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METHOD OF ABRADING

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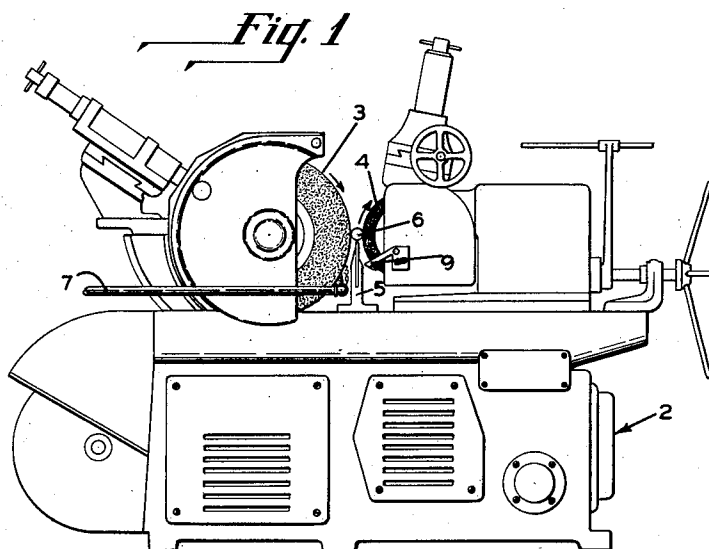


Fig. 2

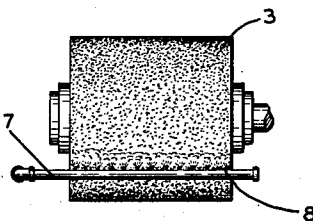
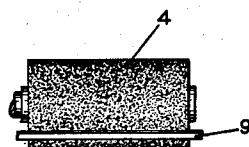


Fig. 3



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METHOD OF ABRADING

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This invention relates to a method and apparatus for abrading and is concerned particularly with the abrading of cork composition and similar materials containing an ingredient of a thermoplastic nature which tends to "load" the grinding wheel.

In the manufacture of cork composition disks for lining closures such as crowns, the binder for the cork composition includes a lubricant such as a mixture of paraffin wax and synthetic rubber latex. This material tends to migrate somewhat to the outer surface of the rod during heating in the course of manufacture and thus makes it possible to easily remove the rods from the forming molds. In rods manufactured by the extrusion process, the extrusion or forming tube would be the mold surface which must be lubricated continuously in order to permit proper formation of the extruded rod.

The cork disks must be of a substantially uniform diameter, and, consequently, the outer surface which is somewhat rough and irregular is generally severed. According to my invention, a centerless grinding machine is rendered useful for this purpose. In attempts to employ centerless grinding on cork composition rods heretofore, indifferent success was achieved, and it was found that frequent wheel dressings were necessary in order to maintain a reasonably close tolerance in the finished diameter of the rod. In the grinding operation, it was found that the thermoplastic lubricant, particularly rich at the surface of the rod, tended to fill the grinding wheel or load it, as the trade terms it. In centerless grinding, the finished diameter of the workpiece is predetermined by the spacing between the abrading surface of the grinding wheel and the working surface of the regulating wheel between which the workpiece is fed. Any loading of the grinding wheel, therefore, decreases the distance between the abrading surface and the regulating surface, and the finished diameter of the workpiece is reduced. In addition, the loading of the wheel tends to decrease the abrasive action, and the speed of cutting and the smoothness of cut are impaired.

It is an object of my invention to provide a method whereby the working surface of the abrading wheel may be continuously cleaned to remove thermoplastic material deposited therein.

Another object of my invention is to provide a method of centerless grinding cork composition elements or the like wherein the grinding wheel is heated to melt a thermoplastic ingredient deposited therein during the grinding operation and

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to flush the same away, and the wheel is cooled prior to its re-entrance into a zone where abrading is effected.

In order that my invention may be clearly understood, I shall describe the same in conjunction with the attached drawing in which:

Figure 1 is a side elevation of a conventional centerless grinding machine incorporating my invention and useful in the practice of my method;

Figure 2 is a diagrammatic view illustrating the application of my invention to a centerless grinding wheel; and

Figure 3 is a view similar to Figure 2 illustrating a regulator wheel cleaning arrangement.

Referring to Figure 1, the centerless grinding machine as a whole has been indicated by the numeral 2. It includes a power driven grinding wheel 3 and a driven regulating wheel 4. A work support 5 is disposed between the wheels 3 and 4 and supports the workpiece 6 in an abrading zone. These elements are conventional in centerless grinding machines, and a description of the mechanism for rotating the wheels and adjusting their positions is not deemed necessary.

It will be assumed, for purposes of illustration, that the workpiece 6 is a cork composition rod which is to be reduced to a desired diameter and subsequently severed into disks in the fabrication of crown closures. The cork composition material has been formed by an extrusion process and is made up of relatively fine cork granules bound together with a binder composed of glue and glycerine and having a mold lubricant incorporated therein and formed of a mixture of synthetic rubber latex and paraffin wax. The lubricant has migrated to the surface of the rod and is, therefore, rich at such surface.

As previously mentioned, in centerless grinding the diameter of the workpiece 6 will be determined by the distance between the working face of the grinding wheel 3 and the regulating surface of the wheel 4, as will be evident from an examination of Figure 1. Thus, any tendency for the grinding wheel 3 to increase in diameter by the building up of material abraded from the element 6 will result in a diminution of the finished diameter of the workpiece 6. The same is true of any building up on the regulating surface 4, although this is not as great because the surface 4 is not an abrading surface.

In the abrading operation on a cork composition including a thermoplastic binder and a thermoplastic lubricant, there is an excessive tendency for the grinding wheel 3 to load. Common practice has been to grind a few rods and

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then dress the wheel 3 to present a fresh abrading surface free of loading and then adjust the wheel 4 to provide the desired spacing to give a finished diameter to the workpiece within the tolerances allowable.

According to my invention, I provide a conduit for steam under pressure which conduit is indicated at 7 in the drawing. This conduit extends across the working face of the wheel 3 and is provided with a plurality of openings 8 which are positioned so as to direct the steam under pressure against the working face of the grinding wheel. The conduit 7 with the openings 8 is positioned closely adjacent the working face of the grinding wheel at a position in advance of the abrading zone along the direction of travel of the grinding wheel, as will be noted from Figure 1 where an arrow indicates the direction of travel of the grinding wheel. In actual practice using a grinding wheel 20 inches in diameter having 8-inch face and formed of No. 60 grit, I have provided a double row of holes 8, the holes being $\frac{3}{64}$ inch in diameter and spaced $\frac{1}{8}$ inch on centers with the two rows being spaced $\frac{1}{8}$ inch apart and the holes in adjacent rows being staggered. I have used steam under 10 pounds pressure. With a cork composition of the type described above and containing the mold lubricant mentioned, I have found it possible to grind hundreds of cork rods prior to any requirement for dressing of the wheel. The steam has been found effective for heating the abrading surface as it leaves the abrading zone, and this heating is sufficient to melt the thermoplastic ingredients and serves to flush them away from the abrading surface. As the wheel continues its rotation from the zone of steam application, the surface is cooled, and, at the time the wheel re-enters the abrading zone, the heated and cleaned surface has been cooled to a point where grinding may be effected efficiently. Thus, any tendency for the grinding wheel to load up with the material severed from the surface of the cork composition workpiece is eliminated, and, consequently, the spaced relationship between the abrading surface and the regulating surface is maintained. I have found that it is possible to maintain the finished diameter of a cork composition rod at .985 inch within .015 of an inch over a period of several hundred grindings of workpieces 48 inches long, fed through the grinder at a rate of 40 feet per minute.

There is some transfer of severed cork granules and binder to the regulating surface of the wheel 4, and, in order to maintain this wheel clear, I provide a doctor blade 9 which is maintained in engagement with the regulating surface. The blade is effective for removing any slight amount of abraded material which may be transferred from the workpiece to that surface.

While my invention is particularly useful in the grinding of cork composition rods used in the manufacture of closure liner disks, it is equally applicable to the grinding of hollow cork composition cylinders used in the manufacture of cork composition textile cots. It will also be found useful in the centerless grinding of other materials containing a thermoplastic ingredient or ingredients which may be melted and flushed out of the abrading surface.

While I have illustrated and described a preferred embodiment of my invention, it will be understood that the same is not limited thereto but may be otherwise embodied and practiced within the scope of the following claims.

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I claim:

1. In a method of centerless grinding a workpiece containing a thermoplastic ingredient the steps comprising rotating an abrading surface in engagement with said workpiece at an abrading zone in which thermoplastic ingredient is imbedded in said abrading surface, heating the abrading surface as it leaves the abrading zone by directing steam under pressure against said surface to melt said thermoplastic ingredient and remove the same from said abrading surface, and thereafter cooling said surface prior to its re-entrance into the abrading zone.

2. In a method of centerless grinding a cork composition element containing a thermoplastic ingredient the steps comprising rotating an abrading surface in engagement with said cork composition element at an abrading zone in which said thermoplastic ingredient is imbedded in said abrading surface, heating the abrading surface as it leaves the abrading zone by directing steam under pressure against said surface to melt said thermoplastic ingredient and remove the same out of said abrading surface, and thereafter cooling said surface to a temperature below the melting point of said thermoplastic ingredient prior to re-entrance of the heated, cleaned, and cooled abrading surface into the abrading zone.

3. In a method of centerless grinding a cork composition element containing a thermoplastic waxy material the steps comprising rotating an abrading surface in engagement with said cork composition element at an abrading zone in which zone said waxy material becomes imbedded in said abrading surface, heating the abrading surface as it leaves the abrading zone to a temperature above the melting point of said waxy material by directing steam under pressure against said surface and melting said thermoplastic waxy material and removing the same from the abrading surface, and thereafter cooling said surface to a temperature below the melting point of said waxy material prior to re-entrance of the heated, cleaned, and cooled abrading surface into the abrading zone.

4. In a method of centerless grinding a cork composition element containing a thermoplastic ingredient the steps comprising rotating an abrading surface and a regulating surface in engagement with said cork composition element at an abrading zone in which zone said thermoplastic ingredient is imbedded in said abrading surface and a portion thereof is transferred to said regulating surface, heating the abrading surface as it leaves the abrading zone by directing steam against said surface to melt said thermoplastic ingredient, said steam being applied under pressure sufficient to flush the melted thermoplastic ingredient out of said abrading surface, and maintaining predetermined spaced relationship between said abrading surface and said regulating surface by removing from said regulating surface thermoplastic material transferred thereto.

5. In a method of centerless grinding a cork composition element containing a thermoplastic ingredient the steps comprising continuously rotating an abrading surface in engagement with said cork composition element at an abrading zone, continuously rotating a regulating surface in engagement with said cork composition element at said abrading zone, continuously heating the abrading surface as it leaves the abrading zone by directing steam under pressure against

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said surface to melt said thermoplastic ingredient, said steam being applied under sufficient pressure to flush out the melted thermoplastic ingredient from the abrading surface, continuously removing transferred portions of said cork composition element from said regulating surface to thereby maintain a predetermined spaced relationship between said abrading surface and said regulating surface, and continuously cooling said abrading surface to a temperature below the melting point of said thermoplastic ingredient prior to entrance of said abrading surface into the abrading zone.

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