Dec. 27, 1949 S. MANDL ET AL 2,492,231

PORTABLE SANDER

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Fig. 1.

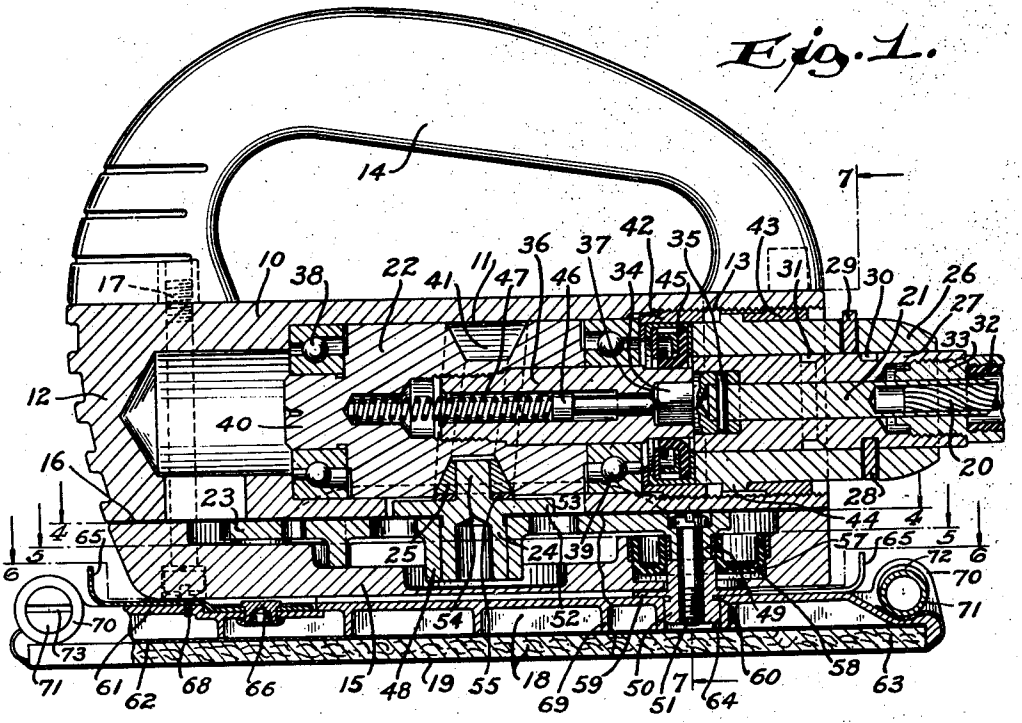
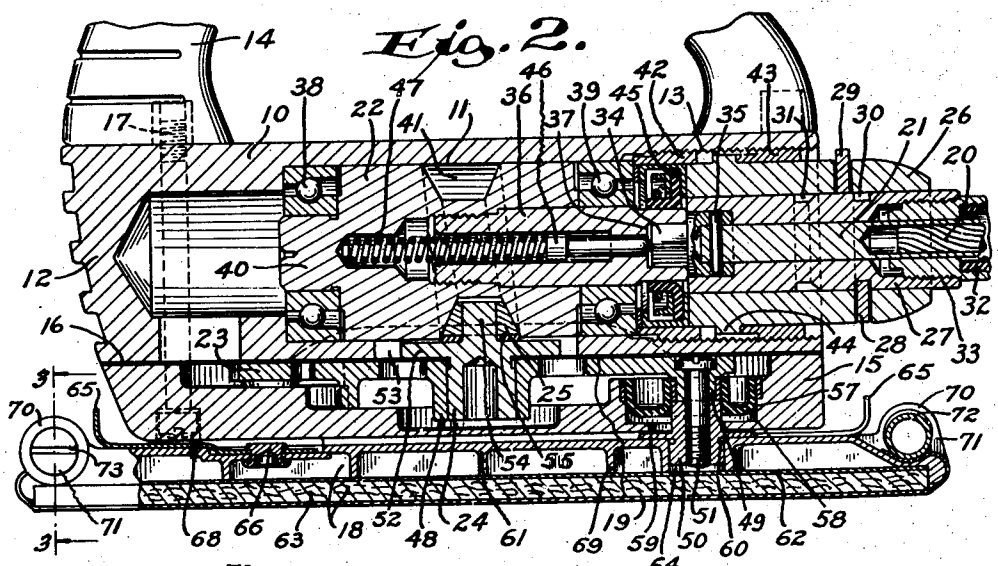


Fig. 2.



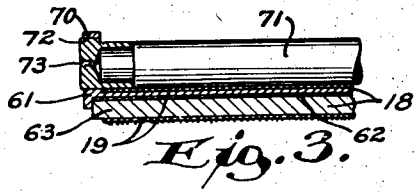


Fig. 3.

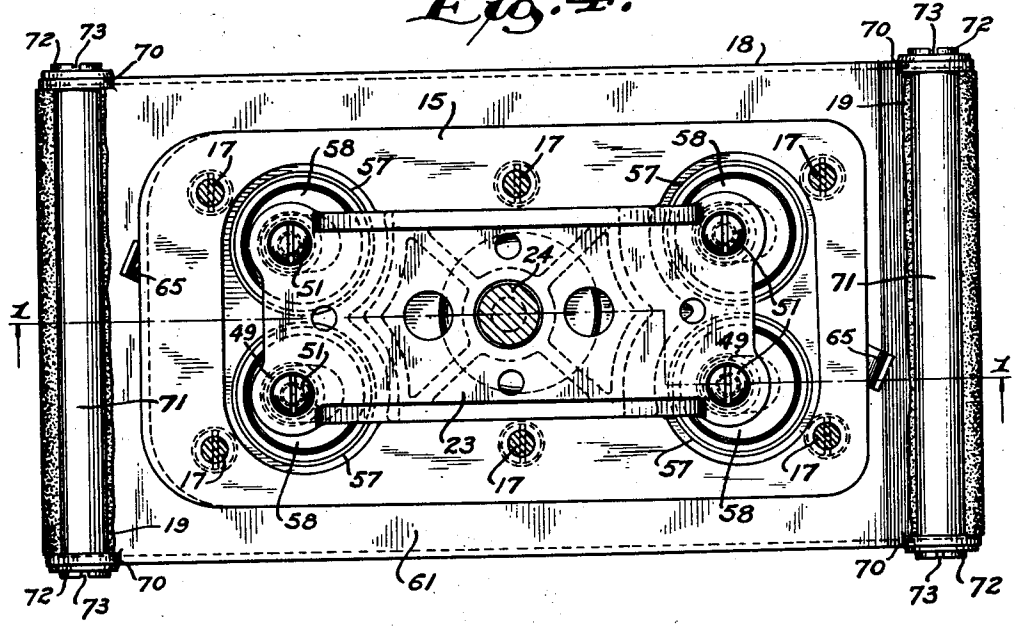
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PORTABLE SANDER

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Fig. 4.



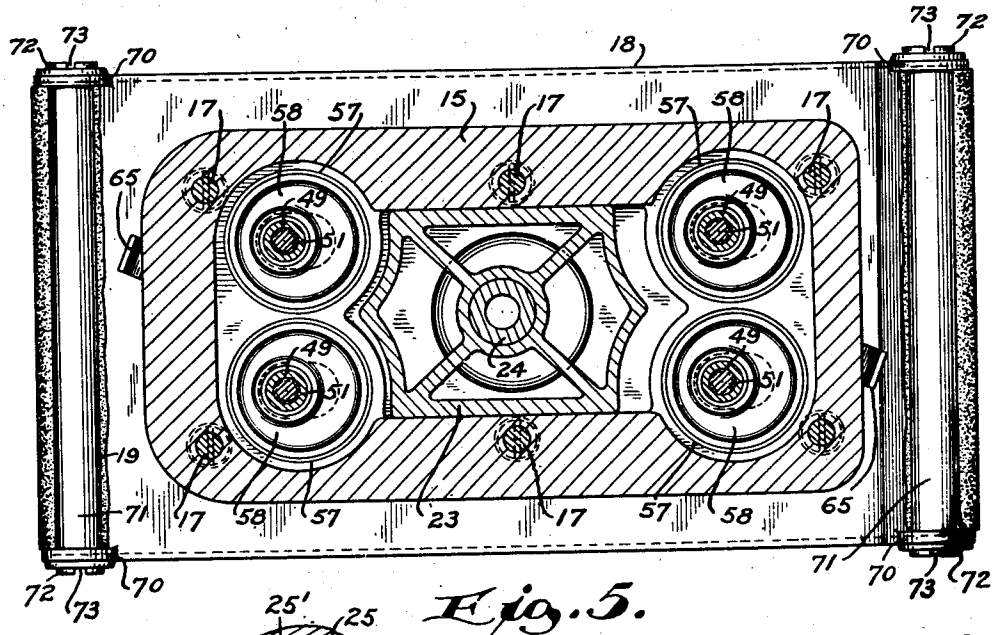


Fig. 5.

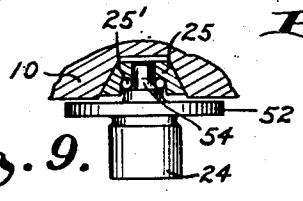


Fig. 9.

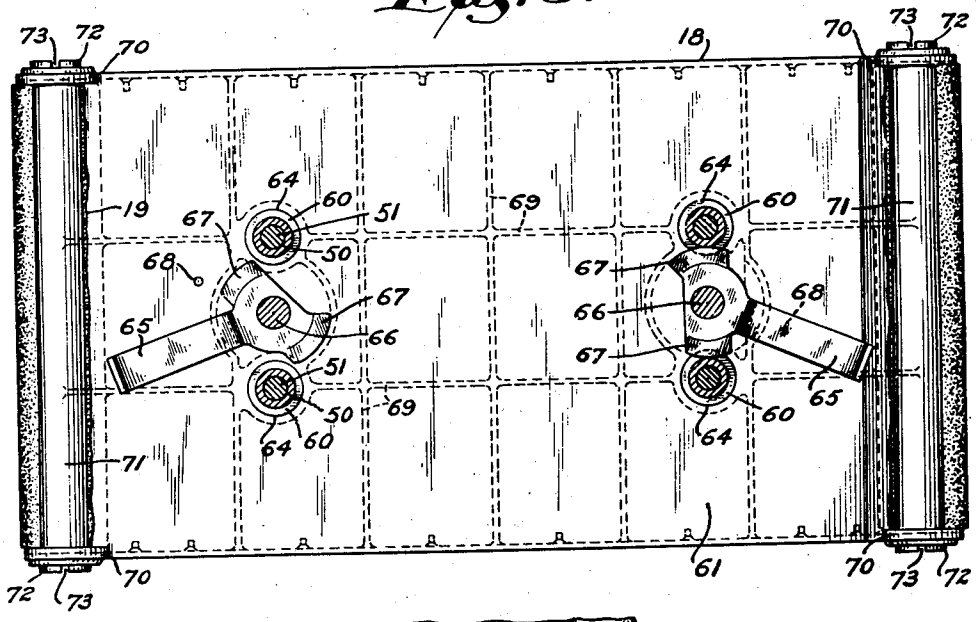
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Fig. 6.



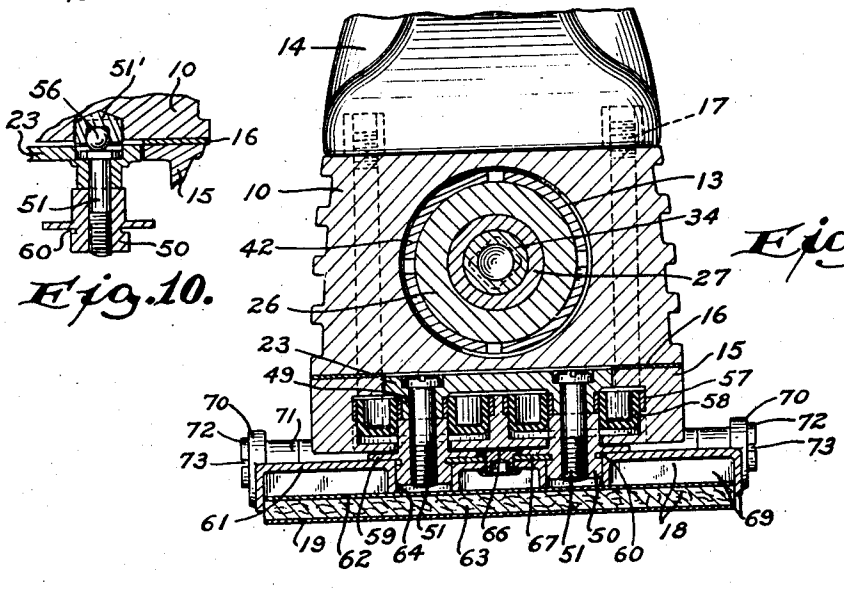


Fig. 7.

Fig. 10.

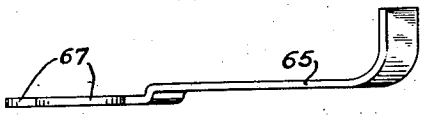


Fig. 8.

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UNITED STATES PATENT OFFICE

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PORTABLE SANDER

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Application June 18, 1945, Serial No. 600,020

12 Claims. (Cl. 51—170)

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The present invention relates in general to improvements in the art of dressing surfaces by abrasion, and relates more especially to improvements in the construction and operation of reciprocatory sanding, polishing, or analogous devices for smoothing surfaces of diverse objects by rubbing or abrasive action.

The primary object of our invention is to provide an improved portable sander or the like having a working surface reciprocable from a rotary source of power, and which is simple and compact in construction, efficient in operation, and flexible in its adaptations.

It is frequently desirable in many industries, to have available a relatively light and compact portable sanding unit operable from a relatively stationary source of rotary motion such as an electric or fluid pressure operated motor, and wherein the working surface is rapidly reciprocable so as to produce smoothly dressed surfaces upon the work. While various types of such portable sanders have heretofore been proposed and used commercially, none of these prior devices are entirely satisfactory either because they are not sufficiently compact for convenient manipulation in cramped localities such as corners, or because they were too complicated and unreliable in operation, or because they produced excessive vibration and jarring which was very annoying to the operator, or because the parts of the mechanisms were not well protected from dust and grit and could not be readily inspected or renewed. For these reasons, most of the prior portable reciprocatory sanding assemblages have not become popular with the trade, and the use of these units has been rather restricted and limited.

It is therefore a more specific object of the present invention to provide a new and useful portable reciprocatory sander unit especially adapted to be operated from a fixed source of rotary power, and which definitely overcomes all of the above mentioned objectionable features of prior apparatus of this type.

Another specific object of this invention is to provide an improved reciprocable smoothing or polishing assemblage operable by rotary power most effectively applied to the working shoe or element of the device, and wherein the various parts are normally well concealed and protected, while still being readily accessible for inspection and renewal.

A further specific object of our invention is to provide a durable, compact, and manually controllable sander, which is readily manipulable in any desired direction and in corners and other limited spaces, and which moreover will not subject the operator to objectionable vibration or the like.

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Still another specific object of the invention is the provision of a reliable reciprocable sanding outfit which by virtue of its simplicity may be manufactured and sold at moderate cost for diverse abrasive and polishing purposes.

These and other specific objects and advantages of our invention will be apparent from the following detailed description, and some of the novel features of motion transmitting and converting mechanisms, disclosed but not specifically claimed herein form the subject of other co-pending applications.

A clear conception of the several features constituting the present improvement, and of the mode of constructing and of manipulating a portable sanding unit embodying our invention, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a part sectional side elevation of one of the improved portable sanding units showing the working shoe in foremost position, most of the section having been taken centrally and longitudinally through the unit, but a portion thereof having been taken forwardly of the central plane, as indicated by the line 1—1 of Fig. 4;

Fig. 2 is a view similar to that of Fig. 1 with a portion of the manipulating handle broken away, and showing the working shoe in rearmost position or end of its reciprocatory motion;

Fig. 3 is a fragmentary transverse section through one of the sand paper clamping or attaching devices of the sanding unit, taken along the line 3—3 of Fig. 2;

Fig. 4 is a transverse longitudinal section through the portable sanding assemblage, taken along the line 4—4 of Fig. 1;

Fig. 5 is another transverse longitudinal section through the sanding outfit taken along the line 5—5 of Fig. 1;

Fig. 6 is still another transverse longitudinal section through the portable sander, taken along the line 6—6 of Fig. 1;

Fig. 7 is a part sectional rear end view of the sanding mechanism, the section having been taken along the line 7—7 of Fig. 1, but showing the rear sander shoe clamp in active position and the front clamping lever released;

Fig. 8 is an enlarged side elevation of one of

the improved sander shoe clamping levers removed from the shoe;

Fig. 9 is a fragmentary view showing a modified anti-friction tapered roller; and

Fig. 10 is a fragmentary view showing an anti-friction ball bearing between the body and base, and the reciprocable plate.

Although our invention has been shown and described herein as being embodied in a portable sanding unit having a reciprocable sand paper carrying shoe operable by a rotary motion converter carried by the unit and which is in turn operable from a relatively fixed source of rotation, it is not our desire or intent to unnecessarily restrict or limit the utility of the improved features by virtue of this specific embodiment, since some of these features may be more generally applicable to sanding devices driven by various types of rotary motors disposed either remotely from or mounted directly upon the unit.

Referring to the drawings, the improved portable sander shown therein by way of illustration, comprises in general a durable and sturdy elongated frame or body 10 having therein a longitudinal central bore 11 closed at one end by a wall 12 and having its opposite end provided with internal screw threads 13; a manipulating handle 14 coacting with the upper or top side of the body 10; a shoe supporting and guiding base 15 coacting with the lower or bottom side of the body 10 through a gasket 16, and being firmly but removably attached to the body 10 together with the handle 14 by means of four screws 17; a sand paper carrying shoe 18 reciprocably suspended from the outer lower face of the base 15 and normally having an abrasive sheet 19 applied thereto; a flexible rotary power shaft 20 for delivering power to the unit through the open end of the body bore 11 through a rotary driving member 21; and mechanism including a rotary driven member 22, a reciprocable plate 23, and a motion converting element 24 and roller 25, all confined within the bore 11 and base 15 for converting the continuous rotary motion of the shaft 20 into reciprocating movement and for constantly imparting the latter to the shoe 18.

The main frame or casing 10 has flat parallel top and bottom faces against which the handle 14 and base 15 are normally firmly attached by the screws 17, and may be provided with external ribbing as shown in Figs. 1, 2 and 7; and the inner end of the bore 11 is of reduced diameter, while the outer threaded end of this bore is normally closed by a hollow removable plug 26 within which a bearing sleeve 27 for the rotary driving member 21 may be slidably and detachably confined by means of two manually releasable latches 28, 29 which are pivotally suspended from the plug 26 and are engageable with annular grooves 30, 31 formed in the sleeve 27. The rotary flexible drive shaft 20 which has its power delivery end firmly secured to the adjacent outer end of the driving member 21 is concealed within a flexible tubular non-rotary casing 32 secured to a fitting 33 which is screw threaded into an end socket of the normally non-rotating bearing sleeve 27, but the shaft 20 may normally be constantly rotated by means of an electric or fluid pressure actuated motor, or from any other suitable fixed source of power associated with the power receiving end of this shaft 20. The opposite inner end of the driving member 21 is provided with a polygonal driving projection 34 secured thereto by a shear pin 35, and the driven member 22 which is rotatable within the bore 11 of the body 10 is provided with a

rigid central tube 36 the projecting outer end of which has a cross-shaped socket 37 therein cooperable with the driving member projection 34 to provide a direct rotary motion transmitting connection between the members 21, 22.

The rotary driven member 22 is mounted for free rotation within the body bore 11 by and between spaced anti-friction end thrust resisting bearings 38, 39 one of which is located near the reduced inner end of the bore 11 and coacts with an integral central projection 40 of the member 22, and the other of which coacts with the tube 36 near the socket 37; and the enlarged intermediate portion of the member 22 is thus prevented from shifting axially, and is provided with a tapered annular peripheral groove 41 disposed in a plane which is inclined relative to the common central axis of the members 21, 22. The bearings 38, 39 are normally clamped in position by means of a removable threaded bushing 42 coacting with the internal screw threads 13 of the body 10, and the plug 26 is likewise normally held in place by this bushing 42 and another removable bushing 43 also coacting with the screw threads, and between which a flange 44 formed integral with the plug is confined. The bushings 42, 43 are provided with end notches adapted for application of a spanner wrench, and may thus be inserted or removed to permit convenient insertion and removal of the plug 26, bearings 38, 39, and driven member 22 relative to the bore 11. A packing 45 is preferably disposed within the inner bushing 42 and between the bearing 39 and the inner ends of the plug 26 and bearing sleeve 27 so that the bearings 38, 39 and the rotary driven member 22 may be confined in suitable lubricant, and a plunger pin 46 slidably confined within the tube 36 is constantly urged by a compression spring 47 toward the socket 37 thereby tending to push the driving projection 34 out of the socket and to thus interrupt the driving connection between the members 21, 22 at all times.

The latches 28, 29 which are formed for coaction with the grooves 30, 31 of the bearing sleeve 27, are pivotally supported upon the plug 26 and are spring pressed toward the sleeve 27 so that when either latch is brought into alinement with an adjacent annular groove it will snap into the groove. The latches 28, 29 are however independently or simultaneously manually releasable by the operator to either merely release the sleeve 27 for automatic interruption of the driving connection between projection 34 and the socket 37 by the spring 47 and plunger 46, or to effect complete removal of the sanding unit from the bearing sleeve 27. If only the latch 28 is released, the spring 47 and plunger 46 will push the projection 34 out of the socket 37, and will also shift the bearing sleeve 27 outwardly until the latch 29 snaps into the annular groove 31, thus preventing this sleeve from becoming detached from the plug 26, and permitting the driving connection between the projection and socket to be quickly re-established by merely pushing the sleeve 27 back into the position shown. However, if both latches 28, 29 are released, the sleeve 27 together with the driven member 21 and its driving projection 34 may be freely axially withdrawn from the plug 26, and it is noteworthy that the sanding unit may at all times be freely rotated about the longitudinal axis of the bearing sleeve 27 due to the annularity of the grooves 30, 31 with which the latches coact.

The reciprocable motion transmitting plate 23

is slidably confined within the base 15 and is provided with an integral central boss 48 having a bore with which the motion converting element 24 coacts, and with four smaller integral bosses 49 to each of which a combined shoe driving plug and oil seal retainer 50 is firmly attached by means of a cap screw 51, see Figs. 1, 2, 4, 5 and 7. The motion converting element 24 is freely rotatable within the bore of the boss 48, and has an enlarged medial flange 52 coacting with the top of the plate 23 and movable along a slot 53 formed in the body 10, while its upper portion is provided with an integral cylindrical projection 54 upon which the tapered roller 25 is freely rotatable. The roller 25 constantly engages the tapered inclined groove 41 of the rotary driven member 22, and coacts with a bearing plate 55 embracing the projection 54 and engaging the flange 52. In order to reduce friction losses to a minimum, an anti-friction or ball bearing 25' may be substituted for the plate 55 and interposed between the tapered roller 25 and its supporting projection 54 as shown in Fig. 9; and anti-friction bearing balls 56 may also be provided between the upper end heads of the four screws 51 and special sockets 51' secured to the body 10 as illustrated in Fig. 10.

The base 15 which is firmly secured to the body 10 by the screws 17 and is sealed at its top by the gasket 16, is also provided with a guiding recess within which the plate 23 is reciprocable and with four through openings 57 into which the bosses 49 of the plate 23 project, and a flexible cup-shaped seal 58, preferably formed of soft rubber, is interposed between each opening 57 and the adjacent boss 49 as clearly shown in Figs. 1, 2, 4, 5 and 7. These cup-shaped seals 58 have their peripheral rims firmly secured within the fixed base openings 57, while their inner tubular portions are likewise firmly secured to the bosses 49 by the retainers 50 and cap screws 51 associated with the reciprocable plate 23, thus providing a positive seal for the body bore 11 and for the interior of the base 15 while permitting free reciprocation of the plate 23 relative to the body and base. Each driving plug or retainer 50 may also be provided with a medial stop flange 59 and with an annular recess 60 adjoining the flange 59 for facilitating attachment of the sanding assemblage thereto.

The improved sanding assemblage comprises the shoe 18 consisting of a re-enforced metal sled 61, a fibre base board 62 coacting with the sled 61, and a felt pad 63 coacting with the board 62 as depicted in Figs. 1, 2, 3, 6 and 7. The sled 61 is provided with four sockets 64 which are adapted for snug reception of the lower ends of the retainers 50, and a pair of latch levers 65 are swingably supported upon the sled 61 by means of pivots 66 and are provided with resilient peripheral wedge wings 67 adapted to engage the recesses 60 of the adjacent retainers 50 as clearly shown in Figs. 6, 7 and 8. The levers 65 are adapted to coact with special friction screws 68 when in latching position as at the right of Fig. 6, and the resilient wings 67 are operable to firmly clamp the sled 61 against the retainer flanges 59 when in active position. The base board 62 coacts with the lower ends of the sled reenforcing ribs 69, and the opposite ends of the sled 61 are provided with alined bearings 70 with which sand paper clamping eccentric tubes 71 are cooperable, see Figs. 3 and 6. Each clamping tube 71 is provided at its opposite ends with eccentric portions 72 and

with adjusting slots 73, and these eccentric portions 72 snugly engage the sled bearings 70 while the cylindrical intervening portions of the tubes 71 are adapted to firmly clamp the opposite ends of a sheet of sand paper 19 or the like, against the rounded ends of the sled 61 and in stretched condition across the pad 63, when the tubes 71 are properly rotated with the aid of a screw driver or similar implement. The sled 61 may also be provided with depending side walls as shown in Fig. 7 for the purpose of retaining the board 62 and pad 63 in proper position beneath the sand paper 19.

During normal use of the improved sanding unit, the improved sanding shoe assemblage 18 should be applied to the retainers 50 and locked thereto with the aid of the latch levers 65 by causing the wings 67 of these levers to coact with the recesses 60 of the four retainers, as shown at the right of Fig. 6 and in Fig. 7. A sheet of sand paper 19 or the like, should then be stretched taut across the felt pad 63 and the opposite ends of the sheet 19 should then be inserted between the clamping tubes 71 and the upper end portions of the sled 61. By subsequently rotating the tubes 71 with the aid of a screw driver or the like applied to the slots 73 of the eccentrics 72, the ends of the sand paper 19 may be firmly clamped to the sled while at the same time further stretching the sheet into snug engagement with the soft pad 63, thereby providing an effective sanding or working surface. The chambers within which the plate 23, element 24, roller 25, and driven member 22 are confined should be provided with proper lubricant which will be sealed within these chambers by the gasket 16, packing 45, and seals 58, whereupon power may be applied from any suitable source to constantly rotate the flexible drive shaft 20 and the driving member 21.

In order to thereafter operate the sander, it is only necessary to force the bearing sleeve 27 inwardly so as to cause the driving projection 34 to enter the socket 37 of the driven member 22 and to also cause the outermost latch 28 to engage the outer recess 30 of the sleeve 27. Rotary motion will then be transmitted directly from the rotary driving member 21 to the rotary driven member 22 confined within the body bore 11, and as the member 22 rotates, the inclined peripheral groove 41 will coact with the roller 25 to cause the element 24 upon which the roller is supported, to reciprocate the plate 23 within its confines in the base 15. This reciprocation of the plate 23 is transmitted through the bosses 49, seals 57, cap screws 51, and retainers 50 to the sled 61 of the shoe assembly 18, thus causing the sandpaper 19 which is carried by the shoe 18 to likewise reciprocate. The abrasive face of the sandpaper 19 may then be applied to the work by manipulating the unit with the aid of the handle 14; and the annular recess 30 with which the latch 28 coacts will permit the unit to be rotated about the bearing sleeve 27, while the flexible drive shaft 20 and casing 32 will also permit the unit to be moved about freely in any direction. The rotary motion of the drive shaft 20 and member 21 are thus effectively converted into reciprocatory movement of the sanding shoe, and the flexible cup-shaped seals 58 thoroughly protect the motion converting parts of the mechanism against dust and grit without interfering or obstructing the motion transfer.

In order to stop the reciprocation of the shoe assemblage 18, it is only necessary to release the latch 28 whereupon the compression spring 47

and plunger 46 will immediately become effective to force the driving projection 34 out of the socket 37, thus interrupting the driving connection. The latch 29 will then snap into the inner recess 31 of the sleeve 27, thereby preventing this sleeve from being forced out of the closure plug 26, but if it becomes desirable to remove the sanding unit from the bearing sleeve 27, both latches 28, 29 may be released whereupon the sleeve 27 may be freely withdrawn from within the plug 26. When the sleeve 27 is thus removed from the sanding unit, the packing 45 will still maintain a seal for preventing escape of lubricant, and if it becomes desirable to remove the plug 26 and other internal parts of the unit, it is only necessary to remove the bushings 43, 42 with the aid of a spanner wrench. The sanding shoe assembly 18 may obviously be removed from the motion transmitting mechanism of the unit by merely releasing the lever 65 as shown at the left of Fig. 6, whereupon the sled 61 may be freely withdrawn from the retainers 50. It is also to be noted that the levers 65 are frictionally held in latching position by the holding screws 68 of the sled 61, thus preventing possible accidental release of the sled from the power transmitting mechanism during normal use of the improved assemblage.

From the foregoing detailed description it will be apparent that our present invention provides an improved portable sanding unit which besides being extremely simple, compact and efficient, is readily manipulable in any desired position and in corners and other cramped localities. All of the internal movable parts and bearings of the improved unit, are thoroughly concealed and protected against possible entry of dust and grit, while still being readily accessible for inspection with the aid of ordinary tools. The improved reciprocating sander shoe assembly 18 may be quickly and conveniently applied to or removed from the motion transmitting mechanism, and the abrasive sheet or sandpaper 19 may be quickly and conveniently replaced without removing the shoe assembly from the unit. The tubes 71 with their eccentrics 72 provide simple and compact means for stretching the sandpaper 19 against the resilient pad 63, and this pad 63 provides a cushion for the working stretch of the sandpaper 19. The improved sanding unit may be operated at high or low speeds, and has actually been successfully operated at driving shaft speeds of three thousand revolutions per minute, and the latches 28, 29 cooperating with the spring 47 and plugs 27, provide simple means for applying and for interrupting the power, while also permitting convenient removal of the sanding unit from its driving source. Any suitable type of rotary motor may be utilized for propelling the unit, and the motor may either be disposed remotely from the unit or applied directly to the driving member 37 thereof. The invention has in fact proven highly satisfactory and successful in actual use, and is operable without subjecting the operator to undesirable and annoying vibrations, while also being adapted to be manufactured and sold at moderate cost for diverse uses.

The specific formation of the motion transmitting plate 23 and of the seals 58 cooperating therewith, are important features of the present improvement, since these parts cooperate to effectively guide and reciprocate the shoe assemblage 18 while positively preventing foreign matter such as grit or dust from reaching the motion converting elements. The plate 23 is snugly but

slidably confined within the guiding recess formed in the upper portion of the base 15 and has the motion converting element 24 pivotally mounted upon its central portion, and the four flexible cup-shaped seals 58 coact with the depending plate bosses 49 and with the openings 57 in the base 15 to constantly conceal the plate 23 within the base recess while still permitting free and unrestrained reciprocation of the plate 23. Since the four bosses 49 are located remote from the central driving element 24 and coact with the shoe assemblage 18 near the four corners thereof, this assemblage is effectively confined to reciprocating movement during normal operation, and the location and formation of the four corner seal retainers 50 makes it possible to effect attachment and removal of the sled 61 with the aid of only two latch levers 65.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of use, herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art; and it is contemplated that specific terms such as "sander," "base," "plate," "shoe," "body," and the like, be given the broadest possible interpretation consistent with the prior art.

We claim:

1. A portable sander comprising, a body having a recessed base, an elongated plate slidably confined within the recess of said base and having two pairs of laterally spaced rigid protrusions extending through parallel openings in the base, means within said body for reciprocating said plate, a sander shoe reciprocable by said plate externally of said base, and a flexible seal interposed between each of said plate protrusions and the adjacent base opening.

2. A portable sander comprising, a body having a recessed base, an elongated plate slidably confined within the recess of said base and having two pairs of laterally spaced rigid protrusions extending through parallel corner openings in the base, means within said body for reciprocating said plate, a sander shoe reciprocable by said plate externally of said base, a single latch lever for detachably connecting each pair of said plate protrusions to said shoe, and a flexible cup-shaped seal interposed between each of said protrusions and the adjacent body opening.

3. A portable sander comprising, a body having a base, an approximately rectangular plate slidably confined within said base, means within said body for reciprocating said plate, a flexible seal interposed between said base and said plate near each of the four corners of said plate, an approximately rectangular sander shoe reciprocable externally of said base, a retainer for each of said seals reciprocable by said plate, and means for detachably attaching said shoe to all of said retainers.

4. A portable sander comprising, a body having a base, an approximately rectangular plate slidably confined within said base, means within said body for reciprocating said plate, a flexible seal interposed between said base and said plate near each of the four corners of said plate, an approximately rectangular sander shoe reciprocable externally of said base, a retainer for each of said seals reciprocable by said plate, and a pair of latch levers carried by said shoe and coacting with said retainers to attach said shoe to said plate, each of said levers cooperating with several of said retainers.

5. A portable sander comprising, a body having a base, an elongated plate slidably confined within said base, means within said body for reciprocating said plate, a flexible cup-shaped seal interposed between said base and said plate near each of the four corners of said plate, an elongated sander shoe reciprocable externally of said base, a retainer for each of said seals reciprocable by said plate, a driving connection between said plate and said shoe piercing each of said seals, and means for detachably attaching said shoe to all of said retainers.

6. A portable sander comprising, a body having a base, an elongated plate slidably confined within said base, means within said body for reciprocating said plate, a flexible cup-shaped seal interposed between said base and said plate near each of the four corners of said plate, an elongated sander shoe reciprocable externally of said base, a retainer for each of said seals reciprocable by said plate, a driving connection between said plate and shoe piercing each of said seals, and a pair of latch levers carried by said shoe and coacting with said retainers to attach said shoe to said plate, each of said levers cooperating with several of said retainers.

7. A portable sander comprising, a base having corner openings, an elongated plate slidable on one side of said base, means for reciprocating said plate, a flexible seal confined within each of said corner openings, an elongated sander shoe reciprocable along the other side of said base, a driving connection interposed between said plate and shoe at each corner of said base and piercing the adjacent seal, retainers for said seals, and means for detachably attaching said shoe to all of said retainers.

8. A portable sander comprising, a base having corner openings, a plate reciprocable along one side of said base, means carried by said base for reciprocating said plate, a sander shoe reciprocable along the other side of said plate, parallel driving elements projecting laterally from the corners of said plate through said base openings and drivingly engaging the corresponding corners of said shoe, a cup-shaped seal interposed between each of said connections and the adjacent base opening, and means for detachably attaching said shoe to all of said connections.

9. A portable sander comprising, a body having an approximately rectangular base provided with corner openings, a cup-shaped seal confined within each of said openings, each of said seals having an outer tubular wall snugly fitting the adjacent base opening and an inner tubular wall connected to its outer wall by a flexible diaphragm, a plate slidably confined within said base, means within said body for reciprocating said plate, a sander shoe reciprocable externally of said base, and a driving connection between said plate and said shoe piercing each of said seals and snugly engaging the inner wall of the adjacent seal.

10. A portable sander comprising, a body having an approximately rectangular base provided with corner openings, a cup-shaped seal confined within each of said openings, each of said seals having an outer tubular wall snugly fitting the adjacent base opening and an inner tubular wall connected to its outer wall by a flexible diaphragm, a plate slidably confined within said base, means within said body for reciprocating said plate, a sander shoe reciprocable externally of said base, a driving connection between said plate and said shoe piercing each of said seals and snugly engaging the inner wall of the adjacent seal, and means for detachably attaching said shoe to said driving connections from the exterior of said body.

11. A portable sander comprising, a hollow body having a polygonal base provided with corner openings, a cup-shaped seal confined within each of said openings, each of said seals having an outer tubular wall snugly fitting the adjacent base opening and a coaxial inner tubular wall integrally united with its outer wall by a flexible bottom, a plate reciprocable in said body at one side of said base, means for reciprocating said plate, a sander shoe reciprocable externally of said body at the other side of said base, and a driving element connecting said plate and said shoe through each of said openings and snugly engaging the inner tubular wall of the adjacent seal.

12. A portable sander comprising, a hollow body having a polygonal base provided with corner openings, a cup-shaped seal confined within each of said openings, each of said seals having an outer tubular wall snugly fitting the adjacent base opening and a coaxial inner tubular wall integrally united with its outer wall by a flexible bottom, a plate reciprocable in said body at one side of said base, means for reciprocating said plate, a sander shoe reciprocable externally of said body at the other side of said base, a driving element connecting said plate and said shoe through each of said openings and snugly engaging the inner tubular wall of the adjacent seal, and means for detachably attaching said shoe to said driving elements from the exterior of said body.

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EDWARD M. PFAUSER.

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