May 30, 1944. A. G. DECKER 2,350,098

OSCILLATING SANDER

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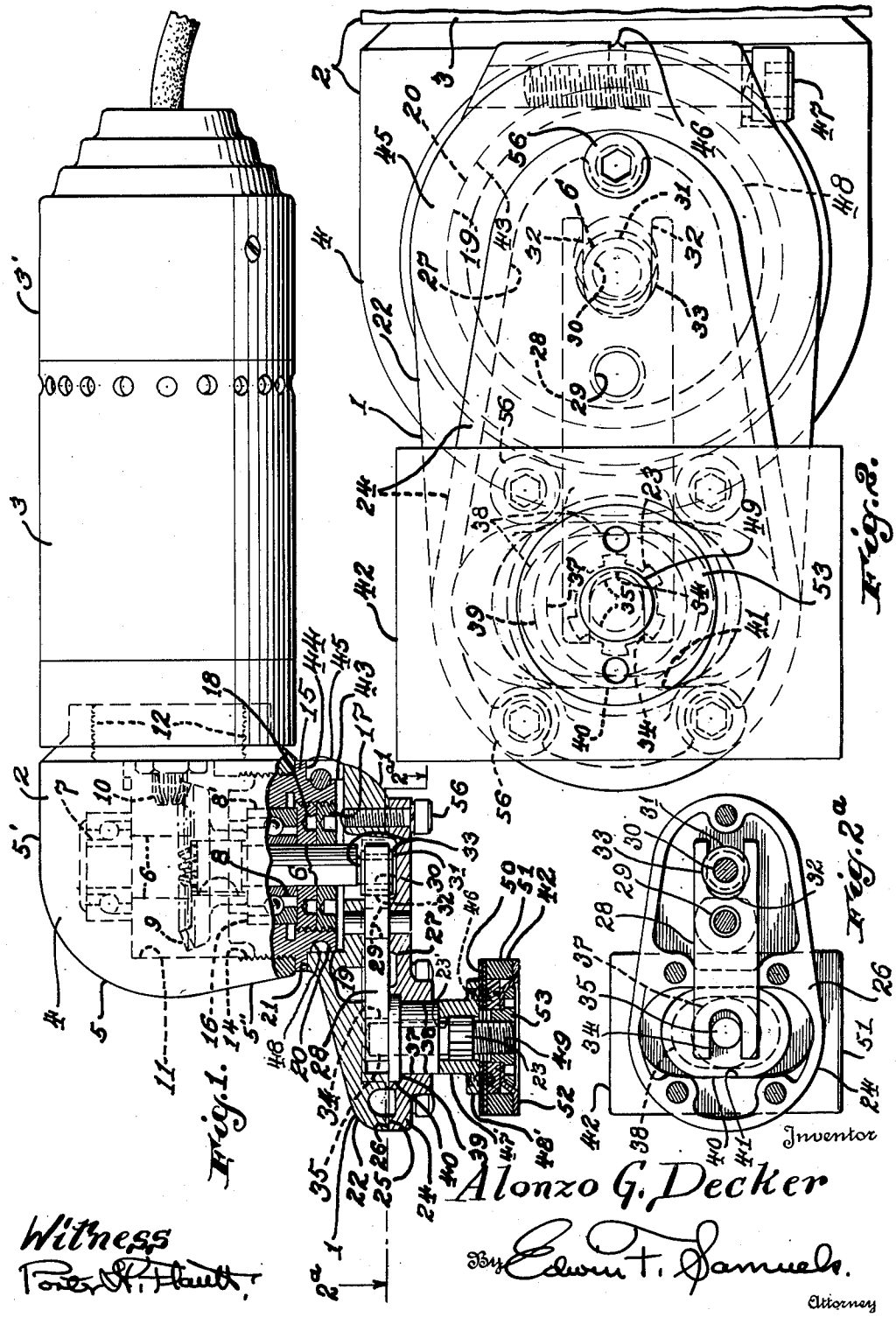


Fig. 1.

Fig. 2.

Fig. 2a

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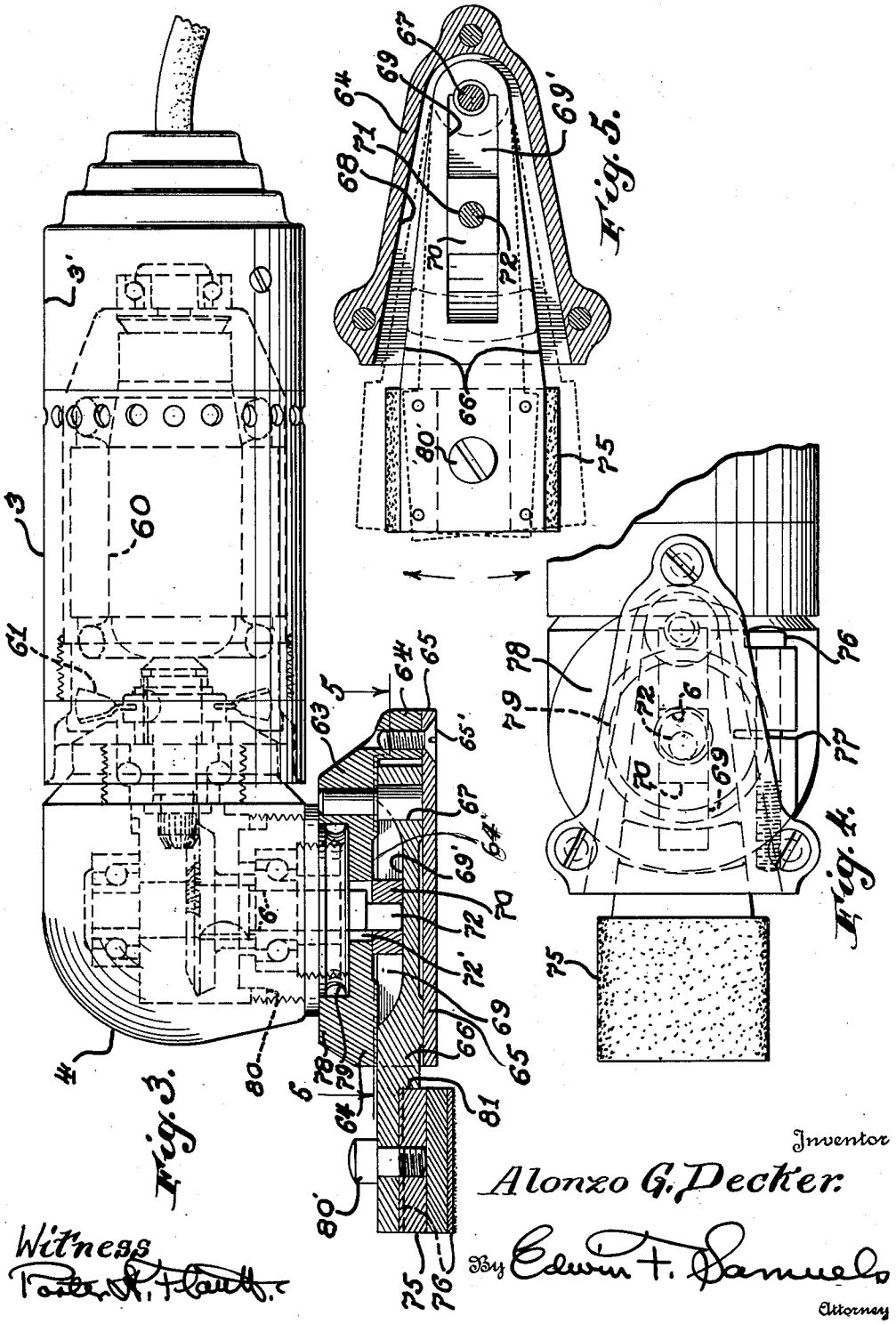
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OSCILLATING SANDER

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OSCILLATING SANDER

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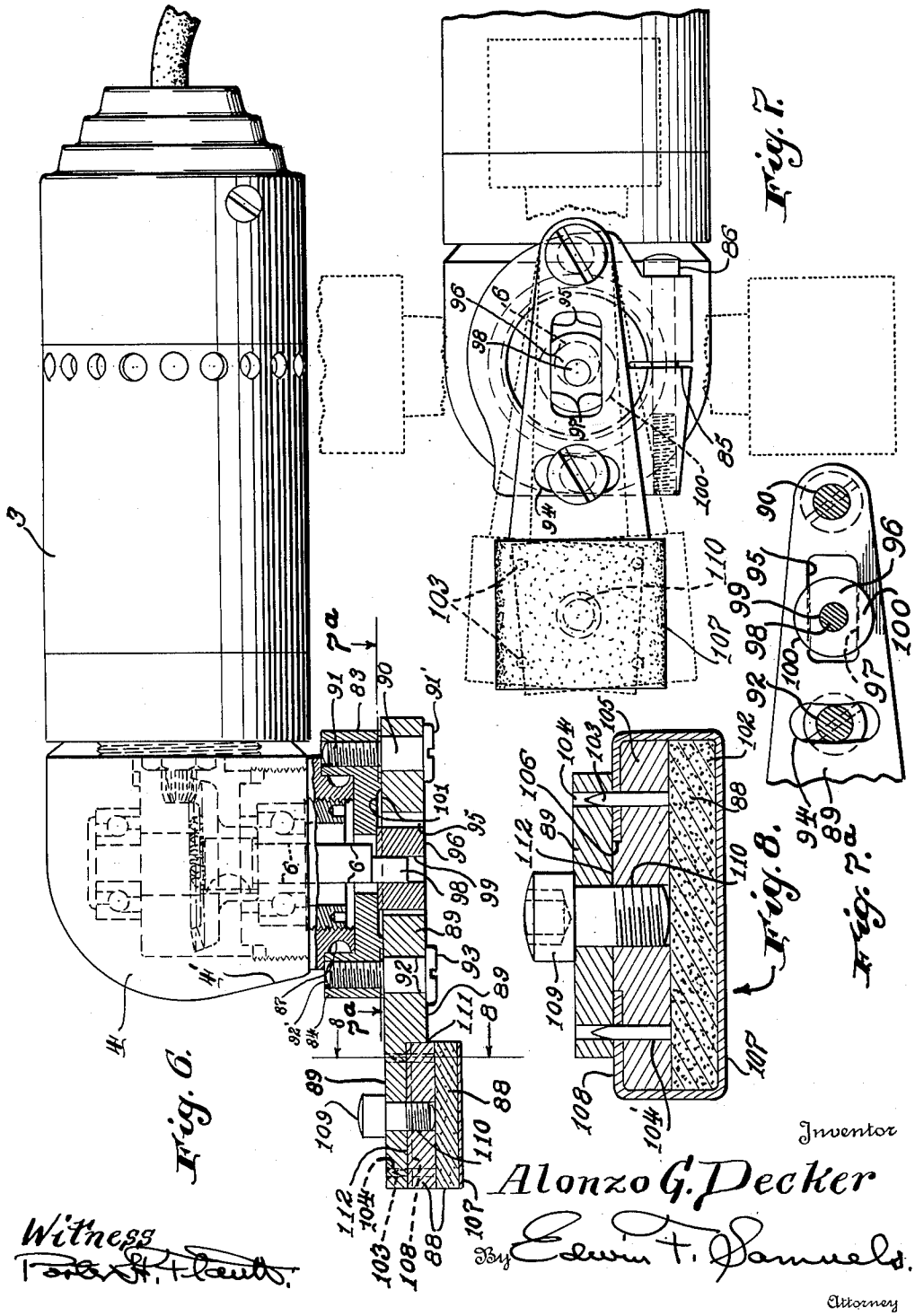


Fig. 6.

Fig. 7.

Fig. 8.

Fig. 7a.

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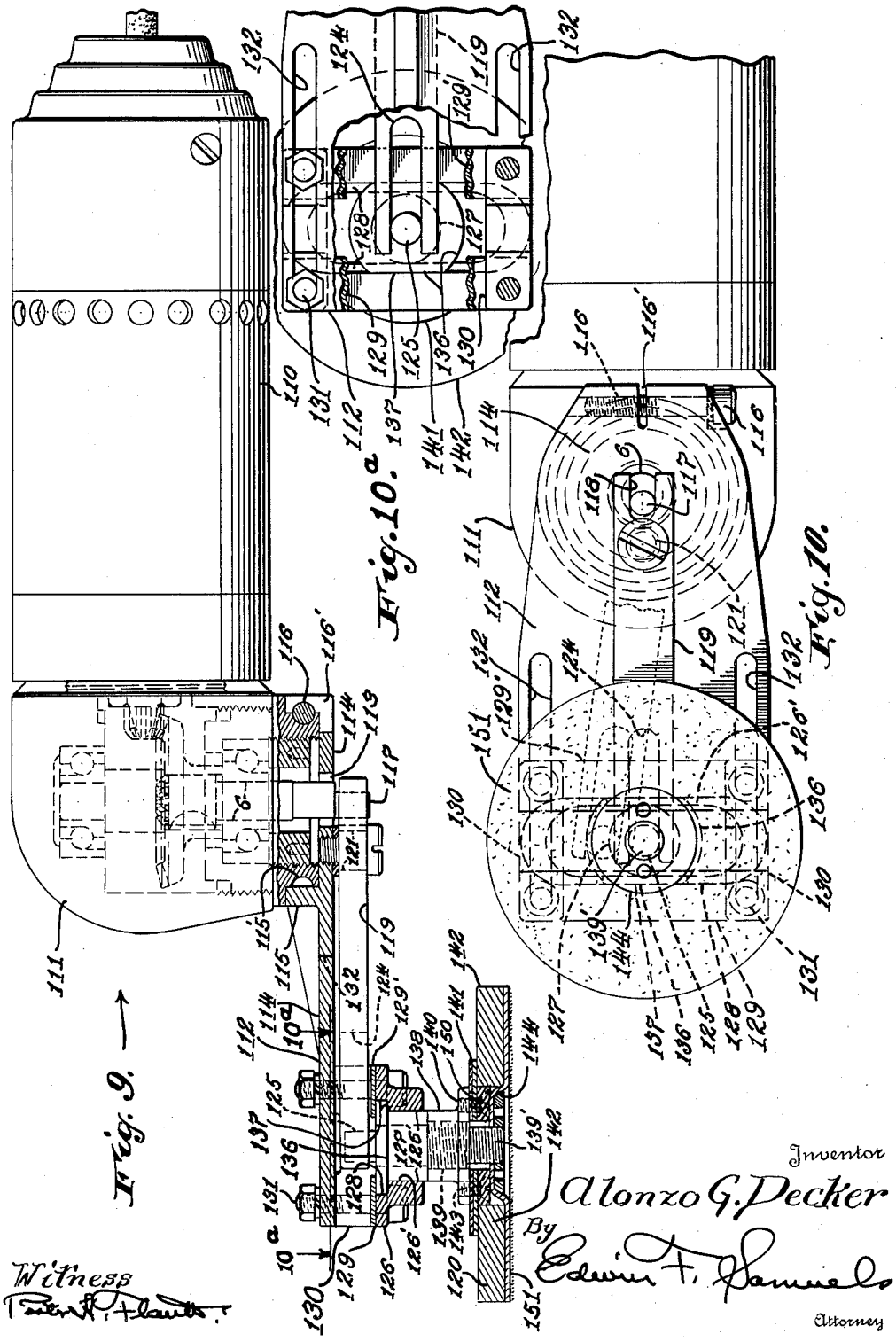


Fig. 9.

Fig. 10.a

Fig. 10.

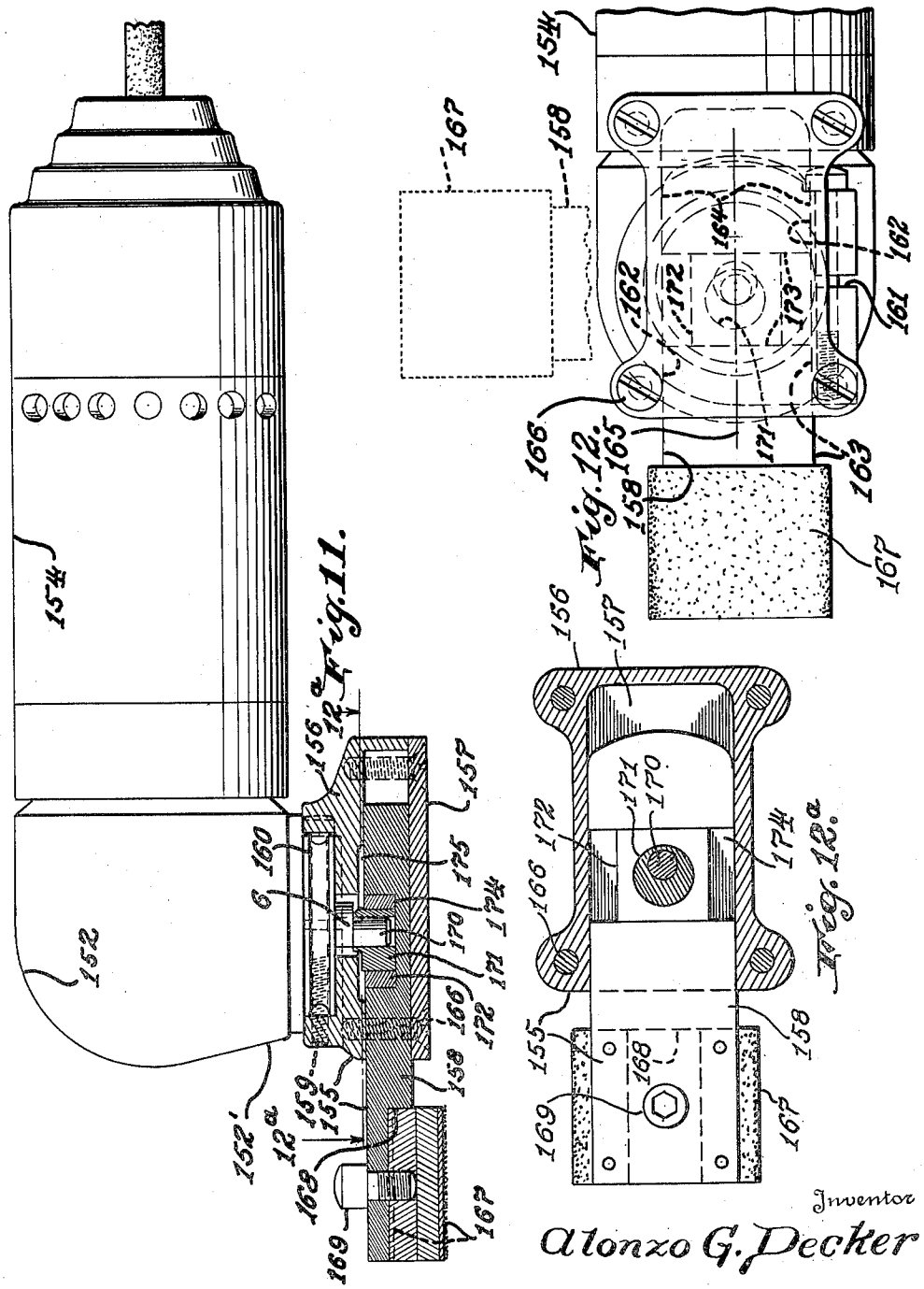
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Filed Dec. 31, 1941 7 Sheets-Sheet 5



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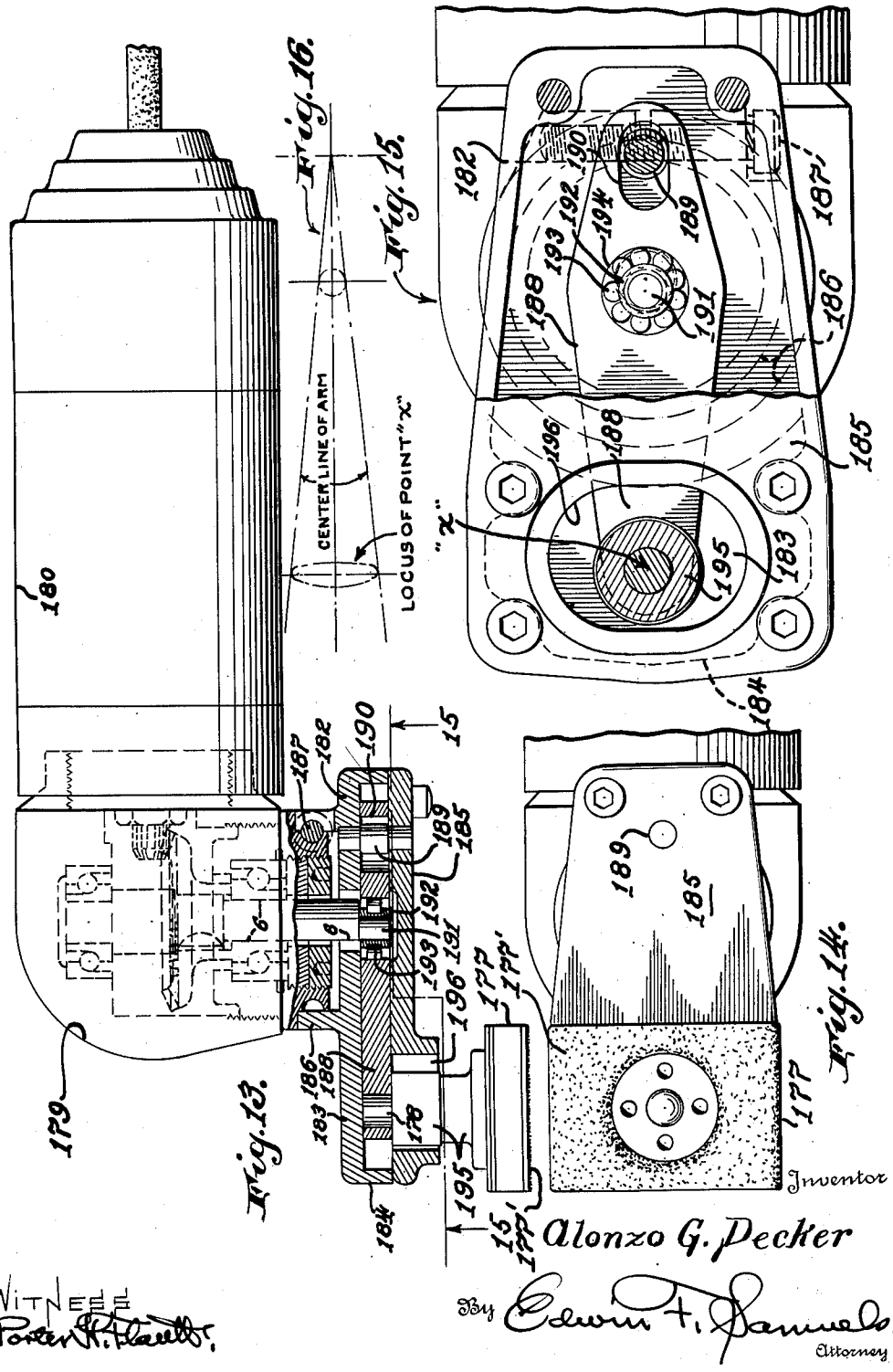
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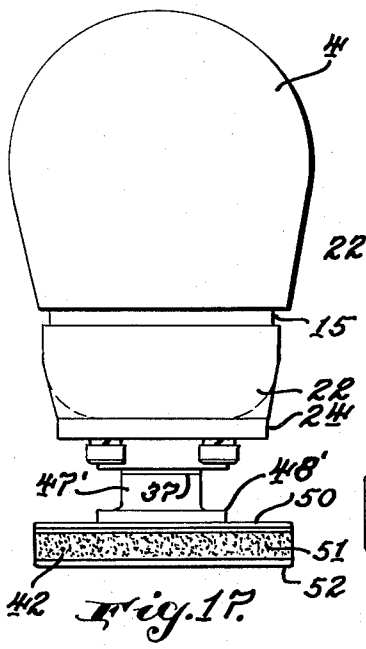


Fig. 17.

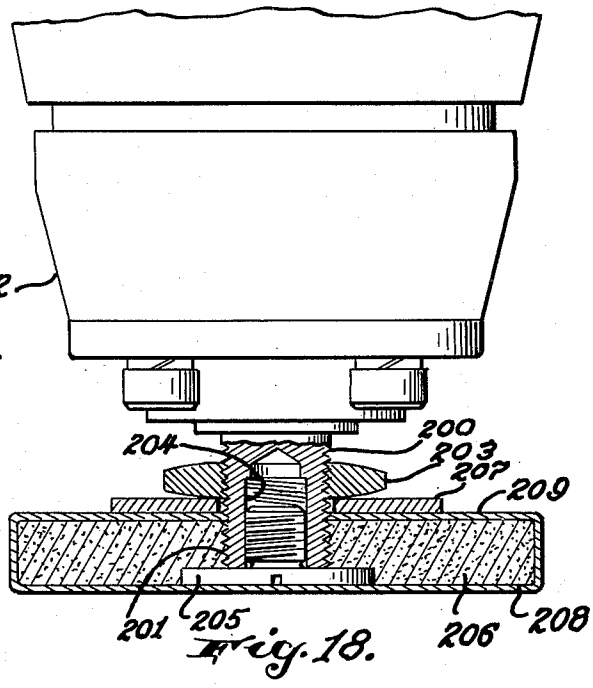


Fig. 18.

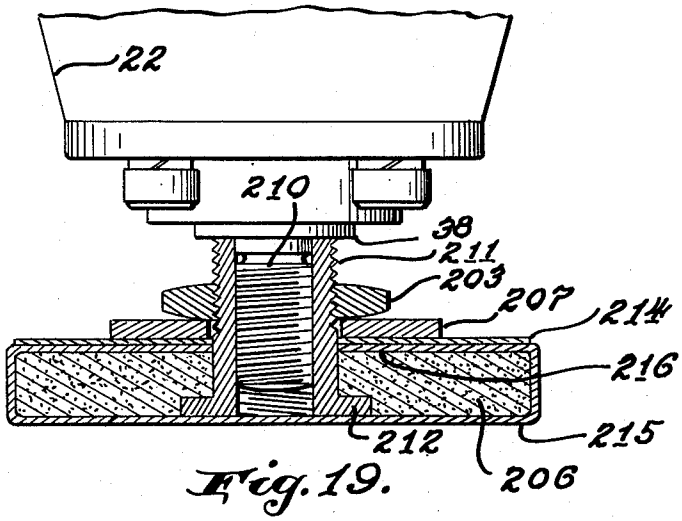


Fig. 19.

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UNITED STATES PATENT OFFICE

2,350,098

OSCILLATING SANDER

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Application December 31, 1941, Serial No. 425,181

11 Claims. (Cl. 51—170)

The invention relates to a reciprocating sander head per se and as a feature of a manually supported and directed power driven tool, more particularly, an electric tool though other power sources may be employed.

In operation the sanding member or pad is reciprocated on an extremely short approximately rectilinear path which may be either transverse to a radius of the head or in the direction of such radius, according to the various forms of the invention to be disclosed and the said transverse motion may be either on an arc, so short as to be approximately rectilinear or it may be a true rectilinear motion defined by slide guides. It is regarded as an important accomplishment that the pad element may support a small piece of sand paper or emery cloth or other abrasive surface, giving the effect of an abrasive sheet pressed by two fingers against the parts which are being sanded and moved back and forth by oscillation of the fingers. To this extent the operation of the machine simulates the hand sanding operation, making it possible for the pad to enter into and operate within corners or other small crevices and confined areas and in grooves or channels formed by machining and similar operations, whereby such internal surfaces and concavities can be treated.

While a hand operation is simulated the pad moves at a rate of from three to four thousand strokes per minute performing many times the work which can be performed by hand. The strokes may be from one half inch to one inch in length averaging less than half the radius of the gear casing.

It is also regarded as of importance that the oscillating sander of the invention is provided with a palm engaging grip above the center of oscillation and the casing is adapted for enclosure in the hand, so that the tool can be operated, supported and directed in and by one hand. It is also of importance that the pad is spaced outward radially from beneath the grip so that the work is in full view and not obscured by the grip or casing.

While various forms of power operated sanders are available they are found insufficient for this purpose in that they do not enter and are not adapted to operate in confined areas as described and the work and the pad are partly concealed from the operator during the sanding operation so that hand work is necessary.

The fact that in the various forms of the invention to be described, the sander head is angularly adjustable about the axis from which the arm carrying the pad radiates, such adjustment being adapted to the positioning of the arm at any angle substantially throughout the arc of 360° is regarded as an important contribution to the result attained in that the path of the sanding member or pad may be transferred or adjusted to any desired angular relation to the grip.

The various forms of reciprocating sander head illustrated are adapted to the accomplishment of the result described and other sanding operations generally performed by hand, thus giving a wide increase in the amount of work performed by the workman in a unit of time without sacrificing the quality of the product, certain forms being preferred on account of increased efficiency or simplicity and commercial advantage.

While the sander head may be otherwise supported and driven, it may be noted that in the preferred form shown the drive shaft or rotary driving member which operates the oscillating sander arm is mounted in the grip to which the sander head is attached, the shaft being driven by a motor or other driving source having its axis transverse to and preferably at right angles to said drive shaft. In the form shown the motor is enclosed in a barrel like casing to the end of which said ball grip is secured. While other types of grip and casing are usable, the ball like grip and barrel casing are preferred, for enclosure in the hand, this arrangement being of important advantage in holding and directing the sanding head in and by one hand of the operator with the pad spaced outwardly from beneath the grip so that the work and pad are always visible at the ends of the fingers of the operator.

In the accompanying drawings, I have illustrated a preferred and various modified forms of the apparatus adapted to the accomplishment of the object of the invention.

In the drawings;

Fig. 1 is a side elevation of a manually supported electric tool drawn to scale and equipped with a sander head according to the invention, the said sander head and adjacent parts being broken away and shown in section on a vertical plane of the tool axis.

Fig. 2 is a fragmentary view of the head and the ball like gear casing, the same being in the nature of a bottom plan of the sander head of Fig. 1, but on an enlarged scale, the barrel being broken away.

Fig. 2*a* is a section on line 2*a*—2*a*, Fig. 1.

Fig. 3 is a view similar to Fig. 1 but showing a

second form of head in which the sanding member reciprocates on a short and hence nearly straight arc,

Fig. 4 is a fragmentary bottom plan view of the sander head of Fig. 3 showing the grip end or gear casing, the barrel being broken away,

Fig. 5 is a horizontal section looking downwardly from the line 5—5 in Fig. 3,

Fig. 6 is a view similar to Fig. 1 showing a modified form of the construction Figs. 3, 4 and 5,

Fig. 7 is a fragmentary view in the nature of a bottom plan of the oscillating sander head Fig. 6, the barrel like casing being broken away rearwardly of the head,

Fig. 7*a* is a section on line 7*a*—7*a*, Fig. 6,

Fig. 8 is a vertical section on the line 8—8 in Fig. 6 looking in the direction of the arrows,

Fig. 9 is a view similar to Fig. 1 showing a modified form of oscillating sander head of the type of Fig. 1 in which the sanding member is guided to reciprocate on a guided rectilinear path,

Fig. 10 is a fragmentary view in the nature of a bottom plan showing the oscillating sander head of Fig. 9, the barrel being broken away rearwardly of the head,

Fig. 10*a* is a fragmentary section on line 10*a*—10*a*, Fig. 9.

Fig. 11 is a view similar to Fig. 1, showing an oscillating sander head in which the pad moves on a straight line, radially disposed as to the drive shaft and grip,

Fig. 12 is a fragmentary view in the nature of a bottom plan of the sander head, Fig. 11, the barrel being broken away rearwardly of the head,

Fig. 12*a* is a section on line 12*a*—12*a*, Fig. 11,

Fig. 13 is a view similar to Fig. 1 showing an oscillating sander head in and by which the radial and transverse paths are combined,

Fig. 14 is a fragmentary view in the nature of a bottom plan view of the oscillating sander head of Fig. 13, the barrel being broken away rearwardly of the same,

Fig. 15 is a section looking upwardly from the plane indicated by the line 15—15 in Fig. 13,

Fig. 16 is a diagrammatic view illustrating the path of the center of the pad and the center line of the arm which carries the pad,

Fig. 17 is a front end view of the construction in Fig. 1, showing ball-like grip as in the other forms illustrated, and

Figs. 18 and 19 are detail views showing modified forms of pad and attachment for the pad and abrasive sheets.

Referring to the drawings by numerals each of which is used to indicate the same or similar parts in the different figures and having particular reference to Figs. 1 and 2, the construction shown comprises a reciprocating sander head indicated in a general way by reference character 1. While other operating means may be employed within the broad conception of the invention, this sander head, as shown, is operatively mounted on a manually supported and directed electric tool unit 2, particularly adapted to this purpose. This unit has a barrel or similar field casing 3, containing an electric motor not shown; such a motor would have its axis coincident with the axis of said casing, which, as shown, includes at its rear end a brush housing or the like 3' which is shown as coaxial and continuous with the field casing proper.

Gear casing 4, as shown, projects forwardly from the barrel and is ball-like or semi-spherical as to its forward upper portion 5 and rearwardly thereof it is of approximately circular outline about a horizontal axis at 5' where it is attached to the field casing. The ball-like portion is to be seated in the palm of the hand, the lower end of the casing being shown as of downwardly reducing taper forming a finger grip or seat terminating at 5''.

Gear casing 4 contains a normally upright rotary member or shaft 6 for driving the sander head, the same being mounted in suitable antifriction bearings 7 and 8 in the upper and lower areas of the gear casing 4, said shaft being driven by a bevel gear 9 mounted thereon and meshing with a pinion 10 on the motor shaft.

Regarding the term, upright, it is assumed, for convenience, that the normal position of the tool is that which it would take in working on a horizontal upwardly exposed surface. This assumption is resorted to at times throughout the application.

The drive shaft 6 is preferably at right angles or at a convenient angle to the motor shaft and to the axis of casing 3, such relation being referred to as transverse. The oscillating sander head may, however, be otherwise supported and driven.

In the form shown the gear casing 4 is formed with a gear chamber 11, preferably concentric with the axis of the shaft 6 and of sufficient diameter to admit the gear 9, the said chamber 11 being also preferably open to the right into the field casing 3 through the threaded shank 12 whereby the gear casing, in the form shown, is secured to the field casing 3.

The chamber 11 is shown as formed with a bottom opening 14, the term bottom having relation to what may be termed the normal attitude of the tool as above described. The opening 14 is shown as internally threaded to receive a plug 15 which is suitably bored at 8' to receive the bearing 8 which may be forced up against shoulder 16 in any suitable manner as by means of screw plugs 17 and 18 screwed upwardly against the lower bearing 8.

An important feature of the plug 15 is that it is provided with a peripheral bearing surface 19, which, in the form shown, encircles a depending ring 20, the ring 20 and the surface 19 being to the best advantage concentric with the drive shaft 6 and preferably terminating above in a downwardly disposed circular flat surface 21 approximately transverse to the shaft 6, the details of construction being subject to such variation as would be obvious to a designer of such machines.

The reciprocating sander head, in the form shown, which is subject to variation as suggested, comprises a casing or frame formed in upper and lower sections 22 and 24 which may have horizontal contacting surfaces 25 and 26. This casing or frame contains a central chamber 27. A laterally or horizontally oscillating arm 28 is mounted on a pivot pin 29 intermediate of said arm being supported above and below by said casing sections 22 and 24. The chamber 27 in said casing is of dimensions sufficient to permit free oscillation of said arm about the pin 29 as herein after described. The sections 24 and 22 of the casing are fastened together by screws 56. The outline of the pad and the preferred form of casing sections 24 and 22 are shown in plan in Fig. 2.

In the form shown, the shaft 6 is provided at its lower end with a depending eccentric or crank pin 30 encircled by a bearing ring or follower 31 which operates in a slot 32 in an

end of arm 28 extending in the direction of the length of said arm. In the form shown, the bearing ring 31 has upper and lower flanges 33 which take over the top and bottom surfaces of the arm 28 which arm is shown in mid-position in the plan Fig. 2.

The arm 28, as shown, is formed at its forward end with a slot 34 similar to the slot 32, i. e., longitudinally disposed in arm 28. This slot is engaged by an operating pin 35 rigidly connected to follower member 39 and shown as projecting upwardly therefrom, and follower member 39 has a shank 37 which may be of suitable cross section and which slides in a slot 38 in the bottom member 24 of the sander head casing. This slot is shown as rectilinear and at right angles to the length of the arm 28 in mid-position. Shank 37, according to the illustration, extends downwardly from follower 39 which overhangs the shank 37 and has rectilinear elongated sides 40 adapted to ride in and be guided by a guide-way 41 in the bottom member 24 approximately at right angles to the length of the arm 28 in mid-position in which it extends forwardly from shaft 6. Guideway 41 is shown as at the upper side of the slot 38 and of increased width as compared to said slot and extending downwardly from the top surface 26 of the casing section 24. The co-operation of approximately rectilinear follower surfaces 40 with way 41 prevents turning of the pad member 42 about its axis, and said member is caused to reciprocate on a path which is approximately a straight line by oscillating arm 28 being operated after the manner of a hand sanding method herein identified.

It is of considerable importance that the sanding head casing, particularly its upper section 22, is provided with a curved approximately circular surface 43 which, as shown, is an internal or inwardly disposed surface adapted to enclose the ring 20 with its external circular surface 19, said surfaces being in engagement, and, as shown, the sanding head 1 preferably has an upwardly disposed circular flat surface peripherally arranged and indicated by reference character 44 which engages the downwardly disposed surface 21 on the gear casing and particularly in this instance formed on the plug 15. It may also be noted that, in the form shown, the head casing, particularly the upper section 22 thereof, includes an upwardly disposed ring member 45 having the inner peripheral surface 43 and the top flat surface 44 formed thereon and that this ring member is split radially and cut away forming a slot 46, Fig. 2, to permit of tightening or clamping as by means of a tangential screw 47. In the form shown, this screw projects into a peripheral groove 48 in the depending ring 20. This arrangement provides for the turning of the reciprocating sander head 1 to any position of adjustment through an arc of 360° about the drive shaft 6 and provides for clamping said head in any of the various positions of adjustment thus provided whereby the path of the sanding pad member 42 to be described may be shifted in its angular relation to casing 3, 4, to a series of positions relative to said casing.

In the form shown, the follower, including shank 37 and top portion 39, are made in a single piece with the follower pin 35 extending upwardly therethrough provided with splines 23, pin 35 is secured in any suitable manner in shank 37 as by forcing into place.

The pad member 42 as shown has a hub 47' shown in section and provided with a horizontal flange at 48' to support the pad. This hub member is apertured and splined at 23' to receive the pin 35 and the lower projecting end of the pin 35 is threaded at 49. The yielding material 51 and flexible plate 50 are secured to flanges 48' by screws 46 threaded upwardly. An abrasive sheet 52 is secured by means of a nut 53 engaging the thread 49. This nut also secures the entire pad member 42 to shank 37 to which it is thus removably attached. Pads usable with the machine are to be more fully hereinafter described.

While the details of construction have been fully described in order that the disclosure may teach the construction of an apparatus in accordance with the invention, it will be understood that these details are capable of wide variation.

The operation of this sander will be apparent from the description. The head being assembled as described and shown, the motor in the casing 3 being energized, the pad 42 with the abrasive sheet 52 thereon, is reciprocated with a short approximately rectilinear motion and at a high speed from three to four thousand strokes per minute being feasible. This operation, except for the speed attained, is closely similar to hand sanding. While the results attained are equal to those attained by hand sanding, the rate of accomplishment is widely multiplied.

It is also important that the sanding head, i. e., the casing 22, 24, with the parts therein, including the sanding pad member and follower and the oscillating arm, and the path of the pad may be adjusted about the driving shaft 6 and about the axis of gear casing 4 through an arc of 360° and secured in various positions of adjustment at any angle to casing 3, 4. It is also notable that the short stroke, and approximately rectilinear motion make it feasible to operate in confined areas as small grooves and channels and various crevices and corners which have previously been treated by hand and regarded as not accessible to and with the regular power sanding apparatus.

It is of interest that the ball-like gear casing 4 is adapted to fit in the palm of the hand, the fingers extending down to or toward ring 20. The barrel 3 is also of small diameter shown as about 2¼", the ball shaped casing 4 being of similar diameter and having its axis at right angles to that of the barrel.

In operating the member 4, being seated in the palm with the fore finger and second finger extending downwardly toward ring 20, the barrel being grasped by the remaining fingers and thumb the tool is in very satisfactory one hand control with the pad spaced outwardly from beneath the grip and immediately below the ends of the fingers so that the control of the pad is very similar to that attained in the hand operation with the speed many times multiplied.

Referring now to Figs. 3, 4 and 5, it will be noted that this illustration includes the field or motor casing 3, gear casing 4 and the motor 60 in said casing and a cooling fan 61, all of which are elements of the construction Fig. 1, the motor and fan not being indicated therein.

The oscillating sander head 63, in this instance, is connected to and operated from the motor but in a manner to be distinguished from the operation of the construction Fig. 1, the result attained being similar with relation to hand sanding.

The sanding head 63 like that shown and described in connection with Fig. 1 comprises upper and lower casing members 64 and 65, the latter being, however, more in the nature of a plate attached by screws 65'.

In this instance, the sander head comprises an oscillating arm 66 which is pivotally mounted in the casing 64, 65, as by means of a pivot pin 67, has its upper end extending upwardly into the upper casing member 64 and seated therein. The arm 66 is supported by the plate 65, the pivot pin being at the rear end of arm 66 remote from the pad member 75.

The upper casing member 64, see Fig. 5, is preferably chambered as shown at 68 to admit and enclose the arm 66 and to provide for its oscillation about the pin 67. To this end, i. e. that it may be thus oscillated the arm 66 is slotted longitudinally at 69 and this slot is engaged by a follower block 70 which fits and slides in the slot 69. Block 70, as shown, is formed with a central internal or female bearing 71. This bearing 71 is engaged by an eccentric pin or crank pin 72 extending downwardly from the drive shaft 6 which may be mounted and driven in the manner disclosed in connection with Fig. 1 providing for oscillation of arm 66.

It may be noted as of advantage that the slot 69 in the arm 66 preferably does not extend down through the arm and it thus serves to support the follower block 70 on the bottom 69' of the slot and that the bottom face of the upper member 64 of the casing may be chambered at 64' to permit the block to project upwardly thereinto, and the block 70 is preferably elongated relatively to its stroke so as to bridge the eccentric chamber 72' at all times and prevent displacement of the block.

The arm 66, as illustrated, extends forwardly from pin 67 in an approximately diametrical direction across the base of casing 4, in accordance with the preferred form, protruding from and beyond the casing 64, 65 and gear casing 4 and being provided at its outer end with a sanding pad member 75 to which abrasive material 76, preferably in the form of an abrasive sheet as emery cloth or sand paper is secured in a suitable manner to be described. This pad is preferably of small dimension so that it carries an abrasive sheet of a size and in a manner, form and arrangement and attains an effect similar to the effect obtained in and by rubbing the work with such abrasive sheet pressed against the work by the fingers of one hand.

It is of advantage that the end of the arm 66 carrying the abrasive, i. e., the sanding pad, projects outwardly from the casing so that the pad and the work can be seen from all sides by the operator and in the preferred arrangement the abrasive is supported below the bottom plate 65 of the casing as most clearly observed in Fig. 3. Thus the operation of the abrasive is free of obstruction and in full view of the operator.

It is also noted that the oscillating sander head 63 is adjustable about the axis of the drive shaft 6 to give a variety of angular adjustment and location of the path of the pad relatively to the gear casing 4 and the motor or field casing 3. An adjustment range of 360° is obtainable and may be regarded as preferred. As a clamping means for holding the sander head 63 in any desired position of adjustment, the clamping screw 76 may be arranged transversely of the radial slot 77 in the sander head casing as shown in Fig. 4 and previously described. The upper portion of the latter casing section 64, indicated at 78, is preferably in the form of a ring surrounding and enclosing a depending ring 79 on the gear casing or more particularly on the bearing plug 80 therein. The ring 78 may be split at 77 as described and clamped by means of screw 76 or other clamping means may be provided. The adjustment disclosed is capable of variation being similar to that in Figs. 1 and 2. The other details disclosed are likewise subject to changes of design.

This form of sander head is regarded as particularly efficient in its performance of the equivalent of hand or finger sanding operation, particularly, in confined areas as grooves, corners and the like, where up to the present time only hand work has been regarded as feasible.

The sanding pad, Figs. 3, 4, and 5, may to advantage be like that shown in detail and described in Figs. 6, 7 and 8 being clamped in position by the screw 80' and held against displacement by the transverse shoulder 81, see Figs. 3 and 5. The pads shown are to a considerable extent interchangeable.

Referring now to Figs. 6, 7 and 8, it will be noted that these figures show the details of a pad which is regarded as satisfactory for various machines of this general type. These figures also show a sanding head of similar operation but of somewhat different construction as compared to that shown in Figs. 3, 4 and 5.

Figs. 6, 7 and 8 show a motor or field casing 3 and a gear casing 4, arranged as previously described, the motor as shown in Fig. 3, having its axis coincident with the axis of the cylindrical casing 3. While this arrangement is preferred, the oscillating sander head may be otherwise driven and supported.

In the form shown in these figures, the sander head casing of the construction previously described is replaced by an upper guide and supporting plate or frame 83 which has an upwardly projecting horizontal ring or bearing portion 84. The ring may be split at 85 as shown in Fig. 7, or provided with any suitable clamping features. In the split form shown the ring is contracted in clamping by means of a screw 86 transverse to said split. The ring 84 with its clamping screw 86 are related to an inner ring 87 preferably of the form disclosed in connection with the previous figures, and in the manner described. In other words, this sanding head in the preferred form is angularly adjustable in what has been herein termed a horizontal plane about the axis of the driving shaft 6, the adjustment being most conveniently provided to operate through an angle of 360°, though it is believed that a lesser angular adjustment would generally be sufficient. Certain features of novelty in this and other forms of the invention disclosed are, however, to be treated as independent of the angular adjustment of the head.

The head shown in these figures comprises a sanding pad member 88 to be further described, the same being seated in the outer end of an oscillating arm 89 which is pivotally mounted on the plate 83 being preferably on the bottom of said plate permitting the pad to be mounted directly on the arm 89 and at the same time placing the abrasive surface of the pad well below the arm and frame. Also the arm is free for dismounting to permit removal of abrasive and metal dust and the like which may accumulate in and about the bearing surfaces and for other purposes. As shown, this arm, in its mid-position,

is diametrically related to the rings 84 and 87 but spaced downwardly below said rings or adjustment bearings and gear case 4.

The arm 89, in the form shown, is pivotally mounted on a pin or other bearing 90 on one side of the center of the shaft 6, said bearing being, in the form shown, formed on a screw 91 threaded upwardly into the plate 83 and having suitably engageable head 91' for operation of the screw. The head 91' takes over and supports the arm, it being understood that any suitable bearing 90 from which the arm may be conveniently removed may be employed. The arm 89 is further guided and supported on a bearing pin 92 at the opposite side of the axis of rings 84, 87, and gear casing 4 from said journal 90. Said pin journal 92 may be supported on a screw 92' or otherwise and it has a head 93 or other suitable means for supporting the arm 89 from beneath. The pin journal 92 engages a slot 94 in the arm for the purposes stated, said slot being approximately transverse to a radius about journal 90 and to said arm. Between journal 90 and 91 the arm 89, as shown, is also slotted at 95 in the direction of its length, this slot 95 is operatively engaged by a block 96 which fits and slides in said slot. This block, as shown, has straight sides 97 spaced according to the width of the slot and parallel to each other, and this block is, in turn, engaged by an eccentric or crank pin 98 projecting downwardly from the shaft 6 into a journal bearing 99 in the block.

The block 96, as shown in Fig. 7, is circular in plan, the surfaces 97 being chords of said circle, which leaves arcuate top flanges 100 at each side projecting laterally from the slot 95 over the top of and engaging the top surface of the arm 89 on each side of said slot. These flanges 100 serve to support the block 96. In the construction shown the bottom surface of the plate 83 is chambered at 101 to admit the flanges 100 and the top portion of the block 96 which projects upwardly into said chamber. It will be apparent that all the operating parts are supported by screws 91 and 92', avoiding the necessity for a bottom cover plate or the equivalent, as in Fig. 3.

By the operation of the shaft 6 and eccentric pin 98 and sliding block 96 and the guiding and supporting journals 90 and 92, the latter operating in transverse slot 94 as described, the center of the pad 88 is given a reciprocating motion in a direction approximately at right angles to the radius from the center of shaft 6 which in the particular arrangement shown, is approximately twice the throw of the eccentric 98 and approximately half the radius of gear casing 4. The sanding pad member 88, shown in connection with the tool in Figs. 6, 7 and 8, though particularly adapted to this machine and those of Figs. 3, 4, and 5, and Figs. 11 and 12 is capable of more general application. It consists of a pad proper 102 provided with four or any suitable number of upwardly projecting pins 103 which fit in corresponding holes 104 which may be formed in the end of the arm 89 or other suitable support. The pad member 88, as shown, has a frame or supporting plate 105 through which the pins extend via holes 104' and from which they project into holes 104 of arm 89 or other support, the pins and holes being essentially arranged in proper relation.

In the form shown the base plate or frame 105 of the pad member is slotted or rabbeted at 106 or otherwise a suitable aperture is provided between arm 89 or other upper support and the plate 105. The pad member is intended to be used with an abrasive sheet 107. In operation the abrasive sheets naturally become worn out or exhausted from time to time and must be replaced. When the worn sheet is removed or in initially applying an abrasive sheet, the new sheet is passed horizontally across the bottom of the pad and the end edges 108 are drawn up over the ends of the pad 102 and plate 105, which are duly assembled, and said edges are seated in the rabbets 106, the base or frame 105 and pad 102 having been removed from the upper member, support, or arm 89 and retained in assembled relation for this purpose. In seating the end edges 108 of the abrasive sheet 107 in the rabbets or apertures 106, these end edges are punctured by the pins 103 and passed down over the same. The assembled pad member is then pressed upwardly against the arm or support 89, the projecting ends of the pins 103 being inserted in the holes 104. Then the screw 109 which supports the pad member 88 on the arm 89 is threaded into the hole 110 provided in the base or plate 105 for this purpose and duly tightened, securing the pad member to the arm and tightly securing the abrasive sheet 107 to the pad 102 in connection with which it is accurately positioned and held against displacement by the pins 103 in the holes 104. The pad member is further positioned relative to the arm 89 by the shoulder 111 which forms the end wall of a seat 112 formed in the arm 89 for this purpose.

By this arrangement of the pad relatively to the arm 89 the pad projects outwardly from beneath the gear casing and the sander head casing or frame and also downwardly well below the moving parts of the machine as well as below the stationary frame or plate and by eliminating the bottom cover plate from the casing a degree of obstruction is removed from the vicinity of the pad and the latter thus advanced beyond the moving and the stationary members of the head is more easily and universally applicable to the work and the degree of visibility of the work and of the pad in operation is greatly increased by the elimination of obstructions existing in other machines for this purpose.

As already pointed out, this sander head is particularly adapted to the performance of sanding operations in grooves and corners and other confined areas and elsewhere under circumstances in which sheets of abrasive material have previously been applied by the pressure of one or more fingers of the hand which fingers are moved with a reciprocating or rubbing motion.

In the drawings, Figs. 6 and 7 are approximately full size, Fig. 8 being an enlarged view. The drawing therein discloses gear casing 4 and barrel 3 as of dimensions to be easily grasped in the fingers of one hand, as in Figs. 1 and 3

In the form Figs. 3 and 6 the path of the pad though arcuate is approximately rectilinear being an exceedingly short arc, which, in the form shown, is approximately a sixth of the length of the oscillating arm and a small fraction of the radius of the gear casing. These proportions are for illustration and are subject to variation, the short stroke being preferred.

The ball-like gear casing 4 fits in the palm of the hand with the fingers extending downwardly over the nose 4' to the ring 84 whereby the pad member 88 is placed just forwardly of the fingers which gives a guiding and controlling relation of the pad to the fingers similar to that existing in the finger or hand sanding operation described.

The construction is conveniently supported and directed in and by one hand.

Figs. 9 and 10 show a motor casing 110 and a gear casing 111. These though subject to wide variation are, in the form shown, formed and related in the manner already described. These figures show an oscillating sanding head, indicated in a general way by reference character 112. This head, in the form shown, is connected to the gear casing 111 for angular adjustment about the axis of the drive shaft 6 in the manner already described or in any suitable manner. In other words, the parts already discussed, except the details of head 112, may be substantially as in Fig. 1, though a considerable degree of variation is contemplated and the adjustment may be omitted.

The oscillating sanding head 112, Figs. 9 and 10, in the form here shown, comprises a single supporting plate or frame member 114 which serves the purpose of the sanding head casings already described, i. e., it projects outward radially from the bottom of the gear casing as do the sanding head frames and casings already described. This frame or casing 114 as shown is provided at its inner end, beneath the gear casing with an upright ring or bearing member 115, which, as aforesaid, engages a depending ring or journal 115' on the gear casing and is adjustable about the axis of the shaft 6. It is secured in any position of adjustment in any suitable manner as by a tangential screw 116 arranged transversely of a radial split in said ring 115 as at 116', other methods of adjustment and clamping being regarded as feasible.

In the form shown, which is for purposes of illustration, the details being largely selective, the shaft 6 projects downwardly from the center of gear casing 111 through the frame or supporting plate 114 by way of aperture 113, provided for this purpose, and the shaft 6 has extending downwardly from its lower end an eccentric pin or crank pin 117 which engages longitudinal slot 118 in the inner end of oscillating arm 119. While pin 117 is shown as engaged directly with slot 118, any suitable bearing may be employed. The arm 119 operates a sanding pad member 120 at its outer end to be further described. This arm 119 is pivoted on the frame or plate 114 intermediately of the length of said arm between said eccentric or crank pin 117 or its slot 118 and the outer end of said arm where the said pad member 120 is mounted or supported. This pivot is shown in the form of a journal 121 supported on said plate or frame 114 and extending downwardly therefrom. This journal 121 is shown as located closely adjacent the eccentric slot 118, so that the outer end of the arm 119 which operates the pad member 120 has a throw or path the length of which is several times the throw of the eccentric 117, the latter being extremely slight as indicated in the drawings, Figs. 9 and 10, which are full size, according to the machines as so far constructed.

The oscillating arm 119, in the form shown, is formed at its outer radial or swinging end with longitudinal slot 124 engaged by a pin 125 projecting upwardly from the pad member 120. It may be noted that the arm 119 extends outward radially from beneath the gear casing 111, its mid position being at the center line of plate 114.

In the form of the invention shown in Figs. 9 and 10, the pad member 120 or more particularly the follower 127, which is connected to said member and carries the pad, is mounted to reciprocate its path being substantially rectilinear and transverse to the length of the arm in mid-position.

To this end guide members 126 are secured to the plate or frame 114 beneath the same or in what may be referred to as a depending relation thereto.

These guide members 126 form a guideway 126' extending in the direction of motion, already described, i. e., transverse to the length of oscillating arm 119. This guide way in the form shown is of what may be described as a T shaped cross section, i. e., said guide members 126 are offset or grooved at 128 forming a widened portion of the way at the top. The widened portion of the way at 128 is covered by relatively thin plates 129 and 129' spaced apart as shown to provide a path for pin 125.

The guide members 126 and the cover plates 129, 129' as shown are spaced downwardly from the frame or supporting plate 114 by two elongated blocks 130 at each end parallel to the arm 119. The guide members 126 and said blocks 130 and cover plates 129, in the form shown, are held in position by four bolts 131. These extend upwardly from suitable seats in the ends of the guide members 126 and through the blocks 130, plates 129 and the plate or frame member 114 which is of sufficient width for this purpose, see Fig. 10.

It may also be noted that, in the form shown, the bolts 131 engage slots 132 in the plate 114. These slots are of considerable length and are approximately parallel to the arm 119 in mid-position. These slots, incidentally, are of a length corresponding to the length of the slot 124 in the arm 119 and thus provide for the adjustment of the position of the ways 126 in a radial direction toward or from the shaft 6 whereby the position of the pad member 120, and particularly its drive pin 125 and hence the path of pin 125 and pad member 120 about the shaft 6 may be changed to suit the operator. In this way the operator can vary the length of the path of reciprocation of the pad member 120 to meet the changes of conditions involved in and by the change of work.

In the form of the invention shown, the upper enlarged area or flange 136 of follower 127 which fits in the offset and widened portion of the ways at 128 and serves to support the pad member 120 and follower 127 is formed with parallel rectilinear way engaging surfaces 137. Below the follower 127 is the hub 138 of the pad member 120. The hub 138 is in operation secured to follower 127 by threading on to the middle threaded portion 139 of pin 125. The extreme lower end of pin 125 is in the form of a depending screw 139' of reduced diameter as compared to said middle portion 139. The screw 139' is adapted to be engaged by flat nut 144. The lower end of said hub 138 is flanged at 140 and the pad 142 is supported from above by flexible plates 141 and a center ring 150 which is attached to flange 140 as by means of screws 143 threaded through said plates and said ring portion of the pad and upwardly into flange 140.

The nut 144 enters a suitable depression in said pad and serves to secure an abrasive sheet 151 and likewise to secure the pad member 120 and its hub 138 to the follower 127.

While the pad shown at 142 is circular in form, other types of pad can be operated by this oscillating sander head, important features of which are the convenient adjustment as to the length

of the stroke, the projection of the pad member well down below the operating mechanism so that it is free of obstruction, and the ability to use a highly flexible pad, the pad member 142 being flexible for a large portion of its radial length and approximately half its area. Other features of importance are the extreme simplicity of construction and consequently low cost and the ability to perform what has been regarded as essential to hand operation at a relatively high speed and at a correspondingly reduced cost.

It is to be noted that in the preferred form illustrated, the pad member 120 is in effect suspended from the ways through the follower 127 and the lower part of the casing, except for ways 126, is eliminated causing the pad to extend well below the supporting plate or frame 114 and below all other moving and stationary portions of the machine, thus avoiding obstruction of the area around the pad and giving a relatively unobstructed view of the work and the pad and particularly the area of the work near the pad. This head has the advantage of a straight line path of adjustable length and the advantage of one hand support and direction from the end of the fingers as previously described. The rectangular pads may be used with this sanding head.

Referring now to Figs. 11 and 12, it will be noted that in the form illustrated the motor casing or field casing 154 and the gear casing 152 are as illustrated in the figures previously described and this arrangement has important advantages in the way of the convenience with which the oscillating or reciprocating pad is directed and supported by one hand of the operator, however, other forms of casing and drive are usable and the various features of the oscillating sander head of these and other figures are regarded as capable of more general application.

In the construction illustrated in Figs. 11 and 12, there is an oscillating sanding head indicated in a general way by reference character 155. This head comprises an upper member or casing 156 and a bottom cover plate 157. While this particular form of casing has advantages in connection with the operation to be described, particularly, in guiding and supporting the oscillating arm and in the exclusion of grit and the like from the contacting sliding surfaces of said arm 158 and the guideway to be described, it is subject to some variation in the light of previous disclosures in this application, other methods of supporting and driving the reciprocating or oscillating arm being contemplated.

It may be noted that the top member of the casing 156 is shown as provided with an upwardly projecting horizontal ring 159 which encloses a corresponding ring or journal member 160 depending from the gear casing 152 so that the journal member 160 is adapted for adjustment in a normally horizontal plane and about the axis of shaft 6. The ring 159 is shown as split at 161, said split being closed by a screw 162. This or any suitable means may be employed for adjusting and clamping the casing 156, 157 in any desired position of angular adjustment about the gear casing 152 and/or motor casing 154 whereby the path of the sander pad to be described is shifted about said casing 152, 154 or other hand grip.

An important object of the construction Figs. 11 and 12 is to provide a sander of the general type described in which the pad is reciprocated on a path which is in approximately radial relation to the drive shaft 6 and/or the gear casing 152 or other hand grip said path being disposed in the general direction of the length of the arm 158 and spaced downwardly beneath the hand grip and preferably adjacent the finger tips for which a suitable frustoconical seat is provided at 152' in the various forms shown, the term downward is used for convenience as having relation to the posion in which the tool is shown.

In view of the various constructions herein shown, it is feasible to provide oscillating sanding heads, having respectively the oscillating and approximately straight, or a true straight line or rectilinear path said strokes or path being radial as in Figs. 11 and 12 or tangential, i. e., at right angles to a radius as in Figs. 9 and 10 and other similar figures all of said heads being operable by and from a single portable tool unit as indicated at 152 and 154, and adjustable relatively to the same to operate at any angle to and with the gear casing or other hand grip or casing. If desired, several different heads may be adapted for use with a single grip and/or tool unit.

Referring again to the details of Figs. 11 and 12, it will be noted that the upper casing member 156 is formed with a guideway 162, the center line of which is radially related or approximately so related to the drive shaft 6 of the head and to the casing or grip 152, however, a degree of displacement of this center line from this exact location would not seem material except insofar as it might be sufficient to interfere with the efficient operation of the arm 158 from and by said shaft or any equivalent device and its control and direction from said grip in the manner described.

In the form shown the arm 158 has rectilinear side surfaces 163 and the way 162 has corresponding inwardly disposed rectilinear surfaces 164 disposed in the general direction of a diametrical center line, indicated for convenience at 165. Said direction or path being preferably capable of change and/or adjustment in the manner described.

The reciprocating or oscillating arm 158, in the form shown, is supported and held in said ways by the bottom plate 157 which is secured in the form illustrated by means of screws 166, being guided by sliding contact of surfaces 163 and 164.

In the form shown, the arm 158 is provided at its outer end with an abrasive pad 167 positioned by a flat transverse shoulder 168 on said arm and secured in any suitable manner as by means of one or more screws 169, a suitable form of pad being shown in Figs. 6 and 8. Fig. 12 shows in broken lines a second position of adjustment of said pad and arm and path which is merely an example of the effect of the adjustments described, also shown in Fig. 7.

The arm 158 is reciprocated in said ways in relation to said head and said gear casing 152 in the form of the invention shown, by an eccentric or crank pin 170. This pin 170, in the form shown, has a rotary engagement with a disc or bushing 171 shown as eccentrically bored to receive said pin and seated in the center of a rectangular slide block 172 fitting in sliding relation in transverse way 173 which may be formed in the arm 158. In the form shown the way 171 extends downwardly into said arm being closed at the bottom at 174. Also in the form shown, the top section of the casing 156 is chambered above the path of the bearing block or slide block 172, said chamber being indicated at 175 and tending to provide freedom of motion of the block 172 and bushing 171 in the operation indicated, avoiding unnecessary friction of the block with said casing section. The details are described for

completeness of disclosure and subject to variation.

In performing the sanding operation in crevices and confined areas and particularly in grooves and ways and the like, it is in many instances desirable to operate the pad in a radial direction giving a relation of the abrasive sheet to the work closely similar to that attained in the hand operation previously found necessary under such circumstances. The sanding head shown in Figs. 11 and 12 is adapted to perform such sanding operations at high speed increasing the output and the economy of production in and by a considerable percentage.

It is also to be noted that the reciprocating or oscillating motion described in connection with the reciprocating sanding heads herein disclosed in various forms is more like the hand sanding operation both in the type of motion and in the results attained than is the rotary sanding operation most generally practiced in power sanding. It is also noted that the machine herein described maintains, more nearly than has previously been possible, the condition of clear observation of the pad and the work and direct finger direction and control of the pad. The rotary sanders require special attention, and skill on the part of the operator on account of the tendency to score and groove the work whereas the reciprocating type of sanders herein described eliminate almost completely the tendency to score and give relatively high speed with results in and to the work similar to those attained by hand operation. The term reciprocating as herein applied has reference to a backward and forward motion substantially on a single approximately rectilinear path.

Figs. 13, 14, 15 and 16 illustrate a sander head in which the motion of the pad may have both a tangential and a preferably slight radial component as illustrated diagrammatically in Fig. 16, the point X the locus or path of which is shown being a point on the pad preferably the center of the pad member 177 and of the operating or driving pin 178 therefor.

The construction shown in these figures includes a gear casing 179 and a field casing 180 as previously described. While this arrangement has important advantages in connection with the type of sander disclosed, as already pointed out, the various combinations of parts described in connection with the sander head are capable of more general application.

The sander head 182 as shown comprises a casing 183 which may consist of upper and lower sections 184 and 185 preferably having a suitable ring or other adjustable connection 186 to the gear casing 179 whereby the head may be turned about the axis of the drive shaft 6 and/or grip casing 179 and clamped in any suitable angular relation thereto as by means of a clamping screw 187 or other clamping means which may span a slot in the ring 186 or operate according to any suitable clamping method.

In the form shown, as in the other forms already described, there is an oscillating arm 188 which may be said to reciprocate with a slight deviation from a single rectilinear path. As shown, there is a pivot pin 189 suitably supported in the casing in parallelism with the shaft 6. This pin or journal 189, as shown, engages a slot 190 in the end of the arm opposite to the pad member 177 said slot being preferably elongated in the direction of the length of said arm which is an approximately radial direction as related to shaft 6 and gear casing or palm grip 179. In the form shown, the shaft 6 is provided with a depending eccentric or crank pin 191 shown as extending downwardly from the lower end of said shaft and forced into a ring 192. This ring forms the inner race of a roller or other suitable bearing 193. The outer race of the bearing, in the form shown, is in the nature of a suitable inwardly disposed circular surface 194 which may be formed in the arm 188 or a suitable outer race may be inserted therein. The bearing 193 and the adjacent portion of arm 188 is thus given a circular motion about the axis of shaft 6. The details being illustrative and subject to variation.

The outer radial end of the arm 188 is engaged by the previously mentioned pad operating pin 178 which extends upwardly therethrough being integral with the shank 195 of sanding pad member 177, the pad 177' thereof, in the form shown, is of rectangular shape, elongated transversely to the length of the arm 188 and to the corresponding radius of shaft 6 though this precise form and size are unimportant except that all the pads used with the machines disclosed are preferably of the small size indicated, providing for the use of a small motor to drive them which motor is suitable to the one hand control unit disclosed, the pads likewise being suitable to the operation described.

In operation the pad has a motion which varies slightly from actual reciprocation on a single path being advanced and returned on slightly different lines so that the abrasive particles assisted by a slight motion of the machine as a whole are continually displaced from any single path which displacement is of advantage in that the tendency to scoring or grooving, which has been found difficult to avoid in the prior art power driven sanding apparatus, is completely eliminated.

The slot 196 in Fig. 13 is of sufficient area to permit free movement of the pad on and along the path described. This slot is in lower casing section 185.

This motion closely simulates the highly desirable but relatively slow hand operation and is suitable not only to the treatment of flat surfaces and uniformly curved surfaces but is particularly adapted to operation in crevices and confined areas as grooves and the like which it has previously been found necessary to surface by hand.

The disclosure Figs. 13 to 16 demonstrates that the invention may not in all forms be closely confined to the reciprocation of the pad precisely on a single rectilinear path.

Figs. 18 and 19 show forms of pad and pad supports particularly adapted for use with the construction Figs. 1, 9 and 13. Fig. 18, for example, shows the shank 200 depending from the follower member as per Fig. 1, externally threaded at 201 to engage a lock nut 203 and internally threaded at 204 to receive a flat headed screw 205. The pad proper 206 is apertured at the center to pass over the screw threaded shank 200.

In assembling the pad on the shank 200, the nut 203 is first turned up slightly above the position shown in the drawings, a washer 207 is then passed up over the shank into contact with the nut, the pad 206 is then engaged with the shank and passed upwardly against the washer and the screw 205 is inserted and turned upwardly to a position shown to support the pad, the head of the same engaging the bottom of the pad. An

abrasive sheet 208 is then placed in position to cover the bottom of the pad and the ends of the sheet at 209 are turned upwardly over the ends of the pad and over the top of the pad, after which the washer 207 having been previously raised to admit the ends 209 of the abrasive sheet is forced downwardly against said pad by turning nut 203 downwardly whereby said ends 209 are clamped and the abrasive sheet is secured in position and is thus made ready for any of the sanding operations mentioned, the pad likewise being suitably clamped.

It may be noted that Fig. 18 is a longitudinal central section, the pad being preferably of elongated rectangular form as shown in plan in Fig. 2, which is likewise true of the pad Fig. 19.

In the construction Fig. 19 the depending shank 210 of the follower is made of reduced cross section and preferably solid being externally threaded as shown. In this construction the pad 206 is mounted on a sleeve 211 which is part of the pad member and is externally and also internally threaded and preferably flanged at its lower end at 212 to support the pad. This sleeve carries threaded thereon above the pad, a lock nut or pressure nut 203 and a washer 207, as described above in connection with Fig. 18, and beneath the washer there may be a flexible plate 214 directly overlying the pad and providing a flexible backing therefor. The pads, in all instances, may be of felt or rubber or sponge or the like.

In this instance the abrasive sheet 215 is placed in registration with the bottom surface of the pad completely covering the same as in the previous instance, i. e., in Fig. 18, and the ends 216 of the sheet are passed upwardly over the ends of the pad and then folded over the top of the same between the top surface of the pad and said plate 214. To clamp the ends of the pad to hold the latter in operative position, the nut 203 is screwed down against the washer 207 and thus applies pressure to the plate 214 clamping the ends of the abrasive sheet in position and holding the latter in its operative relation to the pad. If desired, the flexible plate or sheet 214 may be omitted, the washer 207, in most instances, being of a diameter approximately equal to the transverse dimension of the pad so that it is sufficient to hold the ends of the sheet when pressed down by the nut 203.

The operation of the various sanding heads and pad members and the manner of directing and supporting the same has been fully described in connection with the description of each form of head and pad. While the term oscillating has been applied to the operation of certain heads particularly where the pad carrying arm swings about a center, it is noted that the path of the pad is so short relatively to the radius about said center as to be approximately straight so that all the heads may be said to move the pad back and forth on an approximately straight path or to cause it to reciprocate the slight variation from a rectilinear path being regarded as insufficient to constitute a departure from the true definition of this term.

I have thus described the invention in several different forms, the description being specific and in detail in order that the manner of constructing, applying, operating and using the invention may be fully understood, however, the specific terms herein are used descriptively rather than in a limiting sense, the scope of the invention being defined in the claims.

What I claim as new and desire to secure by Letters Patent is:

1. A hand supported and directed sanding machine having a casing comprising a barrel and a ball like gear casing with gear means therein, the gear casing being adapted to fit in the palm of the hand and serving as a hand grip whereby the tool is supported in and directed by one hand of the operator, a sanding head having a frame and a rotary driving member, the latter being transverse to the axis of said barrel and driven by gearing in said gear casing, an arm guided for reciprocation in said frame and extending outward radially beyond said gear casing and means connecting said arm to said rotary member to impart a reciprocating motion to the arm, and means for supporting a sanding pad member on said arm at a point spaced outward radially beyond and also below said gear casing, said machine having a finger end engaging surface below the palm engaging portion and immediately above said arm.

2. A hand supported and hand directed sanding machine having a casing comprising a barrel and a ball-like grip at the end of said barrel, and adapted to fit in the palm of the hand, and having a depending finger tip engaging nose, the barrel being of a diameter similar to that of the grip whereby the tool is supported and directed in one hand of the operator, a sanding head having a frame and rotary driving member, the latter having its axis transverse to the axis of said barrel and an arm guided for reciprocation in said frame and extending outward radially beyond said gear casing and means connecting said arm to said driving member to impart a reciprocating motion to the arm, and means for supporting a sanding member on said arm at a point spaced outward radially from beneath said gear casing, said frame being mounted for angular adjustment about the axis of said nose whereby said arm and the pad thereon and the path of the latter may be shifted about and relatively to said casing, and means for clamping said sanding head in various positions of adjustment.

3. A hand supported and directed sanding machine comprising a hand grip, a rotating driven member therein, a reciprocating sanding head comprising an arm mounted to reciprocate and receiving a reciprocating motion from said rotating member and extending outwardly beyond said grip, said arm being adapted to carry a sanding pad member thereon spaced outwardly from said grip, said head including said arm being mounted for angular adjustment relatively to said grip about the axis of said rotary member approximately in a plane transverse to said axis, means for securing said head in various positions of adjustment whereby the path of said pad member is shifted about said grip, the path of said pad being approximately rectilinear.

4. A hand supported and directed sanding machine comprising a hand grip, a rotating driven member therein, an oscillating sanding head comprising an arm mounted to reciprocate and receiving a reciprocating motion from said rotating member, and extending outwardly beyond said grip, said arm being adapted to carry a sanding pad member thereon spaced outwardly from said grip, said arm being pivotally mounted at a point in its length remote from said pad member and having a longitudinal slot for en-

gagement with said pad member and a guide transverse to the length of said arm in mid position, whereby the direction of motion of the pad is controlled.

5. A hand supported and directed sanding machine comprising a hand grip, a rotating driven member therein, an oscillating sanding head comprising an arm mounted to reciprocate and receiving its reciprocating motion from said rotating member, and extending outwardly beyond said grip, said arm being adapted to carry a sanding pad member thereon spaced outwardly from said grip, said arm being pivotally mounted at a point in its length remote from said pad member and having a longitudinal slot for engagement with said pad member and a guide transverse to the length of said arm in mid position, whereby the direction of motion of the pad is controlled, and means providing for the adjustment of said guide in the direction of the length of said arm to vary the length of the path of the pad.

6. A hand supported and directed sanding machine comprising a casing having a ball-like palm engaging grip, the grip being adapted for inclosure in one hand of the operator whereby the tool is adapted to be supported and directed in and by one hand of the operator, said ball-like grip containing a rotary driving member, a sanding head having a frame, means whereby said head is supported on said ball member for angular adjustment about the same, means for securing said frame in various positions of adjustment about an upright axis through said grip, means supported in said frame and extending outward transversely to said axis beyond the outer periphery of said ball-like member and adapted to support a sanding member at its outer end, means for reciprocating the said supporting means and said sanding member on a short approximately rectilinear path.

7. A hand supported and directed sanding machine comprising a ball-like palm engaging grip, the grip being adapted for inclosure in one hand of the operator whereby the tool is adapted to be supported in and by one hand, said ball-like grip containing a rotary member, a sanding head having a frame, means whereby said head is supported on said ball member for angular adjustment about the axis of said rotary member and grip in directions transverse to said axis, and means for securing said frame in various positions of said adjustment, means supported and guided in said frame and extending outward radially of said ball-like member and adapted to support a sanding pad member at its outer end, means operated by said rotary member for reciprocating the sanding member and said support on a short rectilinear path, which is approximately half the radius of said ball.

8. In a hand supported and directed sanding machine having a hand grip, an oscillating sanding head supported on said hand grip and comprising a frame, a rotating shaft extending downwardly from said grip and having an eccentric in said frame, an arm disposed in an approximately radial direction as to said axis and extending outwardly beyond said grip, and having a slot with a block slidably engaging said slot and having a bearing therein for said eccentric which imparts a harmonic motion to said block transversely of said slot whereby said arm is given a reciprocating motion, said frame having guiding means for said arm confining it to a predetermined path in the direction of its length, and means on said arm for supporting an abrasive member located outward radially from and below said grip and frame and for securing said member to said arm to move therewith and, said abrasive member having an abrasive surface spaced downwardly below said arm and said frame and disposed transversely of said shaft.

9. In a hand supported and directed sanding machine having a hand grip, an oscillating sanding head supported on said hand grip and comprising a frame, a rotating shaft extending downwardly from said grip and carrying an eccentric in said frame, an arm disposed in an approximately radial direction as to said axis and extending outwardly beyond said grip, and having a slot with a block slidably engaging said slot and having a bearing therein for said eccentric which imparts a harmonic motion to said block transversely of said slot whereby said arm is given a reciprocating motion, said frame having guiding means for said arm confining it to a predetermined path and means on said arm for supporting an abrasive member located outward radially from and below said grip and frame and for securing said member to said arm to move therewith and, said abrasive member having an abrasive surface spaced downwardly below said arm and said frame and disposed transversely of said shaft, said slot being arranged transversely of said arm and said guiding means and path being disposed in the direction of the length of the arm.

10. In a hand supported and directed sanding machine having a hand grip, a reciprocating sanding head supported on said hand grip and comprising a frame, a rotating shaft extending downwardly from said grip and having an eccentric in said frame, an arm disposed in an approximately radial direction as to said axis and extending outwardly beyond said grip, and having a slot with a block slidably engaging said slot and having a bearing therein for said eccentric which imparts a harmonic motion to said block transversely of said slot whereby said arm is given a reciprocating motion, said frame having guiding means for said arm confining it to a predetermined path, and means on said arm for supporting an abrasive member located outward radially from and below said grip, said abrasive member having an abrasive surface spaced downwardly below said arm and said frame and disposed transversely of said shaft, said frame and grip having cooperating means providing for the angular adjustment of said frame and said path about said shaft.

11. A hand supported and directed sanding machine having a hand grip consisting of a gear casing of ball-like form, and adapted to fit into the palm of a hand whereby the tool is supported and directed by one hand of the operator, reducing gears in said casing, a barrel of which said casing forms the end, an electric motor in said barrel having a driving connection to said gears, a reciprocating sanding head supported on said hand grip and comprising a frame, a rotating driving member connected to and driven by said gears, said rotary driving member extending downwardly from said grip and having an eccentric means thereon, an arm disposed in an approximately radial direction as to said axis and extending outwardly beyond said grip, and

having a slot with a block slidably engaging said slot and having a bearing therein for said eccentric which imparts a harmonic motion to said block transversely of said slot whereby said arm is given a reciprocating motion, said frame having guiding means for said arm confining it to a predetermined path and means on said arm for supporting an abrasive member located outward radially from and below said grip and for securing said member to said arm to move therewith, and, said abrasive member having an abrasive surface spaced downwardly below said arm and said frame and downwardly disposed, said guiding means confining said arm to a motion transverse to its length and said slot being disposed in the direction of the length of the arm the machine as thus arranged providing for the placing of the fore finger of the operator holding the grip with his right hand immediately adjacent to the pad whereby the abrasive member is directed with the maximum of precision.

ALONZO G. DECKER.