that when the tool is driven in rapid rotation, it constitutes a centrifugal ventilating means sucking the air from the working surface through the perforations 13-23 and delivering it at the periphery of the plate. Thus, not only the abrasive disk 10 and the working surface are energetically cooled, but moreover the fragments resulting from abrasion are efficiently removed from the working region.

FIG. 3 illustrates a modified form of embodiment of the tool according to the invention, in which the rigid plate 20 described previously is replaced by a plate 20' which is made from plastics and, therefore, is relatively supple or flexible. The plate 20' has the same general conformation as the plate 20, except that the radially outer end of the channels 25 defined between the ribs 24 is closed, whereas their radially inner end opens into free air through openings 26' provided in proximity to the hub 21. This means that when the tool is driven in rapid rotation, it acts as a centrifugal ventilating means by which the air sucked through the openings 26' is delivered towards the working surface through the perforations 13-23. Consequently and in the same manner as in the form of embodiment described previously, the abrasive disk 10 and the surface being worked are energetically cooled and the fragments resulting from abrasion are removed together with the air escaping from the periphery of the working region.

In the modified forms of embodiment illustrated in FIGS. 4, 5 and 6, the plate 30, 30' is constituted by a member moulded from semi-rigid plastics, in the general shape of a disk having the same diameter as the abrasive disk. This plate comprises an axial hub 31 reinforced by an annular metal insert passed onto and retained on the tool-carrying spindle (not shown). As appears clearly from FIG. 5, the central portion of the disk 10 is applied flat on an inner conical bearing-surface 32 of the bearing face of the plate, formed around the cavity of the hub 31. The bearing face of the plate is in addition provided with an annular plane surface 33 extending radially up to its periphery; on the plane face 33 project curvilinear ribs 34 arranged spirally and uniformly distributed crown-wise. The disk 10 takes its bearing directly on the plane tops of the ribs 34, which define between themselves open grooves 35 into which open at least some of the holes 13 of the abrasive disk 10.

According to the form of embodiment illustrated in FIGS. 4 and 5, the grooves 35 defined by the bearing ribs 34 open freely on the outer periphery of the plate 30 as shown by the arrow 36. Under such conditions, when the tool is driven in rapid rotation, it behaves as a centrifugal ventilating means by which air and, therefore, the fragments resulting from abrasion, are sucked from the working surface through the openings 13 of the abrasive disk and thrown out through the radial channels formed by the grooves 35 closed partially by the disk 10.

According to the form of embodiment illustrated in FIG. 6, the outer periphery of the plate 30' is provided with a flange 37 interconnecting the ribs 34, so that the external opening of the grooves 35 is closed. On the

contrary, the channels formed by these grooves, which are partially covered by the disk 10, open into free air through the medium of holes 36' passing through the body of the plate 30' in proximity to the inner end of the ribs 34, so as not to be closed by the disk 10 applied on the conical bearing surface 32. Thus, the tool behaves as a centrifugal ventilating means by which air is blown on the working surface, whose fragments resulting from abrasion are therefore expelled outwardly.

In the last two modified forms of embodiment described, the abrasion tool not only has a simpler structure, the bearing plate of the abrasive disk being purely and simply eliminated, but also is capable of better performances: indeed, the discontinuous bearing of the disk on the plate results in the forming of low-amplitude undulations which, on the one hand, increase the "biting" action of the abrasive disk and, on the other hand, facilitate the removal of the fragments resulting from abrasion; the aggressiveness thus imparted to the abrasive disk also enables the pressure to be exerted on the tool and, therefore, the heating of the disk during work, to be reduced. On the whole, a given work can be carried out in a shorter time and less tiringly. An unexpected consequence of the discontinuous bearing of the disk is to increase its duration of service, since it is sufficient to slightly modify, from time to time, its angular position on the plate in order to move to the level of the ribs 34 such portions of abrasive as have practically not been working until then.

In order to avoid any vibration of the tool during work, and as shown in FIG. 4, the ribs 34 are preferably arranged obliquely with respect to the radii of the bearing face of the plate, and they are, moreover, curvilinear and arranged spirally, a subsidiary effect of such an arrangement being to increase the air flow sucked or blown through the perforations of the abrasive disk and, therefore, to improve its cooling and render more efficient the removal of the fragments resulting from abrasion.

The said ribs may have one and the same shape and be equidistant from one another, as shown, or their shape and/or their angular spacing may vary aperiodically on the periphery of the plate, so as to eliminate any possibility of mechanical resonance and reduce the noise resulting from air blowing.

Generally, owing to the excellent cooling and high aggressiveness of the abrasion tool according to the invention, the latter is particularly well adapted for carrying out operations involving rapid removal of important quantities of stock, for instance the de-burring of castings. Moreover, owing to its flexibility in use and to the easiness with which its action can be controlled, it may as well be used for delicate finishing operations: in this connection, it is worth while mentioning, for instance, the polishing of stainless steel or like materials, which can be carried out without scratching and burn marks, owing to excellent removal of dust and efficient cooling of the tool.

It should also be noted that the removal of the dust and metal particles take place according to the working plane of the abrasion tool. This means that the latter are thrown out at a distance from the region being worked. Thus, during work, the operators face is located in a volume where dust density is least. This problem is always important as far as health and social services are concerned.

A great number of other modified forms of embodiment of the tool according to the invention are of course possible, provided the principle of centrifugal ventilation of the perforated abrasive disk and of the work region is observed. Thus and for instance, the configuration of the ribs and the channels may be modified, the said ribs being for instance straight but oblique and the said channels having a variable depth for local adaptation of their flow section. The bearing surface of the plate may be constituted by a plate provided with openings, for instance oblique slits, whose conformation and distribution are so selected as to uncover at least some of the perforations of the abrasive disk, whatever the relative position of the latter may be; similarly, the said bearing surface may be constituted by a plate provided with multiple small holes distributed uniformly over its whole surface, so as to partially uncover each disk perforation whatever the relative position may be. The abrasive disk itself may of course be provided with perforations, the configuration and distribution of which are different from those illustrated.

Therefore, the invention is by no means limited to the forms of embodiment described and illustrated, which have been given by way of example only. On the contrary, the invention comprises all the means constituting technical equivalents to those described and illustrated, considered separately or in combination and used within the scope of the following claims.

What is claimed is:

1. A rotary abrasive tool comprising interchangeable disk means having an abrasive material working face for performing a work function and annular plate means for detachably supporting said disk means, said plate means comprising a centrally disposed hub portion adapted for rotational movement about the hub axis and an annular wall portion radiating outwardly of said hub portion for rotation therewith, said disk means being substantially coextensive with said annular wall portion and being operatively supported in relation to the hub portion spaced from said annular wall portion of said plate means to define a chamber therebetween, an annular array of substantially uniformly distributed generally radially directed spaced apart wall divider means in said chamber and positioned therein to define a plurality of generally radially directed channels, said disk means being formed with a plurality of radial arrays of openings therethrough, at least one array for each channel, each array containing a plurality of openings, at least one radial array of openings respectively communicating with one of said plurality of channels, and air flow constraining means operatively related to said disk means and to said plate means for constraining air flow from the atmosphere first through said channels and then through said openings for dis-

charge therefrom between the working face of the disk means and a work piece being worked upon.

2. A tool according to claim 1, wherein said hub portion carries an annular planar bearing surface formed with a plurality of openings therethrough, the face of said disk means opposite its working face being in abutting relation with one face of said annular bearing surface and with the openings in the bearing surface in alignment with the openings in the disk means, the opposite face of the bearing surface together with said annular wall portion and adjoining of said wall divider means defining said channels.

3. A tool according to claim 1 wherein said air flow constraining means comprises a peripheral flange at the radial outer end of said annular wall portion for closing said channels at their radial outer ends and air passage means in said annular wall portion for permitting, during operation of the tool, air to enter through said passage means into said channels and out through said openings.

4. A tool according to claim 1, wherein said annular plate means comprises a base portion and a centrally hollow domed portion rising from the base portion, said hub portion being at the upper end of said domed portion, said wall divider means extending from said base portion toward said disk means, said disk means being in direct engagement with said wall divider means in its assembled relationship to said plate means.

5. A tool according to claim 4, wherein said flow constraining means comprises a peripheral flange at the radial outer end of said base portion for closing said channels at the radial outer ends thereof and passage means formed at the radial inner end of said base portion for permitting, during operation of the tool, air to enter through said passage means into said channels and out through said openings.

6. A tool according to claim 5, wherein said base portion is formed with a central conical depression communicating with the interior of said domed portion, said disk means having a central upstanding conical section the conical wall of which engages, in the operative position of the disk means, the conical wall defining the central depression in the base member.

7. A tool according to claim 6, wherein the inner ends of the wall divider means terminate radially outwardly of said conical depression.

8. A tool according to claim 5, wherein said passage means is formed in said base portion in a region between the inner ends of said wall divider means and said conical depression.

9. A tool according to claim 8, wherein said wall divider means comprise curvilinear ribs.

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