Sept. 15, 1964 D. V. FILDES 3,148,487

SANDING DEVICE

Filed June 12, 1963 2 Sheets-Sheet 1

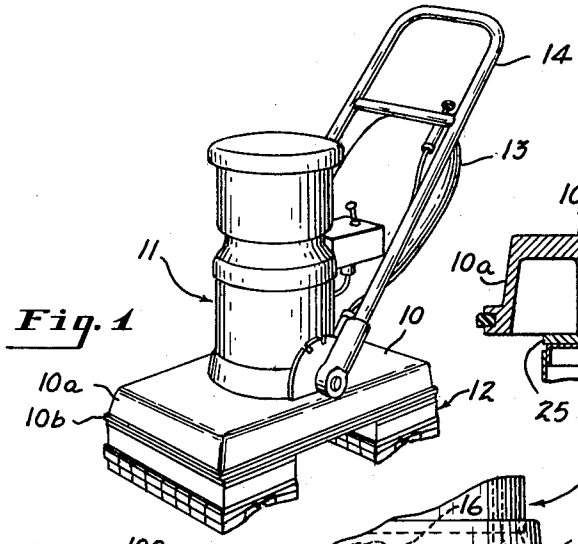

Fig. 1

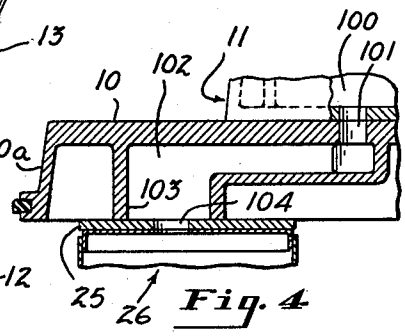

Fig. 4

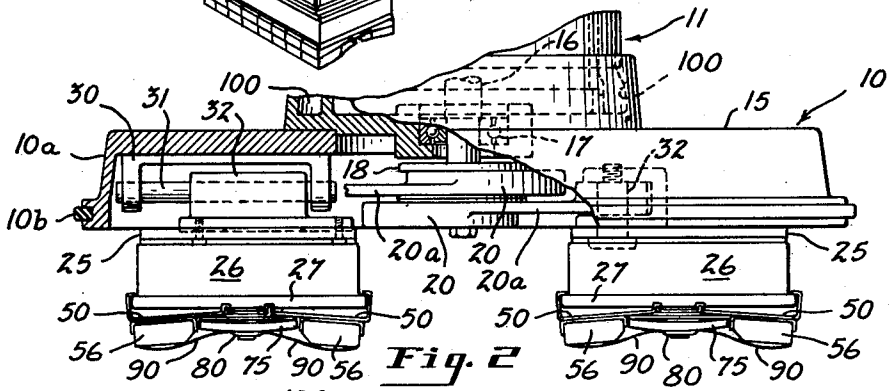

Fig. 2

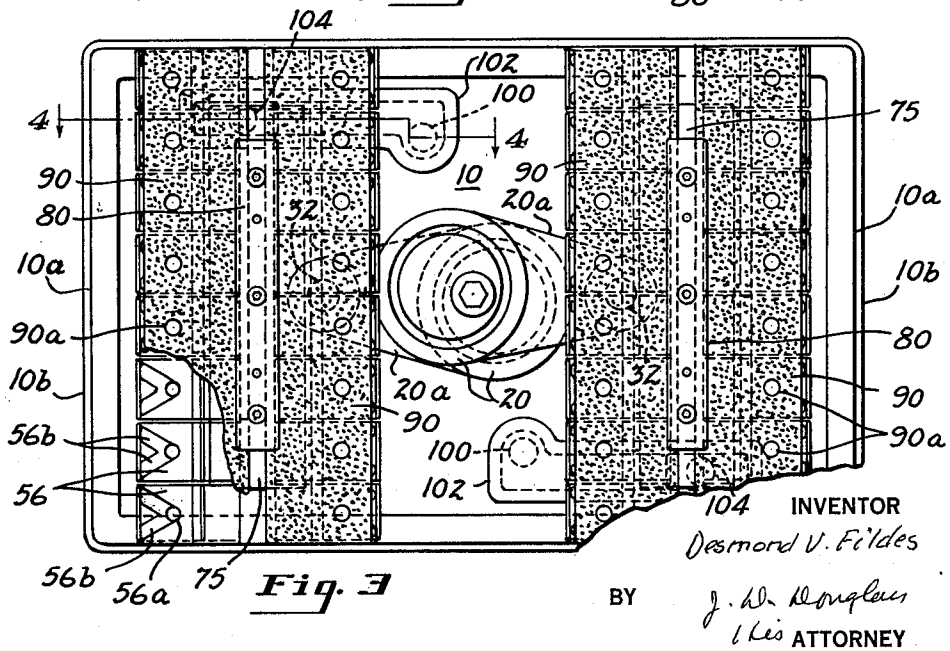

Fig. 3

INVENTOR
Desmond V. Fildes

BY J. W. Douglas & Lois ATTORNEY

Sept. 15, 1964 D. V. FILDES 3,148,487

SANDING DEVICE

Filed June 12, 1963 2 Sheets-Sheet 2

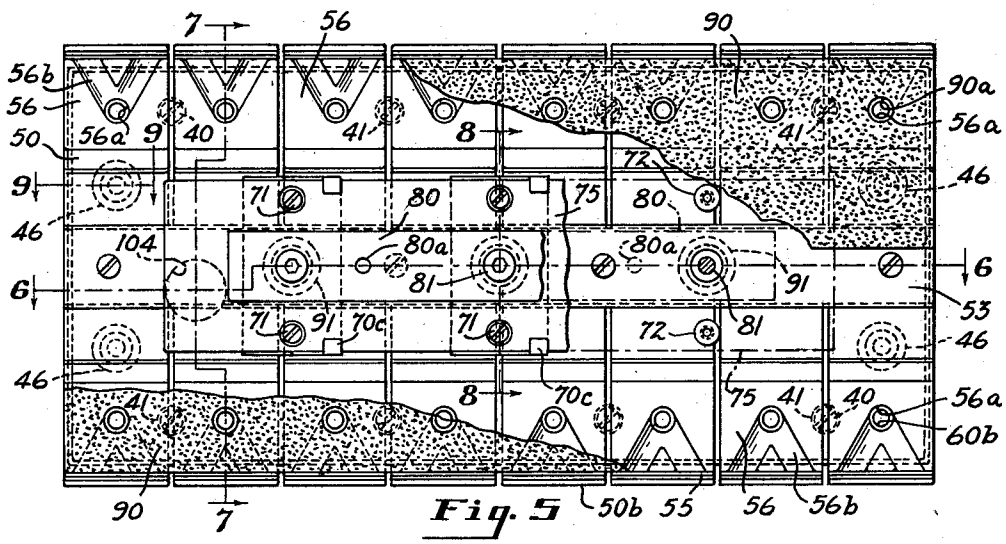

Fig. 5

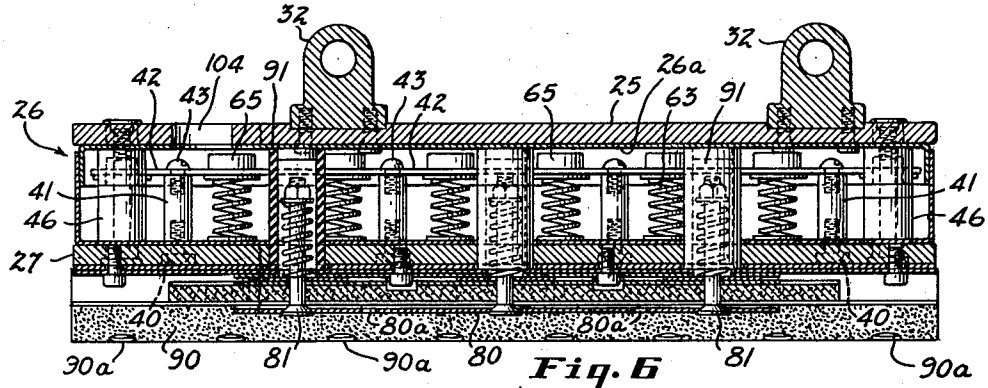

Fig. 6

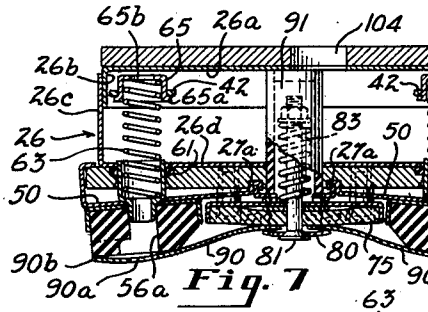

Fig. 7

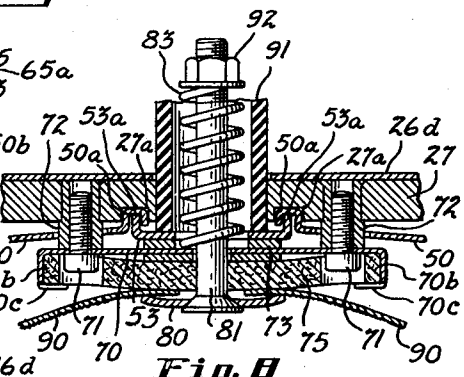

Fig. 8

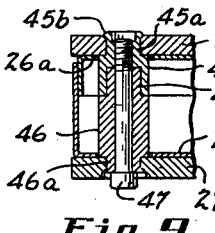

Fig. 9

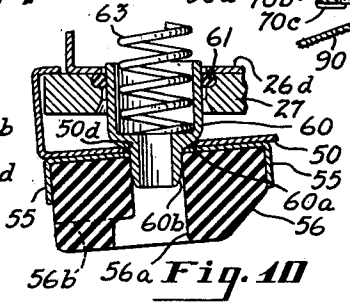

Fig. 10

INVENTOR

Desmond V. Fildes

BY

J. D. Donaldson

His ATTORNEY

United States Patent Office 3,148,487 Patented Sept. 15, 1964

3,148,487

SANDING DEVICE

Desmond V. Fildes, 1014 Cleveland St., Grafton, Ohio, assignor of one-half to Milt Wilhelm, Wellington, Ohio

Filed June 12, 1963, Ser. No. 287,293
14 Claims. (Cl. 51—175)

This invention relates to improvements in sanding devices and more particularly to an improved sander for sanding flat surfaces wherein the sanding means partakes of a reciprocatory motion.

Heretofore there have been proposed many means for the sanding of flat surfaces. These usually comprise an electric motor which is connected by a linkage to reciprocate one or more pads having an abrasive thereon which are in engagement with a flat surface, such as a floor, with a reciprocatory or orbital motion. One such apparatus is illustrated in Patent No. 2,956,379.

Machines of the above type had certain deficiencies in operation which included the fact that the abrasive material became loaded with debris, particularly where the surface being sanded had been varnished or was of a resinous material. This loading of the abrasive surface was largely due to the fact that the surface of the above was inadequately cooled. Furthermore this loading was not necessarily uniform over the entire surface since a portion could become loaded and result in a scoring of the article being sanded and making the abrasive useless even though it was by no means worn out.

Another disadvantage of the prior art resided in the fact that the surface to be sanded, particularly when that surface was newly laid, was not necessarily flat but had inequalities, such as boards of unequal thickness or those that were slightly warped. When such surfaces were sanded, the high spots were sanded but the low spots were not.

Such previous devices required the frequent renewal of the abrasive, which was not only expensive but time-consuming. Due to the above, it frequently happened that the abrasive was not renewed as soon as it should have been renewed, with the result that the work done after the abrasive should have been renewed, was of an inferior quality.

In addition to the above, the prior devices created a large amount of dust and failed to adequately collect the dust, thereby making working conditions undesirable and requiring a subsequently large amount of cleaning to remove the dust.

The present invention contemplates a sander, particularly useful in the sanding of wood floors but not necessarily limited thereto, wherein the abrasive life is greatly prolonged, the surface sanded can be irregular and in spite of the irregularities the sanding may proceed at a much higher rate of speed. In addition, the amount of dust created is reduced to a minimum and efficiently collected in a suitable bag for subsequent disposal.

Still other advantages of the invention and the invention itself will become more apparent from the following description of an embodiment of the invention, which description is illustrated by the accompanying drawings and forms a part of this specification.

In the drawings:

FIG. 1 is a reduced perspective view of a complete sander constructed according to the invention;

FIG. 2 is a fragmentary view on a larger scale, partly in elevation and partly in section, of the lower end of the sander;

FIG. 3 is a fragmentary bottom plan view thereof;

FIG. 4 is a section taken on the line 4—4 of FIG. 3;

FIG. 5 is a bottom view, on an enlarged scale relative to the other drawing of one of the sanding elements, with

certain parts broken away to show the underlying structure;

FIG. 6 is a section taken on the line 6—6 of FIG. 5;

FIG. 7 is a section taken on the line 7—7 of FIG. 5;

FIG. 8 is a fragmentary section taken on the line 8—8 of FIG. 5;

FIG. 9 is a section taken on the line 9—9 of FIG. 5; and

FIG. 10 is an enlarged section of a fragment of FIG. 7.

Referring now to the drawings, throughout which like parts are designated by like reference characters, as best shown in FIG. 1, the sander of the invention includes a base 10 upon which is supported an upright motor and suction fan 11 which is arranged to draw the dust from the sanding member 12 and discharge the same into a bag 13. A suitable handle 14 is pivotally connected to the base 10 whereby the device may be moved backward and forward over the surface to be sanded.

As best shown in FIG. 2, the base 10 comprises an upper flat surface 15 on which the motor and fan housing 11 are mounted and a depending peripheral skirt 10*a*, the lower end of which is provided with a peripheral groove having a resilient bumper 10*b* therein.

A motor is contained in the lower end of the housing and has a shaft 16 mounted in a bearing 17 and carrying an eccentric 18 on which a pair of drive links 20 are journalled. The drive is to the reciprocatory members which are reciprocated under the platform and each of which includes an upper plate 25, and a lower plate 27 held in rigidly spaced relation thereto and under which the pressure sander members are mounted. The space between the plates is enclosed by a housing 26 which forms a plenum chamber connecting a vacuum drawing means to the sander members.

Inverted U-shaped brackets 30 are secured to the underside of the base 15 and support rods 31 on which support members 32 are reciprocably journalled. The support members 32 are in turn secured to the upper side of the upper plate 25. As can be seen from FIG. 6, two of the support members are provided for each of the reciprocatory members disposed at opposite ends thereof. The links 20 have arms 20*a* which are connected to the upper plates 25 by vertical pivots 32 mounted on top of the plate and extending through eyes in the ends of the arms.

When the motor is operating, the eccentric 18 revolves and reciprocates the links and they in turn move the upper plates to and fro, on the rods 31, in opposite directions.

Each of the plenum chambers 26 comprises an upper rectangular plate 26*a* having a peripheral flange 26*b* which telescopes inside a second peripheral flange 26*c* on a lower rectangular plate 26*d* to provide a hollow box-like chamber closed on all sides.

The upper chamber member 26*a*–26*b* is secured to the upper base plate 25 by screws, not shown, which are threaded into the plate 25 with their heads engaging the underside of the plate 26*a*.

The lower chamber member 26*c*–26*d* is secured to the lower plate 27 by screws 40, the heads of which are countersunk into the lower face of the plate 27 with the shanks extending through the plate 26*d* and into spacers 41. The upper ends of the spacers 41 support spring guide strips 42, the purpose of which will later be described, being held thereon by screws 43 which are threaded into the spacers.

The two plenum chamber halves are secured in spaced relation to each other and at the same time the load is relieved from the plenum chamber parts by columns which extend through the plates 26*a* and 26*d* and are secured to the upper and lower plates 25 and 27, FIGS. 6 and 9. The columns include an upper portion 45 of cylindrical formation having a necked down upper end

45*a* which has a close fit in an aperture in the upper plate. The portion 45 is provided with a counterbore and the necked down part is interiorly threaded. The extremity which projects through the plate 25 is spun over at 45*b* or staked to hold the same securely and rigidly to the plate 25.

The lower part of the column likewise consists of a cylindrical hollow body 46 which extends through the lower plate 26*d* and has a necked down part 46*a* which extends down into an aperture in the plate 27. In this instance, the aperture in the plate 27 has a beveled lower edge and the end 46*a* of the necked down part is spun over into contact therewith, whereby this column part is held securely to the base plate and flush with or above the bottom surface of the plate 45.

The upper end of the column 46 is provided with a reduced portion 46*b* which has a close fit with the counterbore in the upper column part.

The parts are held together by cap screws 47 which extend through the bottom plate 27 and through the column parts and are threaded into the upper column part 45*a*. Thus the upper and lower base plates 25 and 27 and the plenum chamber parts are held in fixed spaced relation to each other and the drive for reciprocating the sanding means has all the forces directed from the upper plate 25 through the stiff columns to the lower plate 27, which carries the sanding means. This provides a firm, rigid drive and relieves all the strain from the plenum chamber parts.

The sanding means includes a plurality of independently supported pressure feet and a means for holding abrasive sheets in contact therewith.

As can best be seen from FIGS. 7 and 8, the lower base plate 27 is provided with a pair of spaced, parallel, longitudinally extending grooves 27*a*. These grooves may be of rectangular cross section and are disposed equally spaced on opposite sides of the longitudinal center line of the element. As can best be seen from FIG. 3, the longitudinal center lines of the reciprocatory elements extend transverse to the longitudinal center line of the base 10. The shape of the base 10 is however a matter of choice since it could be square rather than rectangular, as shown, or the device could be wider than it is long.

As best shown in FIGS. 5 to 8, each pressure foot includes a rectangular base 50, one end of which is provided with an inverted U-shaped edge part 50*a* which fits loosely in the groove 27*a*. The outer end of each base 50 is provided with a hook-shaped end 50*b* formed by bending the end at 90° to the base and then backward at its extremity 90°, to overlie the top edge of the base plate 27. The length of the connecting part 50*b* is such that a clearance space is provided between the base 50 and the plate 27, whereby the outer extremity may move toward and from the base with the part 50*a* pivoting in the channel 27*a*.

A keeper is provided which comprises an elongated strip 53 having upwardly extending edge portions 53*a* which extend into parts 50*a*. The engagement of the edge portions 53*a* with the pressure feet is such that the feet are held in position but are free to rotate about the edge parts 53*a*. The lower face of each member 50 has an inverted U-shaped socket 55 welded thereto and each of these sockets has a substantially square block 56 of highly resilient material vulcanized or otherwise cemented therein.

Each of the blocks 56 is provided with a central aperture 56*a* which extends upward through the block and is concentric with an opening 50*d* in the plate 50. The edge of the opening is beveled to provide a seat for a coupling and socket 60. The opening 56*a* is of smaller diameter than the opening 55*d*. Extending from the central opening 56*a* are a pair of grooves 56*b* which diverge from each other and extend to the outer edge of the block. Although the blocks are shown as being of a length equal to the distance between the flanges 55 of the socket, they could overhang the socket, particularly on the outer edge.

Means is provided to resiliently hold the pressure members tilted downward to the limit of their movement as determined by the engagement of the flange 50*b* with the top of the plate 27 and at the same time permit tilting movement of the members about their pivots in the channels 27*a*. This same means also provides a duct means for drawing air through the apertures 56*a* and channels 56*b* into the plenum chamber 26. This includes a lower coupling and spring socket member 60 having a cylindrical outer body, the lower end of which curves to provide a seat engaging part 60*a* and having at its lower extremity a hollow stem 60*b*, the end of which is rounded off at its end. The seat engaging part 60*a* seats on the seat 50*d* in the top of the plate 50 and the stem 60*b* is forced into and provides a tight fit with the wall of the aperture 56*a* in the rubber or resilent block 56. The rounded end facilitates the insertion of the coupling into the resilient block 56.

The aperture in the plate 27 is provided at its upper end with a seat in which an O ring 61 is disposed. The O ring is held in place by the plate 26*d* which lies over the vertical mid-section of the O ring. The body 60 of the coupling has a sliding engagement with the O ring. The aperture in the plate is sufficiently large and the lower end is relieved as indicated in order that the coupling 60 may tilt relative to the plate 27 when the pressure member moves about its pivot. It will thus be seen that air entering through the duct 56*a* is conducted through the coupling into the interior of the plenum chamber by virtue of the stem 60*b* sealing in the block and the body 60 seating with the O ring.

Pressure is exerted on the coupling 60 by a spring 63, the lower end of which seats on the interior of the coupling 60 and the upper end of which is engaged by a cap 65 which extends through an aperture in the strip 42, and has a flange 65*a* in engagement with the underside of the strip. The cap is provided with an end opening 65*a*, the end of the cap being spaced from the wall 26*a* of the plenum chamber.

Thus the pressure member may move up and down within the limits defined by the flange 50*b* and base 50 against the pressure of the spring 63.

There are two rows of these assemblies for each of the sanding members 12, FIG. 5, one row extending toward the outer edge and the other toward the inner edge. The size and number of pressure feet in the rows may be varied. It has been found, however, that for a sanding member 14 inches long, eight of these feet, approximately 1⅝ inches wide, provide a highly satisfactory manner of operation.

The actual abrasive material of each of the reciprocating members is comprised of two strips of a flexible base material having an abrasive surface on one side, such as sandpaper. Each strip is disposed over a row of the feet and clamped at its innermost edge by a centrally disposed clamping means. The outer edges of the strip are free to move on and with the feet.

The clamping means, FIGS. 7 and 8, includes a plurality of clips 70, in this instance three are shown, which extend transversely across the pressure feet clamp bar 53 and are held in place by screws 71 which extend through openings in the clips and are threaded into threaded bushings 72 disposed in and staked in apertures in the lower base plate 27. The clips are held in fixed, longitudinally spaced position by a narrow strip 73 which extends longitudinally of the head and over faces of the clips.

The clips are provided with flanges 70*b* which extend downward on opposite sides of a heavy fabric strip 75 and have tongues 70*c* which are bent over and engage with the bottom side of the fabric to hold it securely in place. The strip 73 also acts as a shim and backing for the longitudinal center zone of the fabric 75 and

causing the fabric to assume a curvature, as shown in FIG. 8.

The abrasive clamping bar **80** is a strip of rigid metal of curved transverse cross section which extends longitudinally along a zone equally spaced about the center line of the fabric strip **75** with the longitudinal outer edges pressing against the fabric. The curvature of the strip **75** prevents the abrasive from being cut or broken, due to the clamping action and also increases the life of the strip **75**. The strip is held against the fabric by means of bolts **81** and springs, the heads of the bolts are countersunk into the face of the strip **80** and the shanks extend through the strips **75**, through openings in the strip **73**, the clamp bar **70**, the keeper strip **50** and the base plate **27**.

The end of each shank has a locking type nut **82** which engages with the end of a helical spring **83**, the other end of which engages with the top sides of the clamp brackets **70**. The openings for the shank of the bolt are sufficiently large that the clamp bar **80** may be tilted by the insertion of suitable tools in holes **80***a* in the clamp bar, which enables the bar to be tilted, the shank swinging to the right or left, as viewed in the figures, to allow one edge or the other of the clamp to be raised and the sandpaper **90** inserted under the edge between the upturned edge and the fabric.

The spring and bolt assembly is sealed against the ingress of air at this point by a rubber cap **91** which surrounds the same and is cemented into the hole in the lower face plate around the spring and bolt.

As stated, the abrasive comprises a rectangular strip **90** which is clamped in place by the clamp means, the clamp means being tilted to raise one edge and the strip inserted between the clamp means and the fabric. This provides a resilient cushioned means for holding the abrasive strip which allows the strip to bend without breakage. The strip extends under the pressure feet and is provided with a series of apertures **90***a* which register with the aperture **56***a* in the feet.

It is preferred that the strip be a continuous piece of material which extends under the pressure feet and also bridges the small gap between the adjacent edges of the pressure feet. It is contemplated, however, that in some instances and for some purposes the abrasive strip may be slitted with the slits disposed opposite the adjacent edges of the pressure feet, whereby the tongues formed thereby may move in an independent fashion.

In operation when the device is supplied with power, the motor in the lower part of the housing **11** operates to rotate the shaft **16** and through the eccentric **18** and links **20**–**20***a* the reciprocable members are reciprocated on the shafts **31** laterally as viewed in FIG. 2. This causes the abrasive to be reciprocated in contact with the floor. If the floor is a board flooring, the machine is placed in contact with the floor and moved lengthwise with the boards of the floor. Should one board be higher than the other, the high board causes one or more of the pressure feet to move upward due to the concentration of weight on that member, also allowing the sandpaper in that zone to move upward. It will be appreciated that under such conditions the discrepancy in height is not very great and therefore this movement is slight. It has been found, however, that by providing this type of flexibility the high boards and the low boards may be sanded with a complete sanding of all the boards to such an extent that the inequalities in height, although not completely eliminated, are not apparent to the observer. Thus if one board out of eight should be lower, it would not be necessary to sand down the other seven to the level of the one, thus the time and amount of material removed is greatly reduced.

Furthermore by making the strip of continuous material, should one board be higher or lower than the others, the pressure feet may raise or lower, at the point where the transition of the sandpaper from a low board to a high board takes place, the sharp edges are removed.

It is pointed out that the strength or compressibility of the springs **63** is correlated with the weight of the machine such that the normal weight of the machine may cause some compression of the springs, whereby the feet take a position somewhere between their limits of upward movement as defined by the hooked ends **50***b*. It is contemplated, however, that the springs may be sufficiently stiff that they are not compressed by the weight of the machine. In this instance if the weight is concentrated over one of the feet **56** it would still rise. Furthermore if it was desired that the normal state be one of a slight compression of all springs, then weights could be placed on top of the platform **10** and the weight of the machine supplemented by these weights to cause the desired amount of compression. It may be desirable in particularly hard wood to make the springs **63** very stiff and then to add weights to increase the entire pressure on the floor by the machine and thus speed up the sanding operation.

At the same time that the drive motor is turned on a fan motor in the upper housing is turned on. This causes a suction or vacuum which is drawn upward through a chamber **100** surrounding the lower motor into the upper fan housing and discharge into the bag **13** in a manner well known in the art. The duct **100**, FIG. 4, connects by a port **101** to manifolds **102** disposed on the underside of the base **10**. Each of these manifolds is provided with an elongated inlet port **103** which registers with an outlet port **104** in the upper plates **25** of the reciprocating members.

Thus air is drawn through the holes **90***a* in the sandpaper, through the ducts **56***a* in the resilient pads **56** and through the coupling **60** into the plenum chamber **26**, by way of the ports **104** and manifold **102** and eventually discharged into the bag. At the same time air as well as dust is drawn in along the diverging grooves **56***b* to the duct **56***a* from the outer edge of the sandpaper strips. This not only greatly reduces the amount of dust which escapes to the surrounding room but also cools both the sandpaper and the pressure feet.

In addition the vacuum causes the sandpaper to be drawn more closely to the outer edge surfaces of the pressure feet and holds it more tightly in place at its outer edges.

It is contemplated that the strips of abrasive be made with two lines of holes **90***a*, one being spaced from the outer edge, as shown in FIG. 5, and the other line having a similar spacing from the inner edge. When the outer edge portion becomes worn, it may be unclamped and turned around 180° and the other edge used.

The cooling of the sandpaper prevents the same from becoming coated with resin and materially increases its life. The suction of the dust from along the edge of the sandpaper materially reduces the dust thrown out into the room.

It will be noted that the couplings **60** not only serve as seats for the springs **63** and ducts for transmitting the dust laden air to the plenum chamber but also hold the pressure feet against longitudinal displacement in the grooves **27***a*. The feet may be removed by pressing the couplings upward so that the reduced part **60***b* is disposed above the body **50** and the feet slid outwardly toward the end.

The air through the couplings **60** is also upward through the springs and even though the springs may be considerably compressed, the air can escape through the openings **65***a* at the top. Thus the springs are cleaned by the passage of air therethrough.

It will be particularly noted that the entire clamp assembly is removable as a unit by taking out the screws **71**. It may thus be easily replaced when worn. The camber given to the strip **75**, as stated, increases the life of the abrasive as well as the fabric itself.

In the previous devices conformance with the irregular-

ities of the floor was accomplished by making the pressure pads soft. Under these conditions the sanding was inadequate and took too long. When the pads were made hard they did not conform to the floor and therefore parts of the floor were not sanded. The above described invention provides conformance with the floor and efficient sanding.

It is pointed out that the action of the pressure feet is materially different than prior devices. As the feet move upward against the spring pressure, which they do when the device is in operation, due to the fixed pivot 50*a* and the short length of the lever arm, which is the body of the pressure member, the sandpaper is forced into the floor with an arcuate movement, which is in addition to the reciprocatory movement by the drive mechanism. Therefore at the start of this reciprocatory movement, the outer edges of the pressure feet have the outermost edge or toe 90*b* in engagement with the floor and as the feet move upward the contact is moved backward toward the inner edge of the blocks 56.

Having thus described the invention, in an embodiment thereof, I am aware that numerous and extensive departures may be made therefrom without departing from the spirit of the invention as defined in the appended claims.

I claim:

1. A device of the class described including a base, at least one reciprocatory member reciprocably supported below the base, said reciprocatory member comprising a pair of members connected to each other, one above the other, in rigidly spaced relation to each other, means enclosing the space between said members to provide a plenum chamber and means for drawing a vacuum supported by said base and connecting means connecting said vacuum means to said plenum chamber, means for performing work on a surface supported from one of said pair of spaced members and arranged to be engaged with a surface upon which work is to be performed and reciprocated by said member, and duct means connecting said work performing means to said plenum chamber.

2. A device as described in claim 1, wherein said work performing means comprises at least one resiliently mounted pressure foot, an abrasive material disposed between the pressure foot and the surface to be worked on.

3. A device as described in claim 2, wherein said pressure foot is formed with an air duct spaced from the edges and air grooves connected thereto and extending to the outer edge of the foot and said abrasive means extends to the outer edge of said pressure foot, and said air duct is connected with said duct means.

4. A sander including a reciprocable member of generally rectangular formation having a plenum chamber, rows of pressure feet hingedly secured to the underside of the reciprocable member near the longitudinal center and with the feet in each row extending in opposite directions to the longitudinal edge of said member, means connected between each of the feet and said member to limit the movement of the feet toward and away from the member, each of said feet having a resilient pad secured to the bottom thereof and extending to the outer edges of the feet on the edge opposite to the point of hinged connections, said pads being formed with ducts extending through the pads intermediate the edges, air duct means for each of said pads for conducting air through the ducts to the plenum chamber comprising a coupling having an enlarged body reciprocably disposed in sealed relation in the bottoms of said member and a reduced portion in sealing engagement with the opening in said pad, spring means supported at one end within said plenum chamber and having the other end connected to said coupling under compression to urge said pressure foot downward away from said member.

5. A sander including a reciprocable member of generally rectangular formation having a plenum chamber, rows of pressure feet hingedly secured to the underside of the reciprocable member near the longitudinal center and with the feet in each row extending in opposite directions to the longitudinal edge of said member, means connected between each of the feet and said member to limit the movement of the feet toward and away from the member, each of said feet having a resilient pad secured to the bottom thereof and extending beyond the outer edges of the feet on the edge opposite to the point of hinged connections, said pads being formed with ducts extending through the pads intermediate the edges, air duct means for each of said pads for conducting air through the ducts to the plenum chamber comprising a coupling having an enlarged body reciprocably disposed in sealed relation in the bottoms of said member and seated on said foot and a reduced portion in sealing engagement with the opening in said pad, spring means supported at one end within said plenum chamber and having the other end connected to said coupling under compression to urge said pressure foot downward away from said member.

6. An appaartus as described in claim 5, wherein said support means for said spring means includes an apertured member disposed in said chamber and apertured cups are seated in said apertured member and said springs are seated in said cups.

7. A sanding machine including a base, motor driven vacuum producing and drive means supported above the base, a pair of reciprocatory members supported below the base and means for connecting said drive means thereto for reciprocating them below the base, each of said reciprocatory members comprising a pair of rectangular plates and means to hold said plates in vertically spaced relation to each other, means enclosing the space between said plates to provide a plenum chamber, duct means in said base connected to said vacuum producing means and to said plenum chamber, sanding means carried by the lower of said plates and comprising a plurality of pressure feet each of which is hingedly connected to said plate spaced from the edge and extends outwardly at least to the edge, means on each of said feet to limit the movement thereof relative to the plate, abrasive means connected at one edge to said plate spaced from the edge of the plate and extending outwardly under said pressure feet, said abrasive means comprising a strip extending lengthwise under said feet.

8. A device as described in claim 7, wherein said abrasive strip is slitted opposite to the juncture of said pressure feet to enable portions thereof to move with independent movement of the feet.

9. In a sander having reciprocatory members for reciprocating and sanding of a surface, support means for holding and exerting pressure on an abrasive material including a base member of generally rectangular formation, a plurality of pressure feet disposed in at least one row on the base member, said feet comprising elements having one end hingedly connected to said base and extending outwardly toward the edge of the base and movable toward and from the base, means to limit the movement of said feet relative to the base, spring means connected to the support means and said feet for resiliently holding the feet away from the base, a sheet of abrasive material, clamp means for securing said sheet at one edge near the hinge means and said sheet being held by the clamp means and extending under said feet.

10. A device as described in claim 9, wherein said feet have resilient pads secured thereto.

11. A device as described in claim 9, wherein said clamp means includes a flexible strip of material extending opposite to said hinges for said pressure feet and means for holding said strip in spaced relation to the pressure feet and a clamp bar comprising a rigid strip of metal and spring means for connecting said clamp bar to said strip holding means whereby the clamp bar may be tilted away from the flexible strip for the insertion of the abrasive between the clamp bar and said flexible strip.

12. In combination with a vacuum producing means, a reciprocable sanding means connected thereto and including upper and lower spaced plates, means for recipro-

cating said plates, connecting means for holding said plates in rigidly spaced relation to each other, closure means extending between said plates and providing a plenum chamber, means connecting said vacuum means to said plenum chamber, said lower plate being formed with a pair of longitudinally extending grooves spaced from each other and from the edges and the center line of the plates, a plurality of pressure feet each of which is formed to provide a socket at one end arranged to be disposed in one of said grooves, keeper means connected to said plate and having a portion extending into said sockets on said pressure feet for hingedly holding them in the grooves, said pressure feet being disposed to provide multiple aligned feet in each row and extending outwardly toward the edge of said plate and individually movable toward and from the plate, means connected between the plate and the pressure feet to limit the movement of the feet away from the plate, means to hold the feet resiliently away from the plate and to provide air ducts from the feet to the plenum chamber and to hold each of the feet against longitudinal movement in the grooves comprising a coupling for each of said feet extending in air sealing engagement and reciprocable through the plate and in sealing engagement with a pressure foot, said

coupling having a duct therethrough communicating with the plenum chamber and spring means connected with said coupling and said upper plate arranged to press said coupling downward into engagement with the pressure feet.

13. A device as described in claim 12, wherein each of said feet is mounted with a resilient pad and said pad has an opening intermediate its edges and said coupling extends into the opening in sealing engagement therewith.

14. A device as described in claim 13, wherein the bottom of said pad is provided with grooves extending from the opening and diverging from each other to the outer edge of the pad.

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