Sept. 15, 1959 W. E. COWLEY 2,903,782

BURNING BLADE

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Fig. 1.

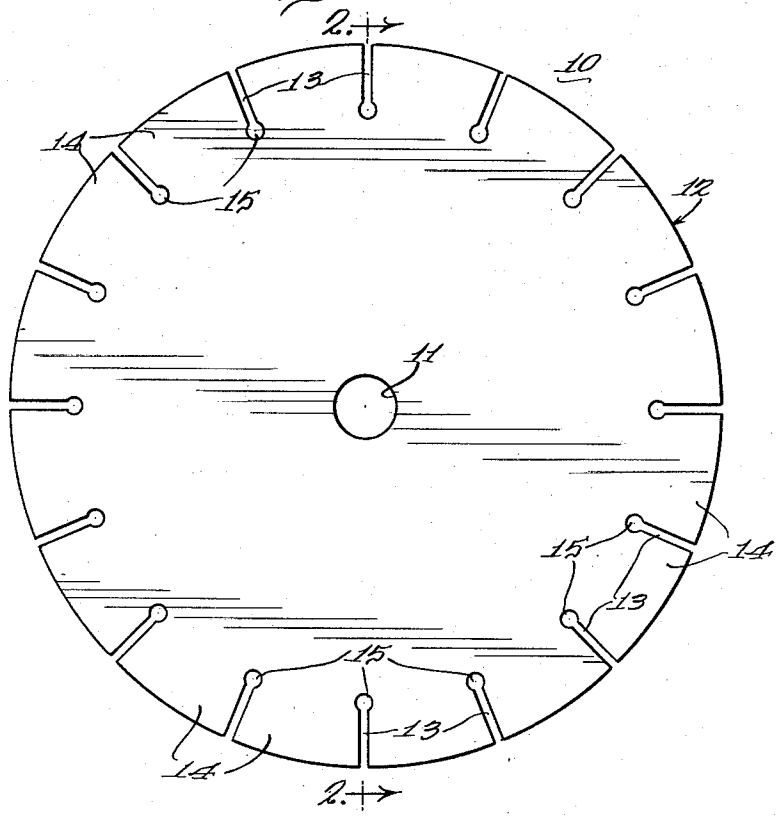


Fig. 2.

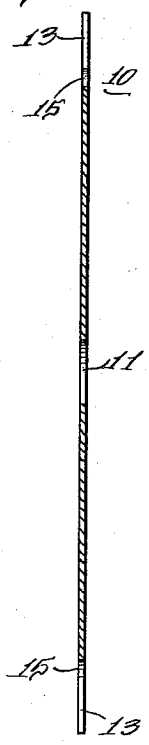
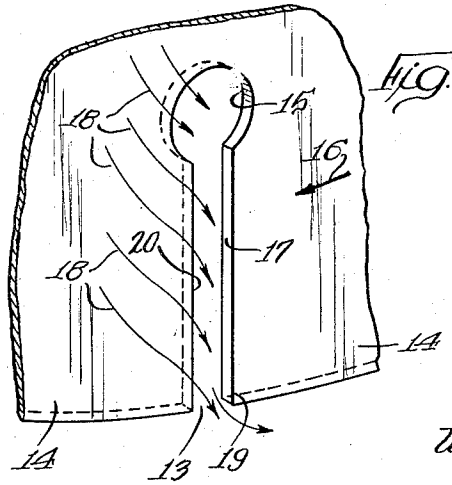


Fig. 3.



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BURNING BLADE

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1 Claim. (Cl. 29—103)

This invention relates to a novel and improved construction of circular cutting blades.

Friction or burning blades have been known for some time in the industrial metal arts for the cutting of metals of relatively poor conductivity, such as iron and steel. A rotary blade of the known type comprises merely a solid metal disc of large diameter operated at high speed, for example to afford a peripheral speed of 18,000 to 20,000 feet per minute. These blades were normally made with no teeth or gullets, although some had small notches in the periphery thereof and operated on the principle of so heating the metal with which it is brought into contact as to burn through the same. Cooling was effected by running water on one side thereof. Due to its principle of operation, the blade is not practical for use on good conductors particularly those of sufficient section to dissipate the heat caused by frictional engagement of the blade with the metal.

A principal object of the present invention is to provide such a blade which will be adapted to function efficiently at lower speeds such as in the range of 3,600 to 5,200 r.p.m.'s and so prove useful when driven at the horsepowers normally available on home workshop tools.

A further object of the invention is to provide a novel means of inducing self-cooling of the blades during operation so as to effect a more efficient cut.

Still another object is to provide means for effectively equalizing heating of the blade during a cutting operation.

Another object is to provide means for relieving stress and in order to accommodate for expansion and contraction of the cutting portion of the blade without substantial distortion thereof during use.

In accordance with these and other objects, the present invention contemplates the provision of a plurality of equidistantly spaced deep and narrow radial slots which will periodically interrupt the peripheral or cutting edge of the blade. Such slots will be controlled in depth and width as well as in spacing so that, during rotation of the blade, cool air which is drawn from adjacent the axis of the blade in an arcuate path toward the blade periphery and in a direction generally opposite the direction of blade rotation, will be drawn by centrifugal action into the deep narrow slots and guided radially outward along the trailing edge of the slot. In this manner, the portions of the blade immediately adjacent the trailing edge of the slot and especially the peripheral edge portion which defines the leading corner of the adjacent blade sector will be cooled by said air. It has been found that cooling of said corner not only mitigates against excessive wear, but also tends to more effectively clear the cut so that succeeding portions of the sector work on solid metal and not on waste accumulated in the cut and thereby increases the efficiency as well as effectiveness of the cutting operation.

In accomplishing the aforesaid result, it has been found important that the slots be radially disposed, or

substantially so, in order to facilitate the cooling action since inclination of the trailing edge of the slots either offers excessive resistance to flow through the slot or accommodates excessive clearance of air from the slots, depending upon the direction of inclination.

Likewise it has been found important, and it is therefore a further object of the invention, to provide a slot of sufficient narrowness that it will confine the collected cooling air on a limited area of the blade to prevent excessive cooling of the cutting sector as a whole yet affording maximum cooling of the leading corner of each sector.

A further object of the invention is to control the depth of the slots as to obtain the most effective cooling possible of said leading corner but without causing the blade to lose stability and/or vibrate to a detrimental extent during use.

Still another object of the invention is to provide a sufficient number of such radial slots and to a depth which will not only obtain the desired cooling effect but will also reduce the effective diameter of the blade so as to cut down the effect of stresses set up in the disc due to the combined radial and tangential stresses resulting from the rotation thereof.

Many other objects and/or advantages and features of the invention will be apparent or will become so from the detailed description of a preferred embodiment of the invention which follows. It will of course be understood that many changes and/or modifications will be suggested by the described structure and that said description is not to be taken in a limiting sense but merely as illustrative of the invention, the limits of which are defined by the appended claim.

Now referring to the drawing:

Figure 1 is a side elevational view of a circular blade illustrating a preferred form of the invention;

Figure 2 is a sectional view taken on the blade of Figure 1 along lines 2—2 in said figure; and

Figure 3 is a fragmentary enlarged view of the blade showing one of the slots and, by the use of arrows, depicting the direction of air flow therein relative to rotation of the blade.

In said figures, 10 is a circular disc or blade having a central arbor or opening 11 by which it may be mounted in a conventional holder not shown. Preferably it is formed of tempered steel and has a uniform thickness of from .040 to 0.50 inch throughout including its outer periphery 12, which periphery is periodically interrupted by relatively deep and narrow radial slots 13 dividing it into a plurality of equi-dimensional arcuate cutting sectors 14. The bottom of each of said slots 13 is preferably rounded and somewhat enlarged as at 15 for a reason which will hereinafter be made clear.

As aforementioned, such a blade is designed for cutting various metals although not limited thereto, by being rotated at a sufficiently rapid rate as to heat the contacted surface by friction and effectively cut the metal by burning therethrough. Since the blade is intended primarily for use in the home workshop or in commercial establishments wherein the machines have speeds in the range of 3,600 to 5,200 r.p.m. which is based on the old and well established wood cutting speeds of "Recommended peripheral speed 8,000 to 12,000 feet per minute," the preferred thickness of the blade is the aforesaid .040 to .050 inch for a 6 or 7 inch diameter blade which is most common. Generally speaking, the thinner the blade, the lower the horsepower requirements, and also, the larger the saw blade diameter, the thicker the blade required.

One of the important improvements made in such blades according to the present invention is the aforesaid slots 13 which periodically interrupt the peripheral or cutting edge 12 of the blade. These slots serve as novel

cooling means in that by reason of their radial disposition they serve to entrain cooling air which is being drawn by rotation of the blade outwardly from adjacent its axis of rotation and in a direction opposite to the rotation of the blade. Thus when as illustrated in Figure 3, the blade is rotating in a clockwise direction, as indicated by the arrow **16**, air will be drawn outwardly from the center of the blade counterclockwise, striking the trailing edge **17** of each slot **13**, and guiding the air currents **18** thus entrained outwardly of the slot **13** along said edge **17** and across the leading edge corner **19** of the adjacent sector **14** to cool the same.

For best cooling effect, the width of the slots should be at least one and one half times the thickness of the blade and preferably in the range of 1/16 to 1/8 inch, since wider slots tend to tear and throw up more burrs. The slots, of course, must be sufficiently wide to entrain the moving air to obtain the desired cooling action and yet be sufficiently narrow to confine the entrained air as much as possible to said side **17** to prevent excessive cooling of the blade which might interfere with the effectiveness of the burning action obtained by the edge **12** of the blade on the work.

The trailing side **17** of the slots **13** should be radially disposed to facilitate maximum cooling. However for ease in fabrication as where the slots are formed in a separate notching operation the sides **17** and **20** of said slot may be substantially parallel with the result that neither side is truly radial. Nevertheless, because of the narrowness of the slot, both sides **17** and **20** thereof are sufficiently close to radial as not to have any material effect on the air collecting and directing function. Moreover, such an arrangement permits the blade to be rotated in either direction and while obtaining the same degree of cooling effect. However as already pointed out above, for best cooling effect said sides should be radial and which can be accomplished by inclining said sides toward each other and so as to be slightly off parallel the required amount.

Although the deeper the slots the more the cooling effect, it has been found that there is less likelihood of the saw losing stability on its rim or vibrating, if the depth of the slots is not more than a quarter of the radius of the blade. A slot depth equal to about one fifth radius of the blade has been found to be particularly satisfactory.

The use of slots also serves to reduce the effective diameter of the blade disc insofar as stresses set up due to the combined radial and tangential stresses set up by the rotation. For this purpose, it has been found that where each sector **14** is approximately one and one half times the depth of the slots, very satisfactory results are obtained.

Desirably, the bottom of each slot has been widened out as at **15** to afford a general keyhole shape to the slot. Although such openings **15** do not appear to affect the cooling function, it has been found, in conducting wear and life tests on such blades, that there was a concentration of stresses in the bottom of the slot which would evidence itself in time by radial cracking. By drilling a hole **15** at the bottom of the slot, this concentration of stresses can be distributed so as to materially lengthen the life of the blade.

It will be clear from the aforesaid description that all of the objects and/or advantages and features of the invention have been demonstrated as obtainable in a convenient, and exceedingly simple, practical and economical manner.

Thus having described my invention, I claim:

A blade adapted for friction cutting metals and the like when rotated at high speed, said blade comprising a disc which, including its peripheral cutting edge portion, is constituted of tempered steel and is of uniform thickness, said disc having a plurality of equidistantly spaced, deep and narrow, radial slots periodically interrupting its peripheral edge to divide the same into arcuate cutting edge sectors of equal size and uniform thickness each having a leading corner, said slots having a depth equal to about one-fifth the radius of the disc and being spaced apart a distance equal to about one and one-half times said depth, said slots further having a width equal to at least one and one-half times the thickness of the disc so as to entrain cool air as the blade is rotated and which width is such as to confine the entrained air to the trailing edge of the slots and prevent excessive cooling of the remainder of the arcuate cutting edge sector, said trailing edge guiding the entrained air outwardly of the slots and over the leading corner of said arcuate cutting edge sectors to cool the same whereby said cooled corners will function to clear the cut of waste so that the succeeding friction heated portion of the arcuate cutting edge sector will work on solid metal, said slots further providing areas of stress relief to accommodate for expansion and contraction of the peripheral portion of the blade.

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