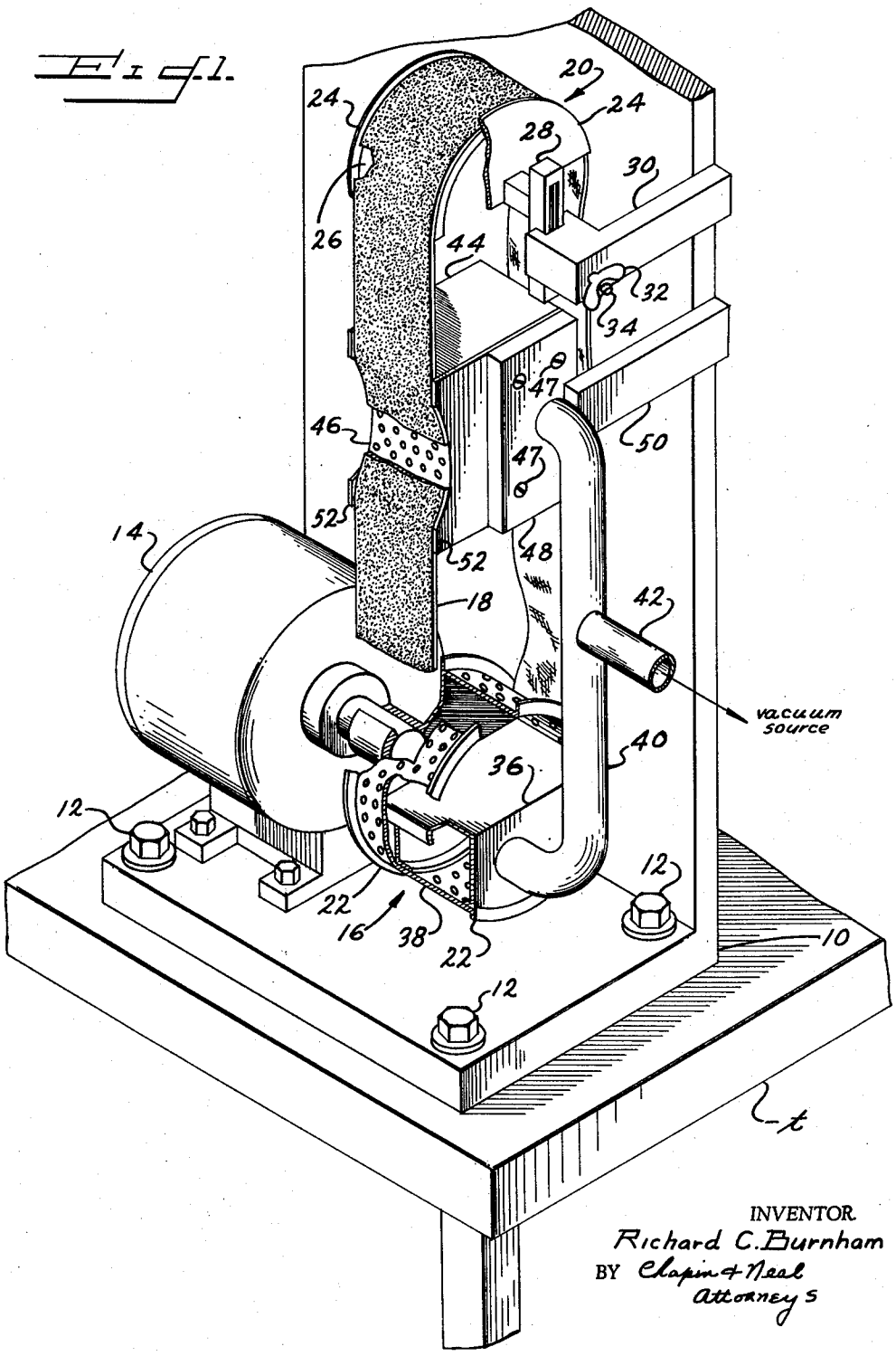
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CONTOUR ABRADING MACHINE AND METHOD

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Fig. 1.



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Fig. 2.

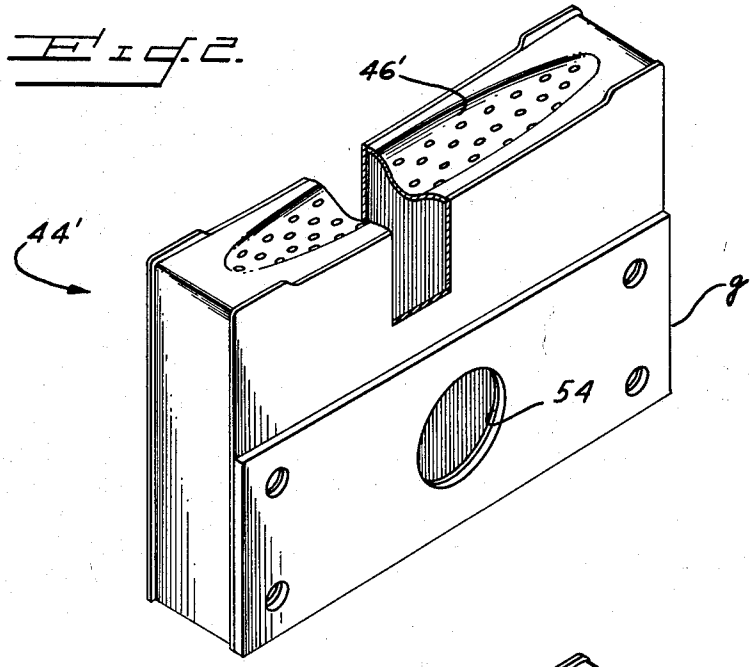
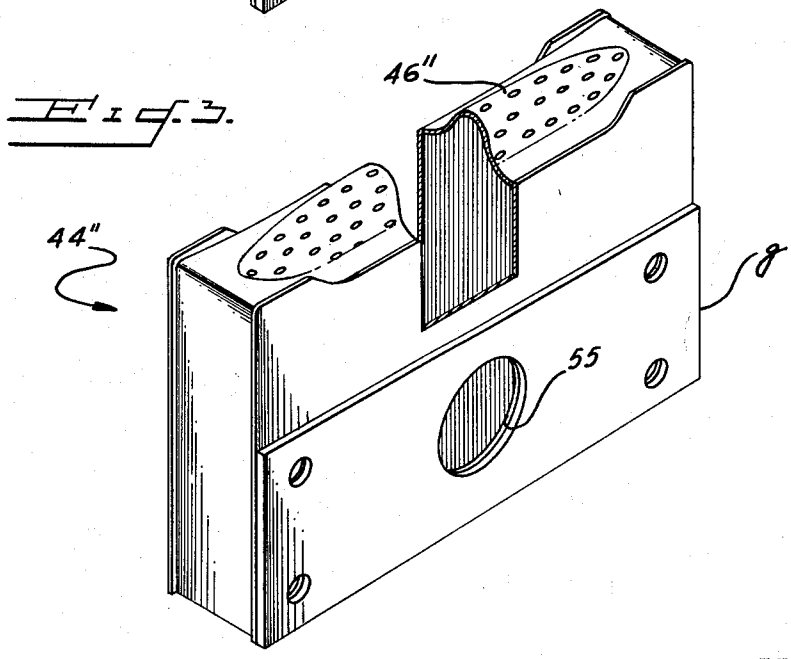


Fig. 3.



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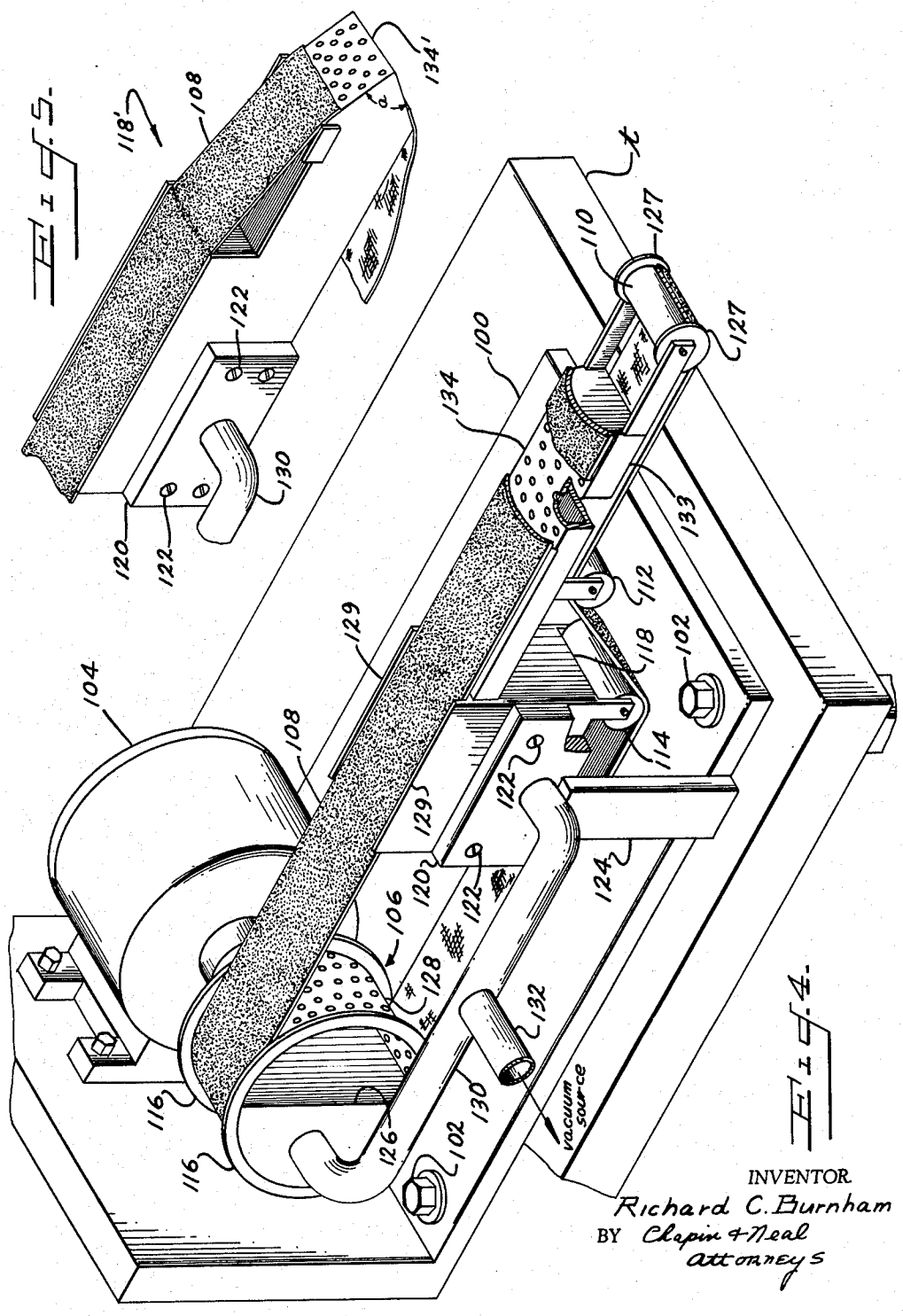


Fig. 5.

Fig. 4.

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CONTOUR ABRADING MACHINE AND METHOD

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9 Claims. (Cl. 51—141)

The present invention relates to contour abrading devices and more particularly to belt-type sanding machines.

The object of the invention is to provide improved means and methods for finishing or removing material from non-planar surfaces.

Ancillary to this, it is a further object to provide improved means for driving an endless belt about a given path without tensioning the belt.

Basically, the present invention comprises the concept of advancing an endless abrading belt and employing suction means to conform a portion of the belt to a non-planar configuration as it is thus advanced.

To enable a portion of a moving abrading belt to be drawn into conformity with a non-planar contour, the belt must be in a slack or relaxed condition. The degree or extent of slackness naturally depends upon the extent of deviation, of the contour from the plane of travel of the belt. Since belt tension is a prerequisite to operation of conventional belt sanders, in accordance with this invention, means is required for driving a belt without tension. The abrading belt may be considered in slack or relaxed condition when its overall length is greater than the path of travel defined by the guide means provided for the belt.

The above and other related objects and features of the invention will be apparent from a reading of the following description of the disclosure found in the accompanying drawings and the novelty thereof pointed out in the appended claims.

In the drawings:

FIG. 1 is a perspective view of one embodiment of the invention;

FIGS. 2 and 3 are perspective views of means for forming different types of non-planar contours for the abrading belt;

FIG. 4 is a perspective view of a modified version of the invention; and

FIG. 5 is a perspective view of a substitute device employed in connection with FIG. 4 for forming other contours.

Referring now to FIG. 1, the illustrated embodiment of the present invention may be conveniently mounted on a bench or table *t* and comprises an L-shaped frame 10 which is secured thereto by screws 12. A motor 14 is mounted on the frame 10 and has a cup-shaped pulley 16 secured to its shaft. An abrasive belt 18 is trained around the pulley 16 and also around a belt guide 20 spaced from the pulley. The pulley 16 and guide 20 have flanges 22 and 24 respectively to prevent lateral displacement of the belt 18.

As shown, the belt guide 20 comprises a member having a semi-cylindrical surface 26 disposed between the flanges 24. This guide is mounted on a bracket 28 which is adjustable on an arm 30 projecting from the frame 10 for moving the guide toward and away from the drive pulley 16. A wing nut 32 may be tightened on a screw 34 to lock the guide 20 in a position properly spaced from the pulley 16. The cylindrical surface of the guide is preferably a material having a low coefficient of friction such as certain plastics, for example "Teflon."

A vacuum chamber which may be in the form of a box 36 is disposed within the cup-shaped pulley 16 which further comprises a perforate cylinder 38. Vacuum is provided within the chamber by a vacuum source connected to the box 36 by conduits 40 and 42. The box

36 provides a vacuum chamber internally of the perforated cylinder opening toward the surface portion of the shell 38 around which the belt 18 is trained. The outer edges of the box are sufficiently contiguous with the inner surface of the shell 38 so that a vacuum is drawn principally through that perforation of the shell 38 around which the belt 18 is trained and against which it is thus drawn and held in contact. The combined action of the vacuum drawing the belt against the cylinder 38 and the rotation of the cylinder serves to drive the belt in a non-tensioned or slack condition. The guide 20 is positioned relative to the drive pulley so that the belt 18 is slack about guide 20 and the pulley 16. That is, the length of the belt is greater than the path of travel defined by the guide means 20 and pulley 16.

A vacuum chamber 44 is disposed within the path of travel of belt 18. The chamber is provided with a perforated, contoured surface 46 over which the belt 18 is advanced. The vacuum chamber may be, and as shown is, in the form of a box removably secured, by screws 47, to a plate 48, which in turn is attached to an arm 50 projecting from the frame 10. The conduit or pipe 40 is also connected to the plate 48 and communicates therethrough with the interior of the chamber 44 to thus provide a vacuum within that chamber by way of the pipe 42 which is connected to the above-mentioned vacuum source. The contoured surface 46 is perforate so that the belt 18 will be drawn into intimate contact therewith as it is advanced thereover to thus provide an abrading surface which accurately reproduces the configuration defined by the surface 46. The sides of the chamber 44 may project outwardly beyond the surface 46, as indicated at 52, to provide further lateral guiding means for the belt 18.

The belt 18, as mentioned above, is slack or longer than the path defined by the pulley 16 and guide 20 to enable a portion of the belt to be drawn while in motion against the contoured surface 46. Since the belt drive is independent of belt tension, highly versatile and adaptable belt-type abrading tools can be provided capable of sanding angles, curves and irregular surfaces.

As this point it will be noted that the term "abrading" is used in its broadest sense to include removal of material by rubbing or wearing away. Thus, the outer surface of the belt 18 may take many forms which would be suitable for removing material from wood, plastic, metal or objects formed of other materials. For example, sand paper or aluminum oxide or tungsten carbide particles could be adhered to the surface of the belt 18. The size or grit of these particles would determine the rate of removal and the smoothness of the abraded surface. Coarse grits are used for rough work and fine grits for a smooth finish. The abrading surface could even be of felt or equivalent material for a polishing operation.

Various alternate embodiments of the suction chamber 44 are illustrated in FIGS. 2 and 3, which also illustrate in somewhat greater detail the construction of the suction chamber, particularly the openings 54 and 55 which provide communication through the plate 48 with the vacuum source. A gasket *g* is provided to provide a seal between the chamber and the plate 48.

FIG. 2 illustrates a vacuum chamber 44' having a contoured surface 46' which has a shape particularly useful in finishing furniture moldings. The gasket *g* which is mentioned above as being disposed between the plate 48 and the vacuum chamber, will also be seen in FIG. 2.

FIG. 3 illustrates a vacuum chamber 44'' having a contoured surface 46'' which provides a surface to which the abrading belt is conformed and which would also be useful in abrading and finishing irregularly shaped articles such as moldings.

Referring now to FIG. 4, a modified form of the invention will be described. This embodiment is also mounted on a table *t* and comprises an L-shaped frame **100** secured thereto by screws **102**. A motor **104** is mounted on the frame and has a cup-shaped pulley **106** secured to its shaft. An abrasive belt **108** is trained around the pulley **106** and also around belt guides **110**, **112** and **114**. The pulley **106** has flanges **116** which prevent lateral displacement of the belt **108**.

The guides **110**, **112** and **114** are mounted on an extension of suction chamber **118**, removably secured to a plate **120** by screws **122**. As shown, the guide **110** is provided with flanges **127** to prevent lateral displacement of the belt. The plate **120** in turn is supported on the frame **100** by an arm **124** secured thereto. A vaccum chamber **126** is disposed within the cup-shaped pulley **106** which further comprises a perforate cylinder **128**. The vacuum chamber, as in the previous embodiment, is preferably semi-cylindrical and provides a chamber which opens on the portion of the cylinder **128** around which the belt **108** is trained. The chamber **126** is connected by conduits **130** and **132** to an appropriate vacuum source. The pulley and vacuum chamber are in all respects similar in operation and construction to the unit shown in FIG. 1. It will be appreciated that the same machine is preferably used for both internal and external sanding operations. Modification from one to the other type of operation may be accomplished by simply changing the contour suction chamber and belt guide element.

The vacuum conduit **130** extends to the plate **120** to connect the suction chamber **118** to the same vacuum source. The suction chamber **118** has an extension **133** which projects beyond the frame **100** and with its upper surface provides a contour plate **134** which is convexly curved transversely of the belt **108**. This arrangement provides a projecting convex abrading surface of the moving belt type which is readily available for abrading concavely curved surfaces and particularly such surfaces as the interior diameters of tubular or ring-like elements. Flanges **129** project from the suction box **118** and together with the flanges **127** and **116** of the pulley **106** prevent lateral displacement of the belt **108**.

FIG. 5 shows a substitute suction box **118'** which may be mounted on the plate **120** in the embodiment of FIG. 4. This substitute suction box is preferably arranged for the abrading of surfaces which are joined at a relatively sharp angle. Thus, it is preferable that the contour plate **134'** have perforate surfaces which are joined along a line transversely of the belt **108** at an angle *a* which may be 90° or any other suitable angle for the job requirements.

In using the suction box **118'** the belt **108** is advantageously slack, as in the embodiment described in connection with FIG. 1 so that there is a minimum of tension on the belt as it is advanced over the corner at which the two perforate surfaces meet.

While in accordance with this invention the belt drive advances the belt in a slack condition, it will be realized that for certain contours, such as in the embodiment shown in FIG. 4, that the abrasive belt could be somewhat tensioned and yet drawn into conformity with the configuration of the contour plate **134**. The relative tension or slackness depends on the direction and extent of the curvature.

The surfaces of the contour suction chamber in contact with the abrading belt may be made of suitable low friction material to minimize belt wear.

Having thus described the invention, what is claimed is:

1. A method of contour abrading which comprises the steps of continuously advancing an endless abrading belt in slack condition and drawing a portion of the moving belt by suction into a non-planar concave configuration for abrading contoured surfaces.

2. A method of contour abrading which comprises the steps of advancing an endless abrading belt in slack condition by employing a rotating pulley and gripping the belt against the pulley through the use of suction means, and drawing a portion of the slack belt by suction into a concave configuration for abrading contoured surfaces.

3. Contour abrading machine comprising means for continuously advancing an endless abrading belt in a slack condition about a path, a contoured surface disposed within said path and suction means for drawing a portion of the abrading belt into surface-to-surface conformity with said contoured surface.

4. Contour abrading machine as set forth in claim 3 in which said contoured surface includes a concave configuration.

5. Method of contour abrading which comprises the steps of continuously advancing an endless abrading belt in a substantially slack condition about a given path by rotating a perforated pulley and gripping the belt thereagainst by the use of suction, and drawing a portion of the slack belt by suction into a concave configuration for abrading contoured surfaces.

6. A contour abrading device as in claim 4 wherein the advancing means include a rotating pulley around which the belt is trained and vacuum means for gripping portions of the belt trained around the pulley thereagainst to thus advance the belt.

7. A contour abrading device as in claim 4 wherein conforming means comprises a perforate plate having two angularly disposed surfaces joined at a line transversely of said belt, the belt being advanced over the side of the plate having the named surfaces and the other side of said plate defining a suction chamber and means connecting the suction chamber to a vacuum source.

8. A contour abrading device as in claim 7 wherein the pulley comprises a perforate cylinder, means disposed within said cylinder forming a suction chamber, said chamber having an opening communicating with that portion of the pulley cylinder around which the belt is trained and means connecting said chamber to a vacuum source.

9. A contour abrading device as in claim 8 wherein the angle between the two named surfaces is approximately 90 degrees and the perforate plate also defines one limit of the path of travel of said belt.

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