Feb. 26, 1952 T. J. MILLER 2,586,848

ROTARY DISK PLATEN

Filed July 19, 1945 2 SHEETS—SHEET 1

Fig. 1

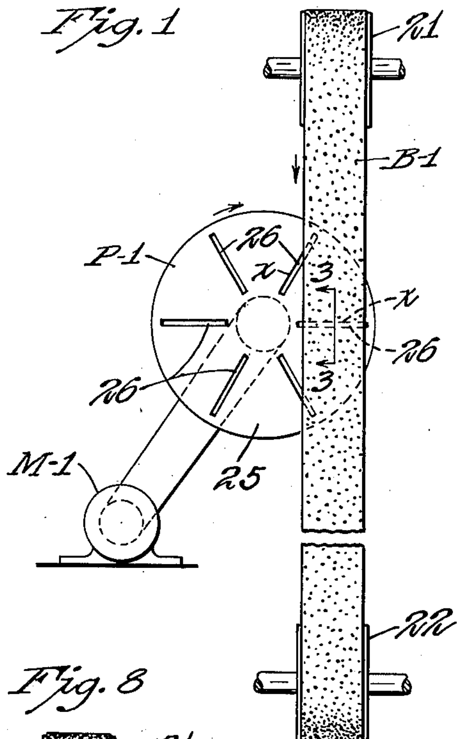

Fig. 2

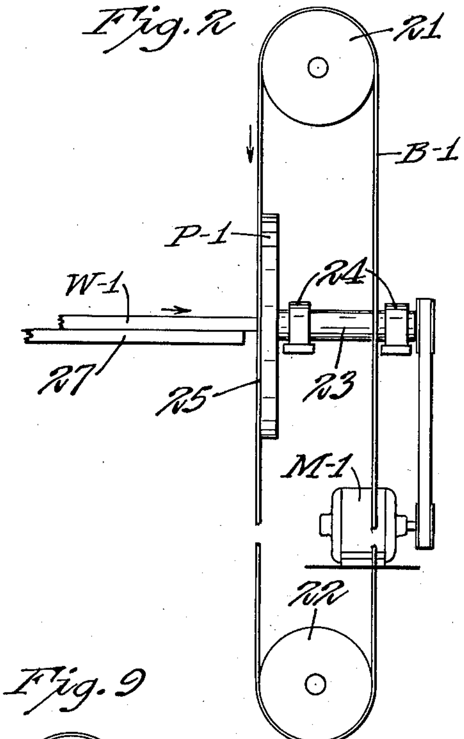

Fig. 8

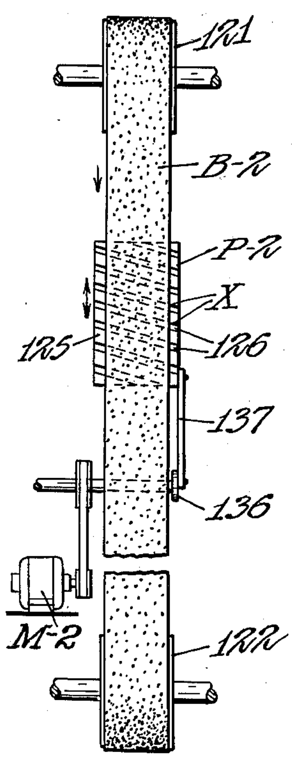

Fig. 9

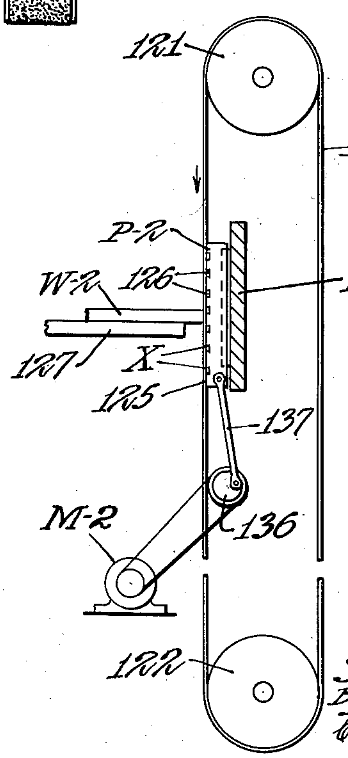

Fig. 10

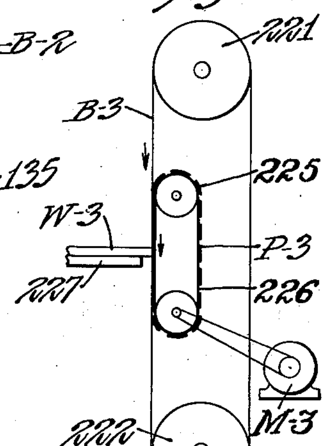

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Fig. 4

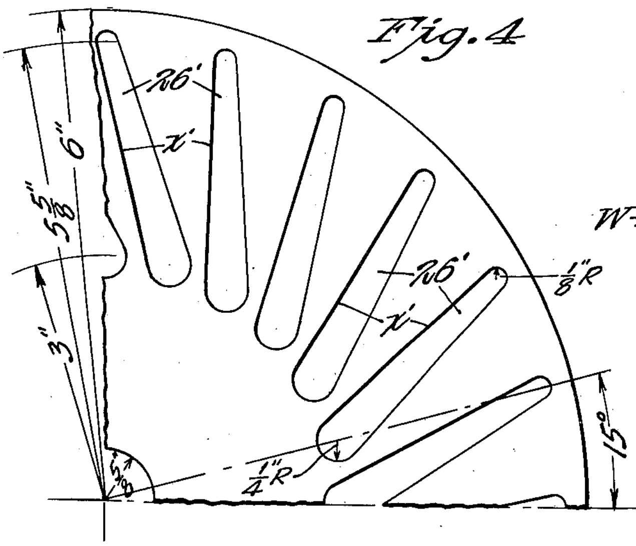


Fig. 3

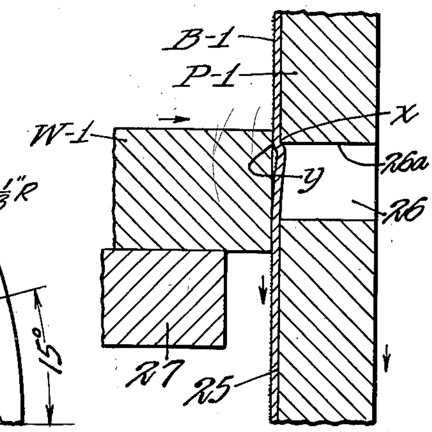


Fig. 5

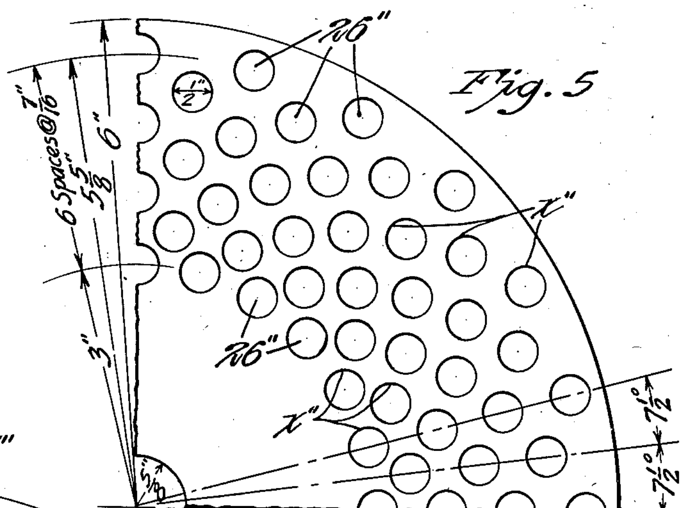


Fig. 7

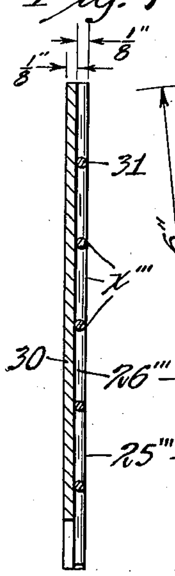
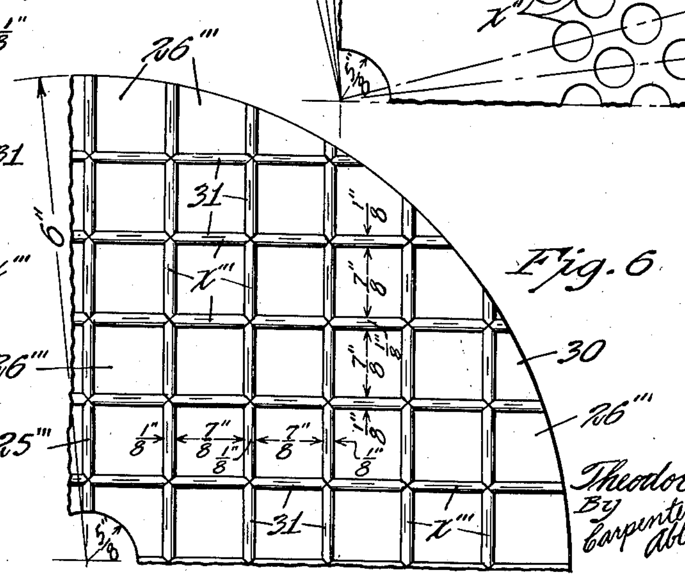


Fig. 6



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UNITED STATES PATENT OFFICE

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ROTARY DISK PLATEN

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12 Claims. (Cl. 51—141)

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This invention relates to supports or anvil members or platens for use in backing up or supporting sheet abrasives at the point where the workpiece being abraded contacts the abrasive coated side of the abrasive sheet during an abrading operation.

It is particularly applicable to "belt sanding" or "belt grinding," i. e., to abrading operations in which an abrasive belt or strip is employed, and the invention is accordingly illustrated in the present disclosure in connection with belt sanding apparatus.

A belt sanding apparatus usually comprises an endless abrasive belt mounted on two or more pulleys, and means for continuously driving the belt. Abrading operations with such apparatus may be divided roughly into two classifications, namely, unsupported operations and supported operations. An unsupported operation is where there is no support back of the belt at the point of contact with the work other than the tension of the belt that is applied between the adjacent pulleys or guides, whereas a supported operation is where there is.

The present invention relates to the latter type of operation, i. e., to supported operations.

In the said supported type of operations there are at least two principal types or classes of supports. One is a wheel or pulley, usually one of the driving or idling pulleys around which the endless belt is mounted, the peripheral surface of the pulley being employed to bear against the work. This is sometimes referred to as a roll or line contact support, and is particularly suited for spot grinding and other precision work such as surface grinding. The second type of support is an anvil member or platen, usually substantially flat, which is applied to a span of the belt between two of the pulleys, and it is to this second or platen type of support that the present invention relates.

Heretofore the flat platen method of support has caused a decided drop in the efficiency of the belt long before the mineral on the belt is worn down or abraded off. This was due largely to a filling and glazing of the belt which developed rapidly early in the life of the belt so that only the tops of the highest particles ever came into full use. Some attempts were made to improve this situation, including the use of irregular surfaced platens but whatever improvement these may have produced in the way of lengthened belt life, was offset by an increased wearing or "hollowing" of the platen face.

Nevertheless, because of its peculiar adaptability to certain types of grinding operations, flat platen belt grinding must of necessity be used and it is therefore an objective of this invention to provide a platen or suitable supporting element for flat belt grinding which will provide inter alia (1) longer belt life, (2) faster cutting and (3) retention by the platen of its flat surface.

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The present invention does indeed meet these and other objectives and solves these and other problems successfully, and, in its illustrated aspect comprises a belt-supporting platen having a generally planar working surface or "face" mounted adjacent the back of a span of the belt with the platen face substantially parallel thereto and means for moving the platen face during an abrading operation in a path substantially parallel to the belt span.

The motion of the platen may be effected in various ways, e. g., by oscillation, by providing a platen in the form of a disc and then rotating it; or by providing a platen in the form of an endless belt positioned to run in contact with the abrasive belt.

The platen face is discontinuous or broken. It may be broken in a variety of patterns, it being preferable to shape the irregularities or breaks so as to provide alternate areas of support and non-support for the belt and so as to produce what may be termed a "line contact" between the belt and the work.

The invention is exemplified by devices described hereinafter and illustrated in the accompanying drawings in which:

Figure 1 is a schematic view (front) of a belt sanding apparatus employing a rotary platen;

Figure 2 is a side view of the apparatus of Figure 1, showing a workpiece being abraded;

Figure 3 is a vertical fragmentary section (enlarged) on the line 3—3 in Figure 1 looking in the direction of the arrows, and showing a workpiece being abraded;

Figures 4, 5 and 6 are fragmentary front elevations of rotary platens.

Figure 7 is a side elevation of the platen fragment of Figure 6;

Figure 8 is a schematic view (front) of a belt sanding apparatus employing an oscillating platen;

Figure 9 is a side view of the apparatus of Figure 8; and

Figure 10 is a schematic view (side) of a belt sanding apparatus employing an endless belt platen.

Figures 1 and 2 show a belt sanding apparatus comprising an endless abrasive belt B-1 mounted on rotatable pulleys 21 and 22, means, such as an electric motor (not shown), for rotating the pulleys so as to drive the belt, and an anvil or supporting member or platen in the form of a disc P-1 rotatably mounted, by means of a shaft 23 and bearings 24, adjacent the back of a span of the belt with the face 25 of the disc P-1 substantially parallel to the span. The face 25 is substantially flat or planar with its continuity broken at intervals by a plurality of depressions in the form of radially extending elongate apertures or slots 26. The wall 26*a* of each slot 26 meets the plane surface 25 to form an edge *x* (Figure 3).

As an object such as the workpiece W-1 on the work support 27, is pressed against the moving belt B-1 so as to be abraded thereby, the belt is pressed against the rotary platen P-1, and the portion of the belt that is opposite a slot 26 (and is thus unsupported) is thereby forced to yield slightly in a direction inwardly into the slot; whereas the portion of the belt that contacts the platen face 25 (and is thus supported) does not so yield, so that the belt is bent slightly and there is formed, in effect, a temporary ridge or bump *y* in the belt in conformity to the contour of the edge *x* (Figure 3). This causes what may, for convenience, be termed a "line contact" between the belt and the workpiece, as contrasted with the flat or "surface contact" that results from continuous or smooth surfaced platens, the "line" being the "impact ridge" or bump *y* which conforms in length, direction, curvature, etc., approximately to the edge *x*. There is consequently produced an impact together with an increase in pressure per unit area between the belt and the work, which causes the belt to cut at each impact much more than when there is simply a sliding frictional contact over a broad area between the surface of the belt and the surface of the work. The line contact thus produces faster cut. It also produces longer belt life because the bending of the belt at *y* "opens it up," breaks up any glaze that has formed, exposes fresh unused portion of the mineral particles and results in keeping the belt at full cutting efficiency until its entire coating of abrasive particles is substantially completely used up. There is substantially no waste mineral.

The movement of the belt B-1 in contact with the platen P-1 causes the latter to rotate; or, rotation may be effected by suitable driving means such as the electric motor M-1.

One very advantageous result of such movement or rotation of the platen is to distribute the pressure and the consequent wear of the platen face throughout its working area, thereby preserving the desired overall planar profile of the working portion of the platen face for a very substantial period of time, as contrasted with the rapid localized hollowing of the ordinary stationary platens. The latter commonly need replacement in a few hours, whereas rotary platens made in accordance with my invention have been known to run for several months without variation in the flatness of the working surface.

The depressions or slots 26 need not necessarily pierce the disc as long as the depression is of sufficient depth and with a wall 26*a* of sufficient steepness to form an effective impact edge *x*. Also the depressions may take a wide variety of shapes, sizes, angles, frequency of occurrence, etc., as shown in Figures 4, 5, 6 and 7, it being understood that the designs as well as the dimensions and angles there shown are illustrative and not limiting.

Figure 4 illustrates a preferred embodiment. To compensate for the difference in linear speed between portions of the disc face that are near to and far from its center, respectively, the depressions or slots 26' are here placed at an angle of 15° to the radial line which increases the space differential between their outer and inner ends; and each slot is narrowed toward its outer end, thereby decreasing the effective impact of the edge *x'* against the work in proportion to the narrowing. The disc of Figure 4 thus provides even cutting across the entire width of the workpiece. Also the angular position of the edges *x'* in this disc provides something in the nature of a shearing effect, a point by point contact between the belt's impact ridge and the leading or upper edge of the workpiece.

Figure 5 shows a still further variation, the depressions here being circular apertures or holes bored through the disc, such a pattern being particularly suitable for fine precision grinding.

Figures 6 and 7 show what may be termed a "ridged" type disc, carrying on its surface a plurality of outwardly extending ridges in spaced relation to each other, the outer portions of the ridges together forming a composite surface of substantially planar contour which constitutes the outer or working surface 25''' or the platen. It comprises a disc base 30 overlaid with ridges 31 which may be of any shape in cross-section. Here they are circular, being rods that are cut and welded to the base 30 to form square "depressions" or spaces 26''' between them, the rods themselves forming at once the impact edges *x'''* and the platen face 25'''. Such a disc is particularly suitable for very fast and very rough abrading or cutting. This is due partly to the increase in the size of the bump or impact ridge *y'''* caused by the relatively wider spaces or depressions 26''' and partly to the increased pressure per square inch between the belt and the workpiece caused by the smaller total contact area. Within certain limits there is a direct inverse relationship between contact area and cutting speed.

From these few illustrative examples it will be apparent that the number of possible variations in the pattern of the platen face is infinite, and that such variations change it from mild to aggressive and fine to coarse cutting action.

Although movement of the platen, preferably in a plane parallel with the belt, is an essential element of my invention, such movement is not confined to that produced by the rotation illustrated and contemplated in Figures 1 to 7, but may, for example, be by oscillation of the platen as shown in Figures 8 and 9, or by the movement of an endless belt platen as shown in Figure 10.

In Figures 8 and 9 the platen P-2 (in a belt sanding apparatus which is otherwise the same as that of Figures 1 and 2), is slidably held by a suitable support 135 and oscillated or reciprocated up and down by a suitable driving means, such as an air engine reciprocator (not shown) or the crank wheel 136 and pitman 137 driven by the electric motor M-2. The face 125 of the platen P-2, like that of P-1, is preferably substantially flat or planar with its continuity broken at intervals by a plurality of depressions 126 to form impact edges *x*. As in the rotary platens of Figures 1 to 7, the depressions of the oscillating platen P-2 of Figures 8 and 9 may have a wide variety of depths, sizes, shapes, angularity, frequency of occurrence, etc. as long as they provide impact edges suitable for operation on the principles described above in connection with the impact edges x of Figures 1 and 3.

In Figure 10 the endless belt or "saddle belt" platen **P-3** (in a belt sanding apparatus which is otherwise the same as that of Figures 1, 2, 8 and 9) is positioned so that one of its spans serves as the support back of a span of the abrasive belt **B-3** opposite the point where the workpiece W-3 is pressed during an abrading operation. It is driven in the same direction as the abrasive belt **B-3** by reason of its frictional contact therewith, or it may be driven by suitable power means, such as the electric motor **M-3**, through its supporting pulleys.

The face **225** of the belt platen **P-3**, like those of the platens **P-1** and **P-2**, is preferably generally planar with its continuity broken at intervals by a plurality of depressions **226** which may, for example, be such as to provide a plan and profile like that of the platen face **125** in Figures 8 and 9. The said platen surface may be formed or constructed by molding; or by cutting the depressions in a smooth surfaced belt, in which case the original surface of the belt would become the platen face **225**; or by fastening strips or patches of suitable material onto a belt, in which case the original surface of the belt would become the bottom of the depressions and the tops of the ridges or patches would become the platen face **225**. The belt may be of ordinary power belting material, such as rubberized fabric, leather rubber, etc., or it may be synthetic rubber or resin, or any hard tough material of sufficient flexibility to serve as an endless belt. As in the rotary platens of Figures 1 to 7 and the oscillating platen of Figures 8 and 9, the depressions of the saddle belt platen **P-3** of Figure 10 may have a wide variety of depths, sizes, shapes, angularity, frequency of occurrence, etc. as long as they provide impact edges suitable for operation on the principles described above in connection with the impact edges x of Figures 1 and 3.

When a saddle belt platen is used, the operation is not then, strictly speaking, a "supported" operation. In a sense it is supported, but the support is, in turn, simply the unsupported span of a second belt, so that the effect is to preserve the aspects of unsupported grinding in the way of yieldability and flexibility while adding the benefit of added support over and above that provided by the ordinary tension of the abrasive belt.

The cutting efficiency of the various types of broken-surfaced moving platens of my invention, increases as their linear speed approaches that of the belt, and substantially beyond that. Their movement may be in the same direction as that of the belt or it may be in the reverse direction.

It will be seen that sanding platens made in accordance with my invention possess numerous important and valuable advantages over those heretofore known, including (1) longer life of the platen and retention by the working portion of its exterior surface of the desired overall planar contour or flatness, due to the movement of the platen; (2) lower or cooler abrading temperatures due to numerous factors, including reduced friction, the faster cut and the movement of the platen; (3) longer life of the abrasive sheet due to numerous factors including the cooler abrading temperature and the fact that substantially all of the abrasive coating is rendered usable by the "opening up" effect of the platen's impact edges; and (4) faster cut, due to numerous factors including the broken-surface feature and the unique effect of a rotating disc platen.

The principle of a broken, irregular or variate surfaced moving platen, as taught by my invention, may be employed in ways other than those described herein and in connection with abrasive materials and structures other than belts. For example the invention may be adapted for use with abrasive discs by using a broken surfaced back-up pad adapted to move or to rotate in relation to the disc.

The invention is not to be understood as restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

The construction of platen disclosed in Figures 6 and 7 is claimed in my divisional application, Ser. No. 212,223, filed Feb. 23, 1951. The construction of platen disclosed in Figures 8 and 9 is claimed in my divisional application, Ser. No. 225,397, filed May 9, 1951.

I claim:

1. In a belt sanding apparatus which comprises an endless abrasive belt and means for continuous propulsion thereof, a belt-supporting platen comprising a rotatably mounted disc positioned with a portion of a surface thereof adjacent the back of a span of the belt and substantially parallel thereto, the said portion of the surface being substantially planar with its continuity interrupted by a plurality of depressions, a wall of a depression and a planar surface of the disc meeting to form an edge.

2. In a belt sanding apparatus which comprises an endless abrasive belt and means for continuous propulsion thereof, a belt-supporting platen comprising a rotatably mounted disc positioned with a portion of a surface thereof adjacent the back of a span of the belt and substantially parallel thereto, the said portion of the surface being substantially planar with its continuity interrupted by a plurality of depressions, a wall of a depression and the planar surface of the disc meeting at an approximate right angle to form an edge.

3. In a belt sanding apparatus which comprises an endless abrasive belt and means for continuous propulsion thereof, a belt-supporting platen comprising a rotatably mounted disc positioned with a portion of a surface thereof adjacent the back of a span of the belt and substantially parallel thereto, the said portion of the surface being substantially planar with its continuity interrupted by a plurality of elongate depressions extending outwardly from the central portion of the disc towards its periphery.

4. In a belt sanding apparatus which comprises an endless abrasive belt and means for continuous propulsion thereof, a belt-supporting platen comprising a rotatably mounted disc positioned with a portion of a surface thereof adjacent the back of a span of the belt and substantially parallel thereto, the said portion of the surface being substantially planar with its continuity interrupted by a plurality of elongate approximately radially disposed depressions.

5. In a belt sanding apparatus which comprises an endless abrasive belt and means for continuous propulsion thereof, a belt-supporting platen comprising a rotatably mounted disc posi-

tioned with a portion of a surface thereof adjacent the back of a span of the belt and substantially parallel thereto, the said portion of the surface being substantially planar with its continuity broken by a plurality of approximately radially disposed depressions, a wall of a depression and the planar surface of the disc meeting to form an edge.

6. The device of claim 5 in which the depressions are at an acute angle to the radii that intersect them.

7. The device of claim 5 in which the depressions are narrowed toward their outer ends and are at an acute angle to the radii that intersect them.

8. In a belt sanding apparatus which comprises an endless abrasive belt and means for continuous propulsion thereof, a belt-supporting platen comprising a rotatably mounted disc positioned with a portion of a surface thereof adjacent the back of a span of the belt and substantially parallel thereto, the said portion of the surface being substantially planar with its continuity interrupted by a plurality of circular depressions.

9. In a belt sanding apparatus which comprises an endless abrasive belt and means for continuous propulsion thereof, a belt-supporting platen comprising a rotatably mounted disc positioned with a portion of a surface thereof adjacent the back of a span of the belt and substantially parallel thereto, the said portion of the surface being substantially planar with its continuity interrupted by a plurality of apertures that pierce the disc.

10. The device of claim 9 in which the apertures are elongate.

11. The device of claim 9 in which the apertures are circular.

12. In an abrading operation which comprises propelling an endless abrasive belt with a span of the belt in contact with the workpiece, the steps comprising pressing the span against the workpiece with an interrupted surface disc platen and causing the platen face to rotate in relation to the span in a plane substantially parallel to the movement of the span and at a different linear speed.

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