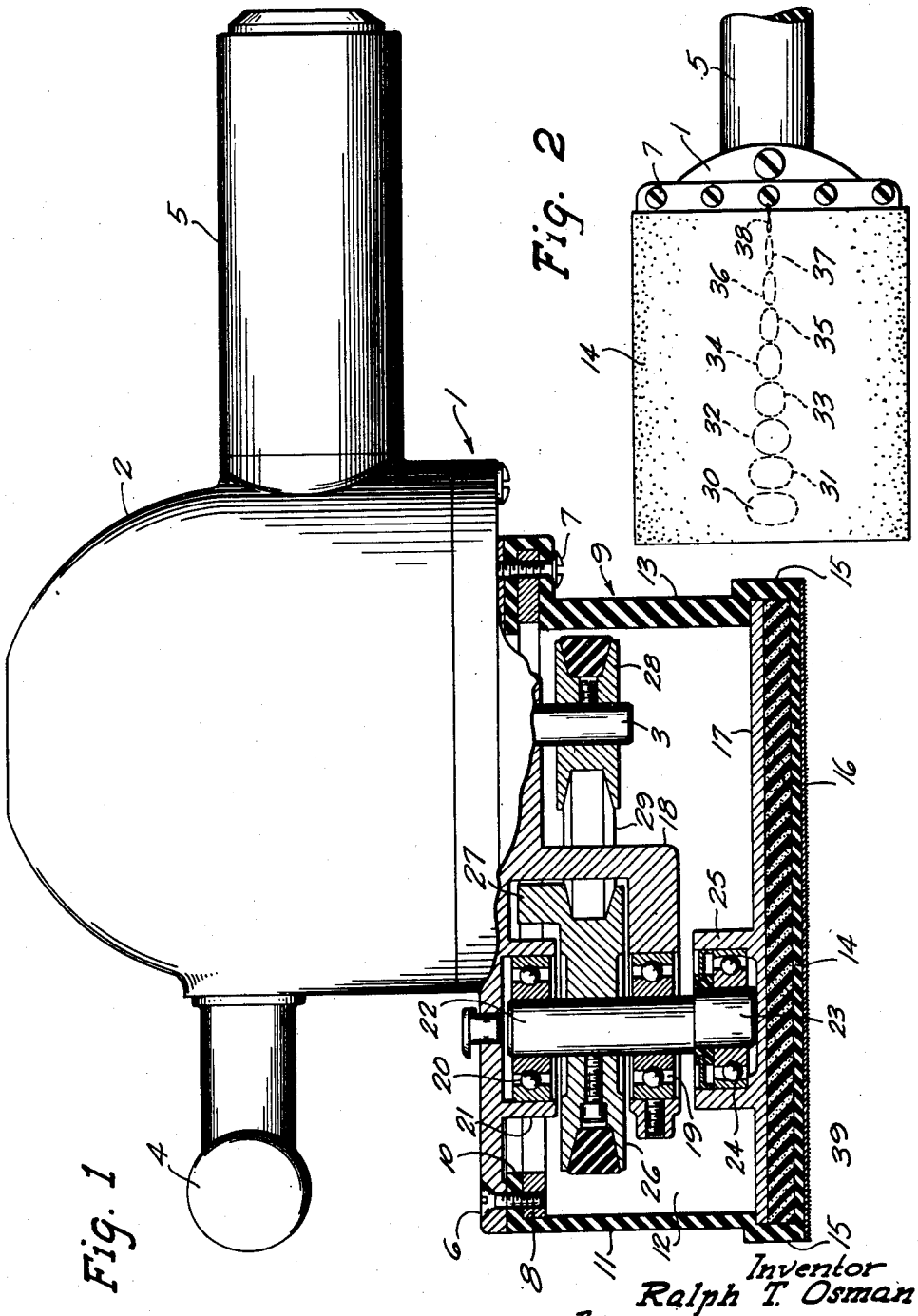
May 11, 1948. R. T. OSMAN 2,441,506

RECURRENT MOTION ABRADER

Filed April 10, 1946 3 Sheets-Sheet 1



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RECURRENT MOTION ABRADER

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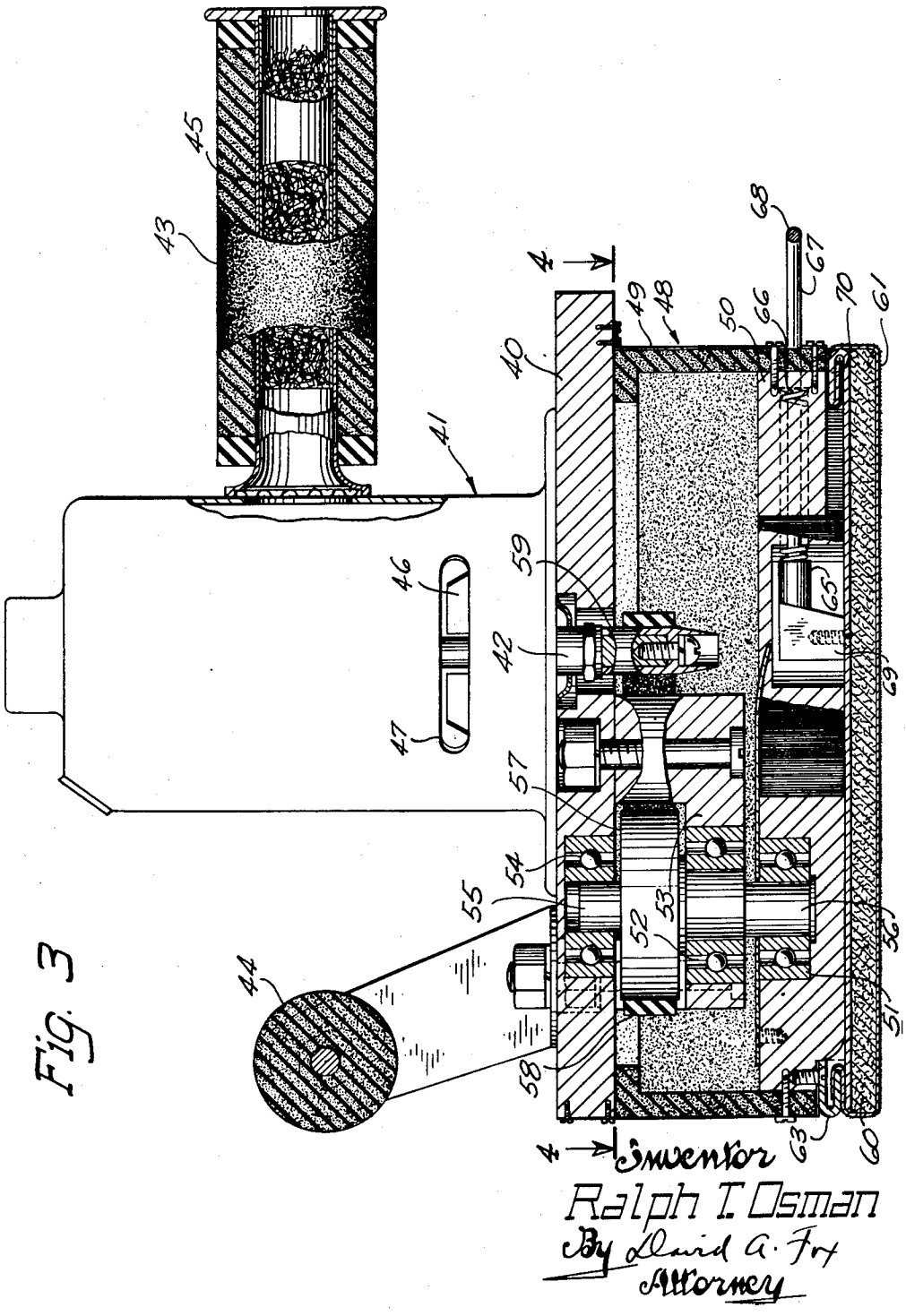


Fig. 3

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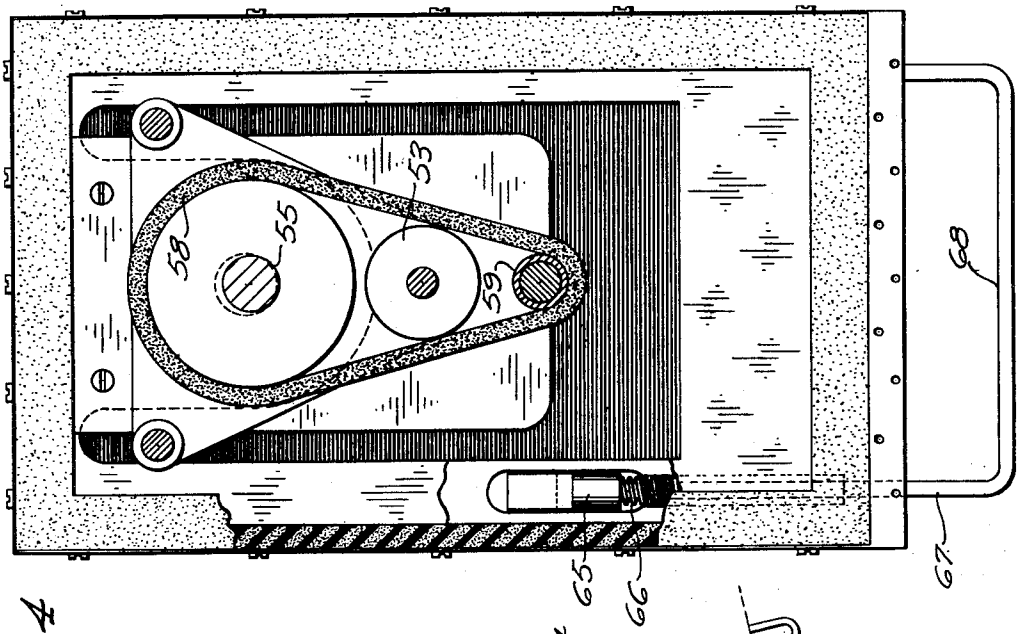


Fig. 4

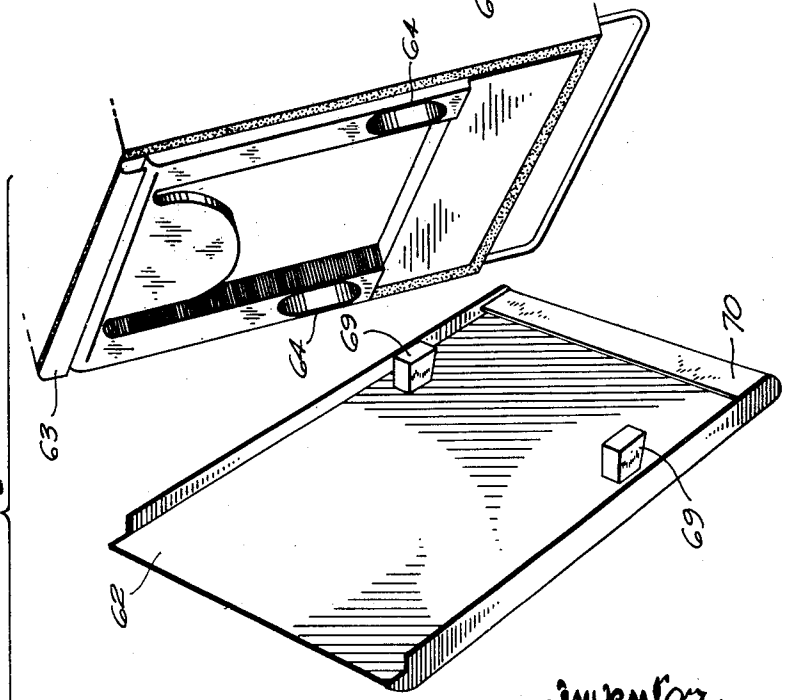


Fig. 5

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RECURRENT MOTION ABRADER

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9 Claims. (Cl. 51—170)

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This invention relates to abrading apparatus and more particularly to apparatus of this character having an oscillating shoe adapted to carry an abrasive sheet which is brought in contact with the material to be abraded and it resides more specifically in an improved form of apparatus of this character wherein the shoe is caused to execute a substantially planar gyration at its forward end which gyration, in passing toward the rear end of the shoe, progressively alters into a substantially coplanar approximately longitudinal oscillation.

Heretofore abrading machines of the type herein referred to commonly called oscillating sanding machines have employed shoes, the motion of which throughout the extent thereof has been a substantially circular gyration. Such a motion is adapted to cause rapid and effective abrasion and further has the advantage of throwing from beneath the shoe, by centrifugal action, the pulverized material resulting from the abrasion. Such a motion is objectionable, however, by reason of the pattern of circular scratches which is left upon the material subjected to treatment. This is particularly disadvantageous where wood surfaces are being prepared for finishing with varnish or other clear coatings since circular scratches remain apparent to the eye after the wood is finished. A similar disadvantage occurs where opaque finishes are being rubbed down with fine abrasive.

In an effort to overcome this difficulty a number of forms of abrading apparatuses have been constructed in which the shoe is caused to execute a longitudinal oscillation. In apparatuses of this sort a desirable finish may be produced but the abrading action is slow because of failure of the shoe to clear itself of the resulting pulverized material.

In the apparatus of the present invention the shortcomings and limitations of the apparatuses heretofore available have been overcome in large measure by means of a novel form of motion imparted to the shoe. In this novel form of motion a major part of the shoe is caused to execute a rounded gyration capable of rapid abrading and capable of throwing out pulverized material by centrifugal action while the remainder of the shoe is caused to execute a nearly longitudinal oscillation such as to make possible the removal of substantially all undesirable circular patterns created by the gyrating part of the shoe. The apparatus of this invention, furthermore, is more easily held to the work and may be advantageously employed in working close to ledges and

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corners without damage to either the machine or the work.

This invention is herein described by reference to the accompanying drawings forming a part hereof in which there is set forth by way of illustration and not of limitation forms in which the apparatus of this invention may be embodied.

In the drawings:

Fig. 1 is a side view in elevation and partly in section of one form of the apparatus of this invention;

Fig. 2 is a bottom plan view on a reduced scale of the apparatus shown in Fig. 1;

Fig. 3 is a side view in elevation and partly in section of another form of the apparatus of this invention employing a different means of attachment for the abrading sheet;

Fig. 4 is a top plan view in section of the apparatus shown in Fig. 3 viewed through the plane 4—4 there indicated; and

Fig. 5 is a fragmentary perspective view of the abrasive sheet holding parts of the shoe of the apparatus shown in Fig. 3 the same being shown separated preparatory to attaching a sheet of abrasive material.

The form of the apparatus of this invention shown in Fig. 1 is carried on a frame generally designated 1 on the top of which a motor 2 having a downwardly extending vertical shaft 3 is mounted. The motor 2 is provided with hand grips 4 and 5 to permit the apparatus to be manipulated by an operator. Secured to the underside of the frame 1 by means of screws 6 and 7 and clamping rim 8 is a flexible boot 9 composed of stiff, molded rubber composition having properties similar to that of tire tread stock. The boot 9 comprises an upper mounting flange 10, a front wall 11 and side walls 12 of relatively thin section, and a rear wall 13 of section substantially thicker than that of front wall 11. The front, rear and side walls of the boot 9 are joined integrally with a bottom or shoe portion 14 of the same material as the side walls. Throughout the periphery of the shoe 14 the walls of the boot 9 are offset as indicated at 15 forming a recess within which a closely fitting layer of highly resilient material 16 is received. The layer 16 is preferably formed of sponge rubber or other comparatively yieldable material.

Disposed above and substantially coextensive with the layer 16 is a rigid shoe plate 17 formed of light metal or other suitable rigid material locked in place within the offset 15.

Extending downwardly from the frame 1 within the boot 9 is a bearing support arm 18 carry-

ing a bearing 19 disposed in alignment with an upper bearing 20 held in a mounting boss 21 as shown. Mounted to freely turn upon the bearings 19 and 20 is a shaft 22 having an eccentric extension 23 at its lower end. The extension 23 engages in turn a gyratable bearing 24, preferably of the spherical, self-aligning type, secured in place within a mounting boss 25 rigidly attached to the shoe plate 17. Secured to the shaft 22 between the bearings 19 and 20 is a sheave 26 having a counterbalance weight 27 attached to the rim thereof as shown. Sheave 26 is disposed in alignment with a sheave 28 secured to the lower end of the motor shaft 3 and a belt 29 forming a driving connection between sheave 28 and sheave 26 and is mounted in the position shown.

When motor 2 is supplied with current so as to cause shaft 3 to rotate, shaft 22 is driven causing the eccentric extension 23 to move in a circular path thus carrying the plate 17 around with it in a circular gyrating movement at a point directly beneath the center of shaft 22. In so doing the shoe 14 is compelled to follow thus distorting the walls of the boot 9. By reason of the location of the eccentric 23 and the relative thicknesses of the walls 11, 12 and 13 the motion executed by the shoe 14 is an approximately circular gyration in the vicinity of the eccentric 23, this motion becoming modified toward a linear oscillation at the rear end of the shoe 14 as the wall 9 is approached.

To illustrate the approximate nature of the motion of the shoe 14 a series of broken elipses designated 30 to 38, inclusive, is set forth in Fig. 2. Such elipses represent in exaggerted form the approximate paths pursued by points in the shoe 14 in the vicinity of the respective elipses.

In the form of apparatus shown in Figs. 1 and 2 the abrasive sheet 39 is preferably held in place by pressure sensitive adhesive. In this way the abrasive sheet can extend to the very margins of the shoe 14 so as to permit working close to corners and ledges. Such close working is further facilitated by the presence of the resilient material of the boot 9 in the offset portions 15 adjacent the margins of the abrasive sheet, such resilient material acting to protect the work and the machine from impact damage.

In use, in performing an abrading operation, an operator may cause the apparatus to move over the surface in such a way that the rear or longitudinally moving part of the shoe 14 is the last to engage each portion of the surface being treated. By thus manipulating the apparatus in a manner, for example, similar to the use of a hand plane, circular scratches produced by the forward part of the shoe 14, are removed by the trailing part of the shoe as it passes over them. In case a particularly fine finish is desired, the operator may bear down upon the handle 5 more heavily than upon the handle 4 thus causing the trailing edge of the shoe 14 only, to engage the work. This latter action is facilitated by the location of the motor 2 which tends to load the trailing edge of the shoe 14 more heavily than the forward edge.

It has been found that the motion of the shoe 14 above described is such as to create sufficient centrifugal effect to rapidly clear powder resulting from the abrading action and, as a consequence, comparatively rapid and effective abrading as well as fine finishing can be accomplished.

If it is desired that the rate of abrading be greater than is feasible with the apparatus shown in Figs. 1 and 2, an apparatus may be constructed in accordance with this invention in the form illustrated in Figs. 3, 4 and 5. The apparatus there shown is made up as before of a frame 40 carrying a motor 41 having a downwardly extending shaft 42. Secured to the motor 41 is a handle 43 and secured to the frame 40 is a handle 44. It is preferred that the handle 43 be made hollow so as to receive a cartridge of dust filtering material 45 composed of oil treated steel wool or the like. Secured to the shaft 42 of the motor 41 is a cooling fan 46 adapted to draw a stream of cooling air through the cartridge 45 and to discharge the same through the outlet opening 47. Extending downwardly from and secured to the frame 40 is a flexible boot 48 formed of resilient rubber and covered with a fabric sheeting 49. The side walls of the boot 48 may be of substantially uniform thickness throughout as shown.

Secured to the bottom of boot 48 and enclosed within the same is a rigid shoe plate 50 carrying a gyratable bearing 51 in a recess therein. Bearing 51 may be of the self-aligning type if desired. Disposed above the bearing 51 is a bearing 52 carried in a lower bearing supporting arm 53. Secured to the lower face of the frame 40 is an upper bearing 54. Mounted to turn in the bearings 52 and 54 is a shaft 55 having an eccentric extension 56 at its lower end which engages the bearing 51. Carried on the shaft 55 between the bearings 54 and 52 is a flat pulley 57 engaged by a belt 58 which passes around a flat pulley 59 on the lower end of shaft 42. When the motor 41 is operated the eccentric extension 56 causes the bearing 51 and plate 50 associated with it to execute a gyrating motion. This motion is similar to that described in connection with the apparatus illustrated in Figs. 1 and 2, although the trailing end of the boot 48 will not follow so nearly linear an oscillation as is the case with boot 9, since the boot 48 is not provided with a reinforced wall at its trailing end. For rougher finishing purposes such a motion may be more desirable.

Detachably secured to the bottom of the shoe plate 50 is a shoe proper made up of a sheet metal backing 62 faced with a resilient shoe pad 60. As shown more clearly in Figs. 4 and 5 the shoe plate 50 is provided with an inwardly facing sheet metal toe slot 63 extending transversely thereof at its forward end and with downwardly facing marginal wells 64 near its sides. Within the wells 64 are disposed longitudinally acting plungers 65 having oblique end faces. Plungers 65 are normally urged forwardly by springs 66, which surround rearwardly extending plunger rods 67 secured to the back ends of the plungers 65. The rods 67 join to form a loop or bale 68 which extends beyond the rear end of the boot 48.

Secured to the upper face of the sheet metal backing 62 is a pair of obliquely faced dogs 69 adapted to extend into the wells 64 so as to be engaged by the oblique end faces of the plungers 65. In this way the shoe proper is urged upwardly into engagement with the bottom of shoe plate 50 by reason of the oblique engagement of plungers 65 and dogs 69 and is urged forwardly with respect to the shoe plate 50 under the action of the springs 66. In use, the relative forward movement of shoe proper is restrained by reason of an interlocking engagement between the for-

ward edge of an abrasive sheet 61 with the toe slot 63 as shown in Fig. 3. This interlocking engagement is quite positive in its character by reason of the high frictional coefficient between the abrasive face of the sheet 61 and the material of the toe slot 63 with which it is in contact. A similar interlocking engagement between the plate 62 and the opposite end of the paper 61 is provided for in the form of the inwardly extending slot formed by the inwardly bent portion 70 at the rear of the backing member 62.

In this way ready and rapid attachment of abrading sheets may be accomplished by first inserting the end of the sheet into the slot 70, then folding the sheet outwardly around the lower face of the resilient shoe pad 60 and around the forward end thereof. The forward end of the sheet 61 is then inserted within the toe slot 63 and while pulling back on the bale 68 the shoe plate 62 is brought to the position shown in Fig. 3. Upon release of the bale 68 the plungers 65 hold plate 62 in place and exert a force which results in tension being set up in the paper 61. In this way the paper 61 is at all times held flat and under tension but it may be readily and simply replaced by pulling back on the bale 68 and releasing the plungers 65.

Not only are the boot 9 of the apparatus shown in Fig. 1 and the boot 48 of the apparatus shown in Fig. 3 readily deflected and distorted to permit the oscillating movement which causes the abrading action, where the gyratable bearing is of the self-aligning type, but they may also be tilted with respect to the frame to a limited extent to compensate for unequal application of pressure. In this way a more uniform and effective engagement between the abrading sheet and the work is ensured and the apparatus may be more easily held to the work.

I claim:

1. In a recurrent motion surface abrading machine, an abrading shoe adapted to bear an abrading coating, a frame, a flexible mounting secured at its top to said frame and at its bottom to said shoe, said flexible mounting comprising sides, front and back walls of resilient composition, a gyratable follower secured to said shoe nearer to the front wall of said flexible mounting than to the back wall thereof, and driving means mounted on said frame adapted to engage said follower to cause gyration of the same.

2. In a recurrent motion surface abrading machine, an abrading shoe adapted to bear an abrading coating, a frame, a flexible mounting secured at its top to said frame and at its bottom to said shoe, said flexible mounting comprising sides, front and back walls of resilient composition, said sides and front walls being of thinner more easily deflected section and said back wall being of heavier more difficultly deflectable section, a gyratable follower secured to said shoe near the front wall of said flexible mounting, and driving means mounted on said frame including a rotatable member adapted to engage said follower to cause circular gyration of the same.

3. In a recurrent motion surface abrading machine an abrading shoe adapted to bear an abrading coating, a flexible mounting secured to said shoe to carry the same and adapted to permit substantially planar gyratory movement of the forward end of said shoe and a substantially coplanar approximately longitudinal oscillatory movement of the rear end of each shoe, a frame secured to said flexible mounting means for carrying the same, and driving means mounted on said frame

adapted to engage said shoe at a point nearer its forward end than its rear end and to cause substantially planar gyration of a point in said shoe in the vicinity of the point of said engagement whereby said shoe may be caused to execute a recurrent motion comprising gyration at its forward end altering progressively toward a substantially coplanar approximately longitudinal oscillation as its rear end is approached.

4. In a recurrent motion surface abrading machine a box-like rubber boot comprising an abrading shoe adapted to bear an abrading coating and having flexible front, back and side walls secured to said shoe to carry the same; means associated with the back wall of said boot adapted to reinforce the same against sideward displacement, a frame secured to the top of said boot, and driving means mounted on said frame engaging said shoe at a point nearer its front end than its rear end and adapted to cause substantilly planar circular gyration of a point in said shoe near its front end whereby said shoe may be caused to execute a recurrent substantially planar gyration at the front end altering progressively toward a substantially coplanar approximately longitudinal oscillation as the back end of said shoe is approached.

5. In a recurrent motion surface abrading machine an abrading shoe having a front and a rear end said shoe being adapted to bear an abrading coating, a flexible mounting secured to said shoe to carry the same and adapted to permit tilting of the same and substantially planar lateral and longitudinal gyratory movement of the front end of said shoe and a substantially coplanar approximately longitudinal oscillatory movement of the rear end of said shoe, a frame secured to said flexible mounting means for carrying the same, and driving means mounted on said frame including an eccentric shaft engaging a self-aligning bearing secured to said shoe at a point nearer its front end than its rear end whereby said shoe may be caused to execute a recurrent substantially planar gyration at its front end altering progressively toward a substantially coplanar approximately longitudinal oscillation as the rear end of said shoe is approached.

6. In a recurrent motion surface abrading machine, a frame, a shoe plate mounted on said frame for oscillatory movement, a toe slot near one end of said shoe plate adapted to receive the end of an abrading sheet, a replaceable shoe proper adapted to be carried beneath said shoe plate and to extend beyond said toe slot and to carry an abrading sheet on the lower face thereof, said shoe proper having an inwardly facing sheet receiving slot above the end thereof opposite said toe slot and upwardly extending oblique dogs secured to its upper face, and spring urged oblique plunger means on said shoe adapted to engage said oblique dogs on said shoe proper and to urge the same upwardly and in the direction of said toe slot whereby said shoe proper is maintained in engagement with said shoe plate and an abrading sheet engaging the slot on said shoe proper and said toe slot on said shoe plate will be held in place under tension.

7. In a recurrent motion surface abrading machine, a frame, a shoe plate mounted on said frame for oscillatory movement, a toe slot near one end of said shoe plate adapted to receive the end of an abrading sheet, a replaceable shoe proper adapted to be carried beneath said shoe plate and to extend beyond said toe slot and to

carry an abrading sheet on the lower face thereof, said shoe proper having an inwardly facing sheet receiving slot above the end thereof opposite said toe slot, and means on said shoe plate adapted to engage said shoe proper and to urge the same in the direction of said toe slot while maintaining the same in engagement with said shoe plate whereby an abrading sheet engaging the slot on said shoe proper and said toe slot on said shoe plate will be held in place under tension.

8. In a recurrent motion surface abrading machine, a frame, a flexible boot carried by said frame, a shoe plate mounted on said boot for oscillatory movement, a toe slot near one end of said shoe plate adapted to receive the end of an abrading sheet, a replaceable shoe proper adapted to be carried beneath said shoe plate and to extend beyond said toe slot and to carry an abrading sheet on the lower face thereof, said shoe proper having an inwardly facing sheet receiving slot above the end thereof opposite said toe slot, and means on said shoe plate adapted to engage said shoe proper and to urge the same in the direction of said toe slot while maintaining the same in engagement with said shoe plate whereby an abrading sheet engaging the slot on said shoe proper and said toe slot on said shoe plate may be held in place under tension.

9. In a recurrent motion surface abrading machine, an abrading shoe having a front and a rear portion adapted to bear an abrading coating, a frame, a flexible mounting secured at its top to said frame and at its bottom to said shoe, said flexible mounting being adapted to permit plane circular gyration of a forward part of said shoe and including means disposed within the area defined by said shoe adapted to restrain the rear portion thereof to an approximately longitudinal oscillation, a gyratable follower secured to said shoe nearer the forward end thereof than the rear end thereof, and driving means mounted on said frame adapted to engage said follower to cause circular gyration of the same.

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