United States Patent [19]

Hutchins

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[54] **PIERCING OF AIR SUCTION HOLES IN ABRASIVE SHEET MATERIAL**

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Related U.S. Application Data

[62] Division of Ser. No. 282,155, Aug. 21, 1972, Pat. No. 3,788,011.

[52] **U.S. Cl.** **30/368**

[51] **Int. Cl.** **B26f 1/24**

[58] **Field of Search** 30/358, 359, 361, 363, 30/366, 367, 368; 83/2, 660; 269/54.5

[56] **References Cited**

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[57] **ABSTRACT**

Apparatus including a portable sander having a power driven shoe adapted to carry a sheet of sandpaper or the like and containing suction holes through which air and abraded particles are drawn by suction to a collection bag, and a coacting piercing tool adapted to punch suction holes in a sheet of sandpaper carried by the shoe when the sander and piercing tool are moved relatively toward one another.

3 Claims, 5 Drawing Figures

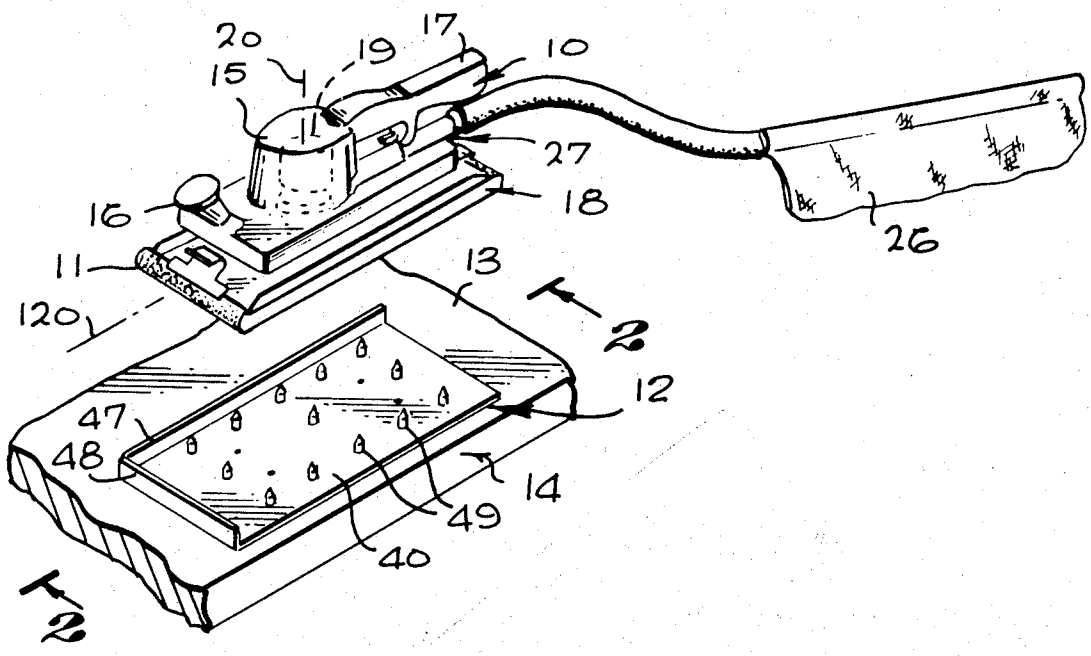


Fig. 1

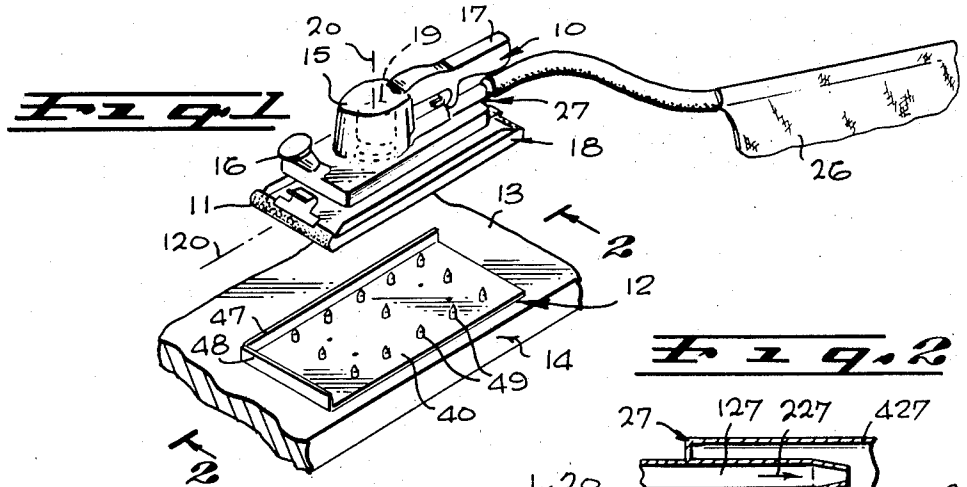


Fig. 2

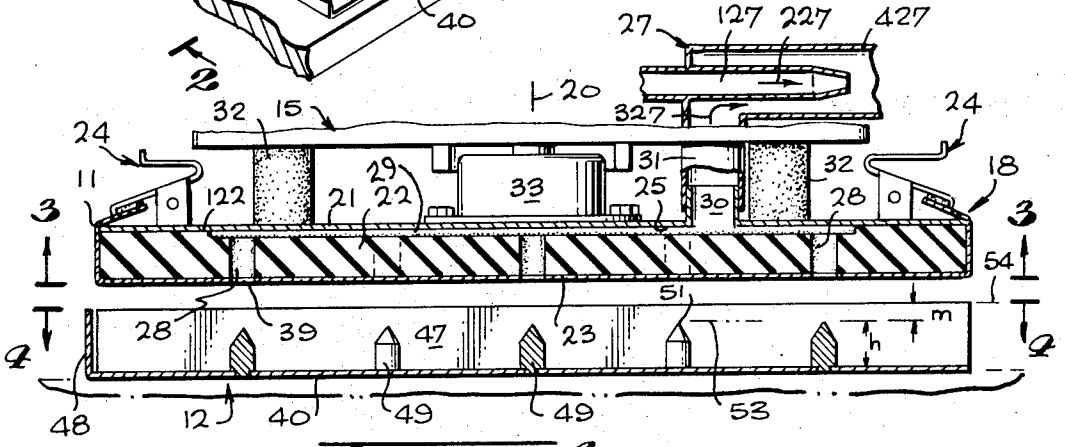
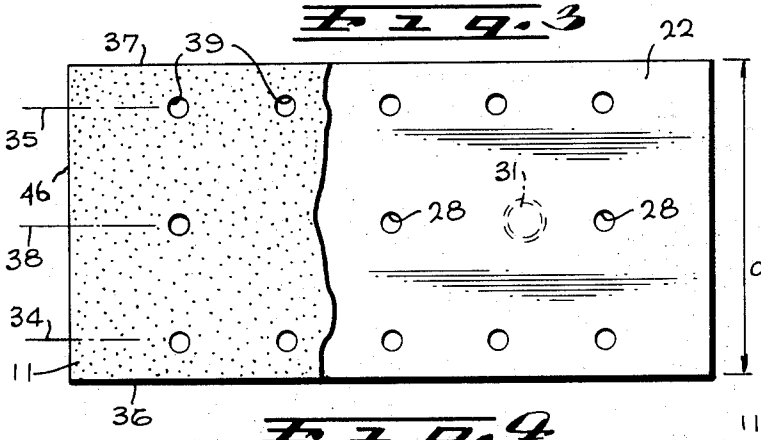


Fig. 3



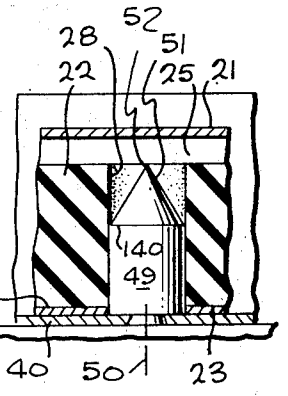
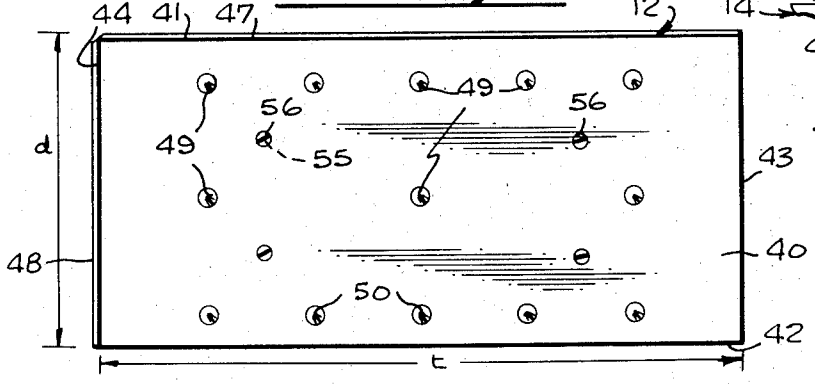


Fig. 5

Fig. 4



PIERCING OF AIR SUCTION HOLES IN ABRASIVE SHEET MATERIAL

This is a division, of application Ser. No. 282,155, filed August 21, 1972; now U.S. Pat. No. 3,788,011.

CROSS REFERENCE TO RELATED APPLICATION

Certain features of the sanding tool illustrated in the present specification have been disclosed and claimed in my prior copending application Ser. No. 213,018 filed Dec. 28, 1971 on "Abrading Tool Having Suction System for Collecting Abraded Particles," now U.S. Pat. No. 3,785,092.

BACKGROUND OF THE INVENTION

This invention relates generally to portable power driven work abrading tools, such as sanders and the like.

In my above identified copending application, I have disclosed a type of portable abrading tool having a power driven shoe or other element which removably carries a sheet of sandpaper or the like, and having suction means associated with the tool for creating a vacuum at the work surface acting to withdraw air and dust particles abraded from the work to a collection location, such as an appropriate collection bag. The suction system of that application preferably takes suction through openings formed in the power driven element and through communicating openings formed in the sandpaper, so that air may be drawn through these openings into the interior of the tool for delivery of the collection location.

SUMMARY OF THE INVENTION

The present invention relates to improved apparatus and methods for forming suction openings of this type in a sheet of sandpaper or the like. To assure proper positioning of the openings in the sandpaper, directly opposite and in registry with the openings in the carrying element itself, I first attach the sandpaper in unperforated form to that element, and then after such attachment pierce holes in the sandpaper at precisely the proper locations of communication with the openings in the carrier element. Such formation of the openings in the sandpaper after attachment of the paper to the carrier avoids the necessity for precise accuracy in locating the sandpaper on the carrier, such as would be required if the openings in the sandpaper were preformed and had to then be brought into exact positions of registry with the openings in the carrier at the time of attachment to the carrier. Further, this method substantially reduces the cost of the sandpaper, since completely conventional unperforated paper can be employed rather than a specially prepared prepunched sandpaper.

Certain particular features of the invention relate to a unique piercing tool, which has projections arranged in a predetermined pattern and designed to form openings in a sheet of sandpaper carried by the tool, with the openings being at precisely the proper locations for communication with the discussed suction openings or passages formed in the carrier itself. Appropriate locating means are provided on the piercing tool, for locating the sander and piercing tool laterally relative to one another in a proper orientation for forming the desired hole pattern. These locating means may include one or more locating flanges formed on the piercing tool, desirably at least two such flanges, for engagement with peripheral edges of a shoe of the sander in locating relation. Preferably, the piercing tool is secured to a mounting structure in fixed position, so that an operator may pierce holes in the sandpaper by merely pressing the sander manually against the stationary piercing tool.

BRIEF DESCRIPTION OF THE DRAWING

The above and other features and objects of the invention will be better understood from the following detailed description of the typical embodiment illustrated in the accompanying drawing, in which:

FIG. 1 is a perspective representation of a sander and piercing tool combination constructed in accordance with the invention;

FIG. 2 is an enlarged fragmentary vertical section taken essentially on line 2—2 of FIG. 1;

FIG. 3 is a bottom plan view of the sander taken on line 3—3 of FIG. 2;

FIG. 4 is a top plan view of the piercing tool taken on line 4—4 of FIG. 2; and

FIG. 5 is an enlarged fragmentary view showing the sander and piercing tool in their fully interfitting condition, at the end of a piercing stroke.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, there is shown at 10 a portable power driven sander carrying a sheet of sandpaper or other abrasive material 11, in which air suction openings are formed by a coacting piercing tool 12 which may be rigidly secured to the upper horizontal surface 13 of a workbench or other mounting structure 14. The sander may include a portable body structure 15 having suitable handles such as those shown at 16 and 17 for holding and manipulating the sander to abrade a work surface. A working shoe or carrier structure 18 is mounted movably to body 15, and is power driven relative thereto in any appropriate manner by a motor typically contained within body 15 and represented diagrammatically at 19 in FIG. 1. The shoe 18 and sandpaper are typically illustrated as of rectangular configuration, and may be given any of the conventional known types of sanding motion relative to body 15, such as for example orbital movement about a vertical axis 20 perpendicular to the sandpaper sheet 11, or straight line reciprocating movement along a front to rear horizontal axis 120 parallel to the plane of sandpaper 11. It is also contemplated that if desired both the shoe and sandpaper may be circular in shape, and be given either simple rotary motion or orbital motion about an axis perpendicular to the plane of the sandpaper.

As seen in FIG. 2, the illustrated rectangular shoe 18 includes a planar rectangular metal plate 21 which in FIG. 2 extends horizontally and carries at its underside a similarly rectangular layer of cushioning material 22, typically formed of a fairly soft resiliently deformable rubber or the like. The cushion 22 has a planar undersurface 23 against which the rectangular sandpaper sheet 11 is retained by means of a pair of clips 24 carried at the upper side of plate 21 and releasably retaining the opposite ends of the sandpaper. The upper surface 122 of cushion 22 may be appropriately cemented to plate 21.

The shoe assembly **18** contains a number of interior passages **25** through which air is drawn from the underside of the shoe and from adjacent the work surface into and through the shoe for ultimate delivery to a collection bag **26,** which is porous to allow escape of air from the bag to the atmosphere while retaining collected dust particles therein. This movement of air and particles may be produced in any convenient manner, but is optimally produced by means of an aspirator which is represented at **27** in FIG. **1** and may be carried by body **15** of the tool. The motor **19** which drives the tool may be an air-driven motor, in which event the exhaust air from that motor may be delivered to an inner tube **127** of aspirator **27** (FIG. **2**), and flow through that tube toward bag **26** as a primary air stream **227,** which induces by aspirator action a secondary flow of air **327** upwardly through shoe **18** and into an outer tube **427** of the aspirator and then to bag **26** in admixture with the primary stream. Certain aspirator systems of this type are disclosed in detail in my above mentioned prior application Ser. No. 213,018.

The air passages **25** in shoe **18** may be formed as a number of vertically extending parallel passages **28** extending upwardly within the material of cushion body **22** from its undersurface **23,** and communicating at their upper ends with horizontal grooves or passages **29** formed in the upper surface of cushion body **22,** beneath plate **21,** in a pattern leading air from all of the passages **28** to a single upwardly projecting air discharge tube **30** connected to plate **21** and communicating with a flexible tube **31** leading to the aspirator **27.** The shoe may be mounted to body **15** for the desired orbital, straight line or other movement in any convenient manner. Typically illustrated in FIG. **2** is an orbital arrangement in which the shoe is movably connected to body **15** by a number of flexible rubber connector posts **32,** and is driven orbitally about vertical axis **20** by a conventional orbital driving connection **33** between the rotor of motor **19** and shoe **18.**

The different air suction passages or openings **28** formed in cushion **22** of the shoe may be arranged in any convenient pattern across the undersurface **23** of the shoe, as for instance in the pattern shown in FIG. **3,** in which there are two rows of passages or openings extending along two parallel lines **34** and **35,** near opposite parallel side edges **36** and **37** respectively of the rectangular shoe. Between these two rows of apertures, an intermediate or central row of apertures may be formed along a parallel line **38,** typically with fewer apertures as seen in FIG. **3.**

When the sandpaper sheet **11** is initially connected to the shoe of tool **10** by clips **24,** the sandpaper is imperforate. After such application of the sandpaper, apertures **39** are formed in the sandpaper directly opposite and in registry with the openings or passages **28** in the shoe, so that air may pass upwardly through openings **39** and then passages **28** for ultimate delivery to bag **26.** These openings in the sandpaper are formed by the previously mentioned piercing tool **12.** This piercing tool preferably includes a rigid horizontal base plate **40** typically formed of a suitable rigid planar piece of sheet metal, such as steel, having substantially the same rectangular horizontal outline configuration as does shoe **18** of the tool. That is, the base **40** may have two parallel opposite side edges **41** and **42** spaced apart essentially the same distance *d* as the opposite straight side edges **36** and **37** of the shoe, and may similarly have two transverse parallel straight opposite end edges **43** and **44** spaced apart substantially the same distance *t* as are the transverse opposite end edges **45** and **46** of the rectangular shoe. Along a portion of its peripheral edge, base plate **40** has one or more upstanding flanges which are engageable with the corresponding edges of the shoe for accurately locating the shoe relative to the base plate as the shoe is pressed downwardly toward that plate. Desirably, two such flanges are formed on the base plate at **47** and **48,** extending along the two previously mentioned side and end edges **41** and **44,** with these flanges projecting directly upwardly perpendicular to base **40** and perpendicular to one another, and typically being formed by merely bending upwardly the edges of plate **40.**

At a number of different locations spaced across the area of base plate **40,** this plate carries a series of upwardly projecting rigid pins or projections **49,** which may be spot welded or otherwise rigidly secured at their lower ends to plate **40** and centered about individual parallel vertical axes **50.** These pins may be cylindrical about axes **50** from the level of plate **40** upwardly to a location **140,** beyond which the upper ends of the pins may be tapered conically at **51,** as seen in FIG. **2,** to form sharp points **52** at the upper ends of the pins capable of easily and quickly piercing openings in the sandpaper. These upper pointed ends of the various pins may lie in a common horizontal plane **53,** disposed parallel to the planar base plate **40** of the piercing tool **12,** but preferably spaced beneath the plane **54** in which the upper edges of flanges **47** and **48** lie. For best results, the distance *m* vertically between planes **53** and **54,** that is, the distance that the flanges project upwardly beyond the tips of pins **49,** should preferably be at least about one-fourth of the height *h* of pins **49,** desirably at least about one-third of that height, and for optimum results approximately one-half of the pin height.

The piercing tool **12** should be appropriately connectible to a suitable support, such as the illustrated workbench **14** of FIG. **1.** For this purpose, the base plate **40** of the piercing tool may contain a number of spaced openings **55,** typically four such openings in the pattern illustrated in FIG. **4,** with fastening screws **56** extending through those openings and connecting into the workbench **14** or other horizontal support surface, to hold base plate **40** tightly against surface **13** of the workbench in fixed position relative thereto.

To now discuss the manner of use of the described sander and piercing tool combination, assume that the piercing tool has been connected to the workbench in the position illustrated in FIG. **1** and that there is initially no sandpaper on the sanding tool **10.** The first step then is to connect an initially imperforate sheet of sandpaper to the underside of shoe **18** of the sanding tool, and retain it in that position on the tool by extending the opposite ends of the rectangular sheet of sandpaper upwardly as shown in FIG. **2** for connection to and retention by clips **24.** After the sandpaper has thus been secured to the shoe in taut condition, a user grasps handles **16** and **17** of the sander, and moves the sander to the FIG. **2** position in which the sandpaper and shoe **18** are directly above and parallel to the piercing tool. The sander is then moved downwardly toward plate **40** of the piercing tool, and as the shoe reaches the location of flanges **47** and **48** the corresponding edges **36** and **46** of the sander shoe are moved to posi-

tions in which they engage or abut laterally or outwardly against the inner surfaces of flanges **47** and **48** respectively, to thereby accurately locate the shoe relative to the piercing tool during the final portion of the downward movement of the sander. The pins **49** of the piercing tool are arranged in a pattern corresponding exactly to the pattern of openings **28** of the shoe, and are so located on the base plate that, when the shoe is positioned by engagement with flanges **47** and **48** as discussed above, each of the pins **49** will be directly vertically opposite a corresponding one of the passages or openings **28** in the shoe. Thus, as the operator presses the sander downwardly within piercing tool **12,** and toward base plate **40,** the pins **49** simultaneously pierce openings **39** in the initially imperforate sandpaper at the locations of shoe passages **28.** The cylindrical portions of the pins have an external diameter corresponding substantially to the internal diameter of cylindrical shoe passages **28,** so that the openings pierced in the sandpaper are of essentially the same diameter as passages **28** and are in exact registry therewith. Ultimately, the sandpaper carried at the underside of the shoe reaches a position of engagement with base plate **40,** which position is illustrated for one of the pins in FIG. **5,** and in which position pins **49** project upwardly into the corresponding cylindrical passages **28** in the shoe, typically to about the tops of those passages as shown. The operator may then lift the sander off of the piercing tool, and use the sander in conventional manner by placing it on a work surface and energizing motor **19** to actuate the shoe and sandpaper orbitally (or otherwise) in a sanding motion. During such operation, the suction system draws air and dust particles upwardly from the work surface through openings **39** and **28** to aspirator **27,** and to bag **26** for collection therein.

While a certain specific embodiment of the present invention has been disclosed as typical, the invention is of course not limited to this particular form, but rather is applicable broadly to all such variations as fall within the scope of the appended claims.

I claim:

1. For use with a portable sander having an essentially rectangular power actuated movable section which is adapted to carry an abrasive sheet and contains a plurality of spaced suction openings through which air and abraded particles are withdrawn by suction from a work surface, a piercing tool comprising:

an essentially flat and essentially rectangular plate having four edges;

a plurality of projections attached rigidly to said plate in a pattern corresponding to that of said suction openings in said movable section of the sander, and projecting from said plate in a predetermined direction essentially perpendicular to the plate; said projections terminating in outer essentially sharp ends adapted to pierce openings in said abrasive sheet upon movement thereof with said movable section toward said plate;

a first flange at a first edge of said plate projecting in said direction and essentially perpendicular to said plate for engaging a first side of said movable section in locating relation; and

a second flange at a second edge of said plate perpendicular to said first edge and projecting in said direction essentially perpendicular to the plate to engage and locate a second side of said movable section;

both of said flanges projecting in said direction farther than said sharp ends of said projections, to both engage sides of and locate said movable section before it reaches said sharp ends upon movement of said section and a carried abrasive sheet toward said plate.

2. A piercing tool as recited in claim **1,** in which said plate contains apertures through which fasteners can extend for securing said plate to a surface of a support structure with said projections facing away from said structure.

3. A piercing tool as recited in claim **1,** including fastener means for securing said plate to a surface of a support structure with said projections facing away from said structure.

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