May 3, 1955 R. T. OSMAN 2,707,357

OSCILLATING SHOE ABRADING APPARATUS

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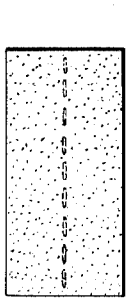


Fig. 12

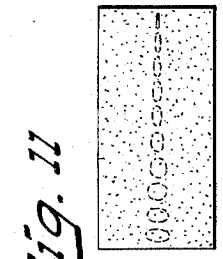


Fig. 11

Fig. 1

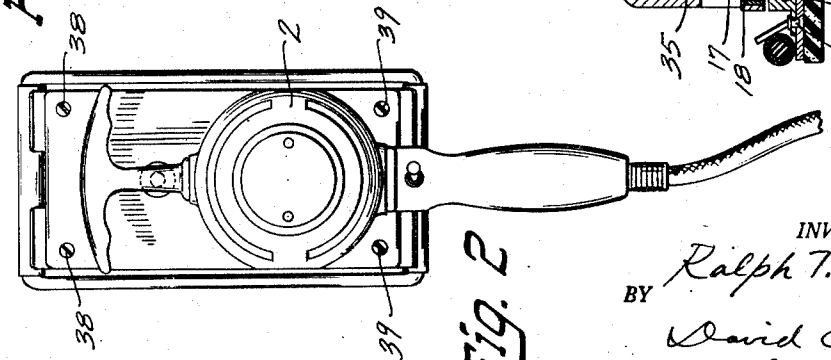


Fig. 2

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Fig. 3

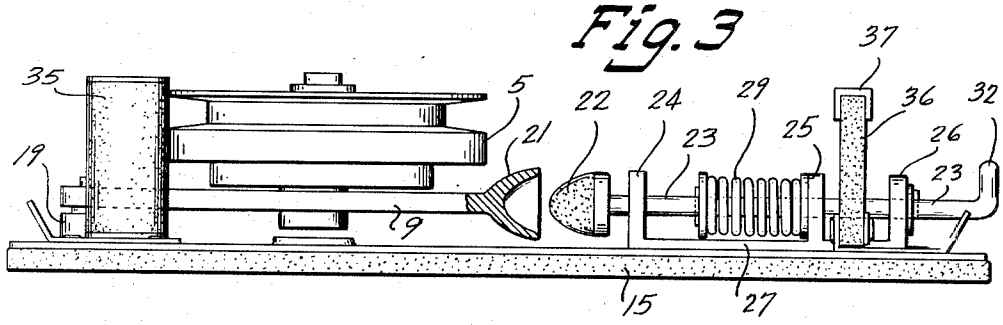


Fig. 4

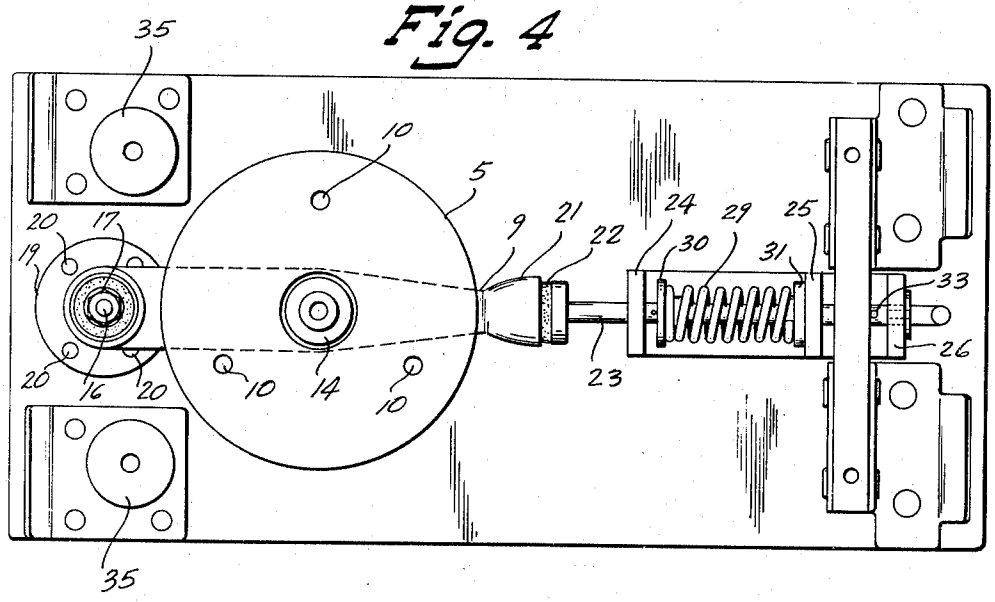


Fig. 5

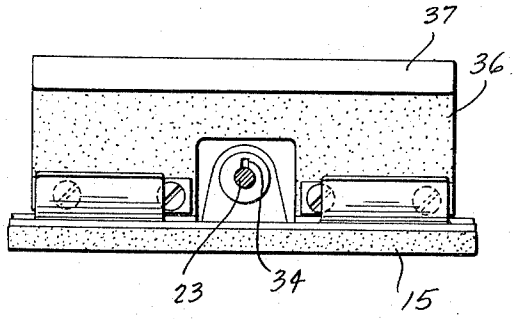
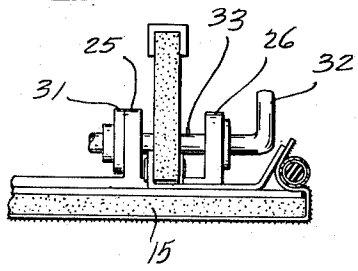


Fig. 6



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Fig. 7

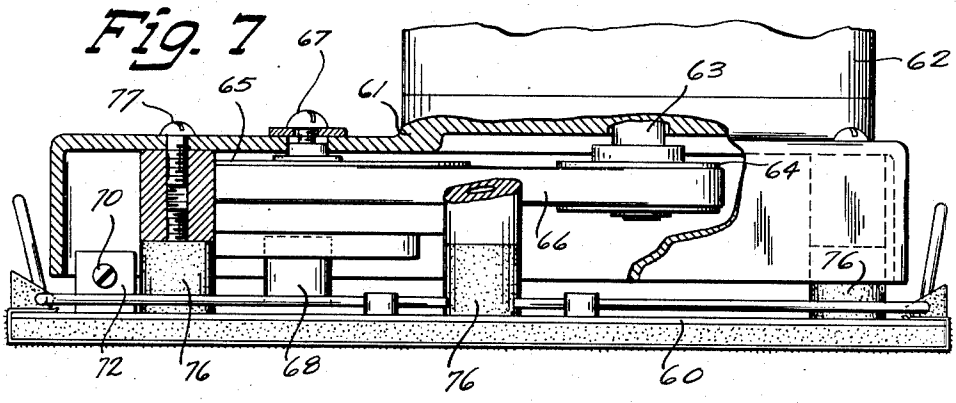


Fig. 8

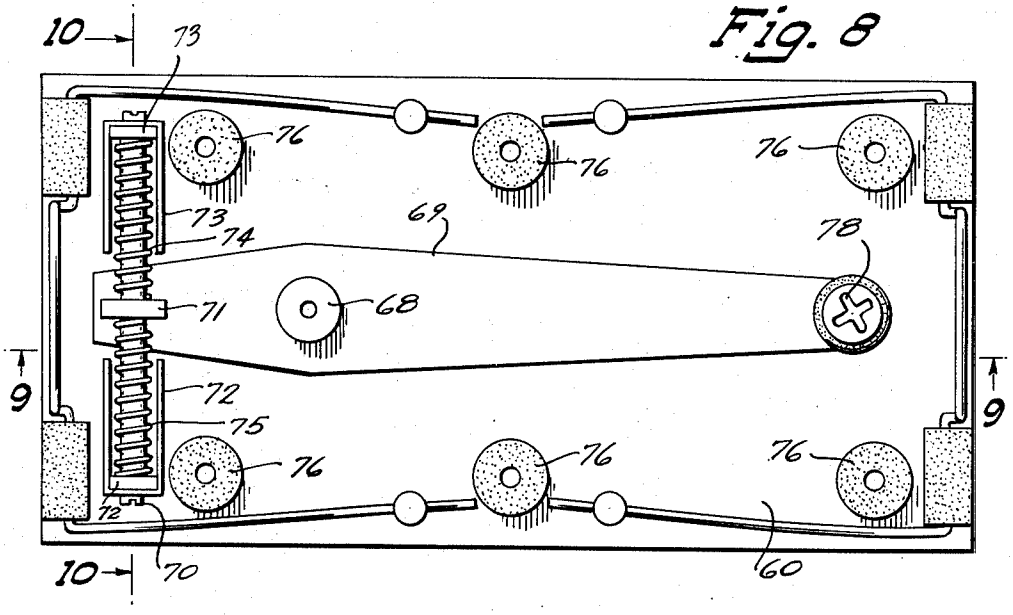


Fig. 9

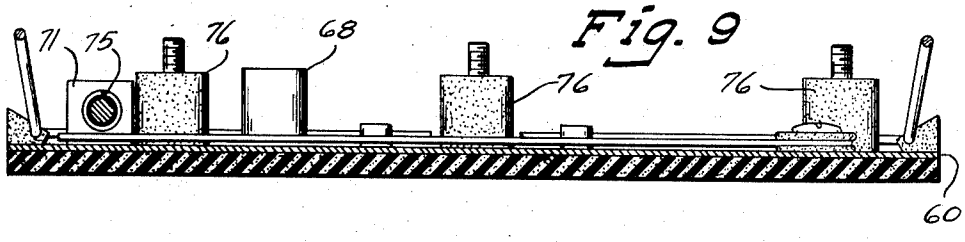
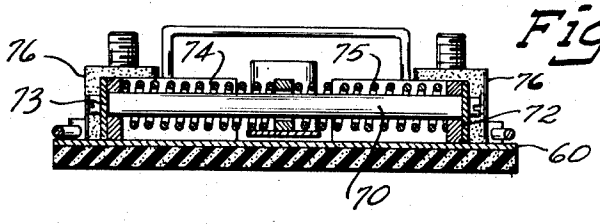


Fig. 10



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OSCILLATING SHOE ABRADING APPARATUS

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Application March 6, 1950, Serial No. 147,905

9 Claims. (Cl. 51—170)

This invention relates to abrading apparatus of the oscillating shoe type wherein a flat abrasive sheet is caused to execute a recurrent motion and the invention resides more particularly in an improved form of said apparatus in which the abrading shoe is mounted for limited freedom of longitudinal and horizontal movement with respect to a frame carrying an eccentric member which is rapidly driven and in which a resilient or flexible non-positive connection is provided between the eccentric member and the shoe for the purpose of imparting to the shoe oscillatory or gyratory movement which may vary from the strict oscillatory gyration dictated by an eccentric member, the invention including at times means adapted to cause modification of the oscillatory motion executed by the shoe.

This invention is related to and in certain aspects constitutes an improvement over the recurrent motion abrader set forth in my Patent 2,441,506 issued May 11, 1948.

Heretofore various forms of apparatus have been proposed in which an oscillating or gyrating abrading shoe has been mounted on a frame and driven by a rapidly rotating eccentric member carried by the frame upon which the shoe is mounted. In these apparatuses the connection between the eccentric and the shoe has included non-yieldable means constituting a positive connection thus compelling the shoe to oscillate with an amplitude in at least one direction which corresponds exactly with the throw of the eccentric. Because of the high inertia forces involved in rapidly oscillating the shoe the loading imposed upon the bearings carrying the eccentric member has been severe. As a result the bearings required to meet the peak stresses have been expensive.

It is one object of this invention to provide apparatus of the character described wherein the peak stresses imposed by inertia effects are substantially reduced thus relieving the bearings of excessive loading.

Also in apparatuses as heretofore constructed, in which a positive connection is provided between the eccentric member and the shoe, no means for altering or modifying the character or amplitude of the oscillation of the shoe has been made available to the operator of the apparatus. It is an object of this invention to provide an abrading apparatus of the character described in which the operator may, if he desires, cause the machine to execute a fast cutting elliptical gyration over a substantial portion of the shoe or, alternatively, he may cause the shoe to execute a more nearly lineal or longitudinally extending oscillation for the purpose of avoiding introduction of circular marks in the work or for the purpose of removing previously cut circular marks in the work.

The apparatus of this invention is also well adapted to be embodied in a form in which a combined elliptical gyration at one end of the shoe and nearly longitudinal oscillation at the other end of the shoe is caused to take place as set forth in my Patent 2,441,506 aforesaid wherein the operator may avail himself of a rapid cutting motion or a fine finishing motion by altering the pressure applied to the ends of the shoe.

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

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 top plan view on a reduced scale of the apparatus shown in Fig. 1;

Fig. 3 is a detail side view in elevation and partly in section of the rubbing shoe, members attached thereto and the actuating eccentric member of the apparatus shown in Fig. 1;

Fig. 4 is a plan view of the apparatus shown in Fig. 3;

Fig. 5 is a rear end view in elevation of the apparatus shown in Figs. 3 and 4.

Fig. 6 is a view in side elevation of the rear portion of the apparatus shown in Figs. 3, 4 and 5.

Fig. 7 is a side view in elevation and partly in section of another form of apparatus of this invention;

Fig. 8 is a plan view of the rubbing shoe shown in Fig. 7;

Fig. 9 is a side view in elevation and partly in section of the apparatus shown in Fig. 8, viewed through the plane 9—9 there indicated;

Fig. 10 is an end view in section and partly in elevation of the apparatus shown in Fig. 8, viewed through the plane 10—10 there indicated;

Fig. 11 is a bottom plan view of the shoe plate of the apparatus shown in Fig. 1, illustrating diagrammatically one form of the movement thereof, and

Fig. 12 is a bottom plan view of the shoe plate of the apparatus shown in Fig. 1 illustrating diagrammatically another form of the movement thereof.

The form of the apparatus of this invention shown in Fig. 1 is provided with a frame generally designated **1** on the top of which a motor **2** having a downwardly extending vertical shaft **3** is mounted. Secured to shaft **3** is a sheave **4** disposed in alignment with and drivingly connected to a sheave **5** by belt **7**. Sheave **5** is rotatably mounted beneath frame **1** by means of a bearing **11** carried on stub shaft **12** which is held in place by screw **6**.

As will be noted in Figs. 1 and 4, sheave **5** is divided into upper and lower halves held together by screws **10**.

Disposed within the lower half of sheave **5** is a bearing **13** which is mounted for rotation on a post **14** which post **14** is secured in turn to a yieldably mounted shoe driving member **9** by a screw **8**. The bearing **13** is disposed eccentrically with respect to the center of bearing **11** and connects the sheave **5** to the post **14** on member **9** so that post **14** is caused to gyrate in a circular path upon rotation of sheave **5**.

As shown in Figs. 1 and 4, shoe driving member **9** is yieldably attached to a bottom or shoe plate **15** by means of a yieldable rubber mounting **18**, held in place by a screw **16** and nut **17** passing through a pedestal **19** secured to plate **15**. The mounting **18** is preferably formed with concentric, inner and outer bushings secured to the rubber by vulcanized bonds as shown so as to completely isolate the member **9** from any metallic connection with the shoe **15**. In this way the connection between the eccentric bearing **13** and the shoe **15**, at the left hand end of member **9**, is rendered yieldable or flexible rather than positive.

At its right hand end member **9** is provided with a cup shaped receptacle **21** adapted for the insertion of a plug **22** formed of rubber or other resilient material, said plug being attached to a longitudinally adjustable rod **23**. Rod **23** is positioned for slidable movement through upright flanges **24**, **25** and **26** of a bracket support member **27** which is attached to shoe **15** by rivets **28**. A coil spring **29**, in compression, surrounds rod **23** to bear against collars **30** and **31**. Collar **30** is held against motion to-

ward the left with respect to rod 23 by a key shown, while collar 31 admits rod 23 for free sliding movement therethrough. The plug 22 may be disengaged from contact with the cup shaped right hand end of member 9 and entirely withdrawn therefrom by movement of rod 23 through manipulation of its handle 32 extending therefrom. When rod 23 is pulled back far enough to cause a short transverse pin 33 projecting from rod 23 to be drawn backward through a key way 34, in supporting flange 26, as shown in Fig. 5, the rod 23 may be turned by handle 32 through an arc of 90 degrees to move the handle 32 into a horizontal plane, whereupon pin 33 is held against the rear surface of flange 26 thus preventing plug 22 from engaging or interfering with member 9.

With plug 22 held in engagement with cup 21 a flexible or yieldable non-positive connection is established between the right hand end of member 9 and the shoe 15 as well as the yieldable connection provided at the left hand end of member 9 by the rubber mounting 18. When the plug 22 is withdrawn from the cup 21 a single yieldable connection only is provided between the member 9 and the shoe 15.

As shown in Figs. 1, 3 and 4, there is secured to shoe plate 15, adjacent its forward corners, cylindrical, yieldable rubber mounts 35 of columnar form, the upper ends of which are in turn fastened to frame 1 by screws 38. Because of their composition and cylindrical shape the mounts 35 may be deflected horizontally in any direction, symmetrically, with equal ease. At the same time the mounts 35 act to position the front end of the shoe 15 vertically with respect to the frame 1 and to transmit working thrust from the frame 1 to the shoe 15. Secured to shoe plate 15 adjacent its rear end is an upright flat transverse mounting member 36 of yieldable rubber composition which acts as a vertical positioning and thrust transmitting mounting and which guides the rear end of the shoe 15 for relatively free displacement in the longitudinal direction. However, because of the transverse stiffness of member 36 the rear end of the shoe 15 can be displaced but little in the transverse direction. Secured to the top of member 36 is a channel shaped metal member 37, which is secured in turn to the right hand end of frame 1 by screws 39.

When motor 2 is supplied with electric current causing shaft 3 and sheave 4 to rotate, eccentrically disposed bearing 13, driven through belt 7, is caused to move in a circular path thus carrying member 14 around with it and causing a gyrating movement of the member 9. Since member 9 is yieldably rather than positively connected to the shoe 15, the motion imparted to the shoe 15 is not of the same configuration and amplitude as that of the eccentric even when plug 22 is in engagement with the cup 21. Under the latter condition the movement imparted to the shoe 15 is such that the same follows a generally elliptical configuration at the left end of the shoe 15 adjacent to the symmetrically deflectible mounts 35, which gyration is of smaller average amplitude than the throw of the eccentric 13.

At the rear or right end of shoe 15 a different action takes place. Because of the specific location of eccentric bearing 13 with reference to the forward and rear ends of shoe plate 15, and because of the greater resistance to transverse deflection offered by the transverse mount 36, the motion progressively modifies from an elliptical gyration at the front of shoe 15 toward a nearly straight line oscillation as the rear end of the shoe is approached. The general nature of the motion executed by various points in shoe plate 15 under such conditions may be represented by the paths shown in somewhat exaggerated proportions in broken lines in Fig. 11. With this motion, the operator may as previously pointed out, apply pressure to the left end of shoe 15 to cause a rapid cutting action or to the longitudinally moving right end of the shoe 15 to produce a fine finishing action. In either case the yieldable connection between the member 9 and the shoe 15 relieves the bearings of peak stresses and limits the loading which the operator may apply by exerting working pressure, since such yielding action between the member 9 and the shoe 15 will in substantial measure reduce the amplitude of motion of the shoe 15 when overloaded.

The clutch forming members 21 and 22 are within the immediate control of the operator, by manipulation of handle 32, and may be readily separated to provide an even greater degree of transverse yielding in the connection between the eccentric and the shoe 15. With the clutch members disengaged the movement of shoe plate 15 is immediately translated into substantially longitudinal oscillation as illustrated generally in Fig. 12.

To obtain a uniformly fine non-circling abrading action, particularly for a final finishing operation, the operator may thus disengage clutch members 21 and 22 as shown in Fig. 3 and thereby obtain a slower cutting but finer finishing action without any tendency whatever to leave circular marks in the work.

Another form of the present invention, not including a choice of shoe motion, is shown in Figs. 7, 8, 9 and 10 wherein a shoe plate 60 is provided with deflectible rubber mountings 76. As shown in Fig. 7, the apparatus is provided with a frame 61 which carries the shoe 60 through the mounts 76 attached by screws 77. The frame 65 also supports a motor 62 having a downwardly extending shaft 63. Secured to shaft 63 is a sheave 64 disposed in alignment with a sheave 65 with belt 66 forming a driving connection between sheaves 64 and 65, sheave 65 being rotatably secured to frame 61 by screw 67. In a manner identical with the construction of sheave 5 shown in Fig. 1, sheave 65 is provided with upper and lower bearings, the center of the latter being disposed eccentrically relative to the center of said upper bearing which is mounted for rotation on a depending post secured to frame 61 by screw 67. Said lower bearing is mounted for rotation on upstanding post 68 secured to shoe driving member 69. As shown in Figs. 8 and 10, shoe driving member 69 is flexibly attached to shoe plate 60 at its forward end, being secured to a yoke 71 which is slidably supported on the cross bar 70 carried at its ends by flanges or brackets 72 and 73 which are secured to shoe plate 60. Member 69 is mounted at its opposite end for pivotal action in a yieldable rubber mount secured to shoe plate 60 by screw 78. Springs 74 and 75 surrounding bar 70 which are held in compression on both sides of yoke 71, provide a yieldable connection of predetermined stiffness between the left end of member 69 and the shoe 60. The circular gyratory motion of the eccentric within sheave 65 rotating on post 68 is thus modified and the motion induced in the shoe 60 is similar to that illustrated generally by Fig. 11 since the action of the shoe illustrated in Fig. 8 is substantially similar to that shown in Fig. 4. Translation of the circular gyration of the eccentric into modified elliptical motion in the shoe 60 is, however, somewhat different because the resiliency of cylindrically shaped posts 76 of molded rubber composition carrying the shoe 65 is uniform in all directions. In this modification of the apparatus of this invention the advantages of a yieldable connection between the eccentric and the shoe are exhibited although not to the full extent realized in the apparatus shown in Fig. 1.

I claim:

1. In an oscillating shoe abrading machine the combination of an abrading shoe adapted to bear an abrading coating, a frame, flexible mounting means secured between said shoe and said frame, said mounting means including means deflectible with equal ease laterally and longitudinally at one end of said shoe and a transverse mounting deflectible more easily longitudinally of said shoe at the opposite end thereof, a motor driven rotatable member mounted on said frame, an intermediate driving member yieldably secured to said shoe at a point of

pivotal attachment therewith for swinging motion parallel thereto and having a free end movable freely transversely of said shoe, an eccentric driven by said rotatable member, means providing an eccentric driving connection between said eccentric and said intermediate member for driving said shoe with a substantially longitudinal oscillatory movement when the free end of said intermediate member is unrestrained, and an adjustable stop movable from open to closed position including means for maintaining said stop in open and closed positions mounted on said shoe and positioned to engage and resiliently restrain the free end of said intermediate member when in closed position to cause movement of said shoe to be modified from substantially longitudinal oscillation to an elliptical gyration at one end which progressively alters toward substantially straight line oscillation at the opposite end of said shoe.

2. In a rubbing machine, a rubbing shoe, said shoe including a rigid reinforcing plate, a frame, a flexible mounting means securing said shoe to said frame, a power driven rotatable member mounted on said frame, an eccentric driven by said rotatable member, an intermediate driving member having a portion in driven engagement with said eccentric and having a point of swingable attachment to said reinforcing plate which is spaced a substantial distance from said eccentric engaging portion, and resilient restraining means for said intermediate driving member secured to said reinforcing plate and engaging said intermediate driving member at a point remote from the point of swingable attachment thereof to said plate, said resilient restraining means being movably mounted for engagement with and disengagement from said intermediate driving member, and manually operable shifting and securing means cooperatively connected to said restraining means for moving the same into and out of engagement with said intermediate driving member and for holding the same in either of said positions.

3. In a rubbing machine, a rubbing shoe, said shoe including a rigid reinforcing plate, a frame, a flexible mounting means securing said shoe to said frame, a power driven rotatable member mounted on said frame, an eccentric driven by said rotatable member, an elongate intermediate driving member having a portion intermediate its ends connected in driven relation with said eccentric and having a point of swingable attachment to said reinforcing plate which is spaced a substantial distance from said eccentric engaging portion and adjacent one end thereof, and resilient restraining means for said intermediate driving member, said restraining means being secured to said reinforcing plate and engaging said intermediate driving member at a point adjacent the opposite end thereof, said resilient restraining means having a portion thereof movably mounted for separable connection with said intermediate driving member, and manually operable shifting means cooperating with the movable portion of said restraining means to connect or disconnect the same with said intermediate driving member.

4. In a rubbing machine, a rubbing shoe, said shoe including a rigid reinforcing plate, a frame, a flexible mounting means securing said shoe to said frame, a power driven rotatable member mounted on said frame, an eccentric driven by said power driven member, an elongate intermediate shoe driving member having a portion intermediate its ends connected in driven relation with said eccentric and having a point of swingable attachment to said reinforcing plate which is spaced a substantial distance from said eccentric connecting portion and adjacent one end thereof, and resilient restraining means for said intermediate driving member secured to said reinforcing plate and engaging said intermediate driving member at a point remote from the point of swingable attachment thereof to said plate, said resilient restraining means comprising a bar member movably mounted on said reinforcing plate and adapted to engage one end thereof with said driving member, a handle at the other end of said bar member for manually withdrawing said bar member and disengaging the same and resilient means for normally urging said bar member into engagement with said driving member.

5. In a rubbing machine which is characterized by an oscillating shoe and a rigid frame for supporting said shoe, a flexible mounting means secured between the shoe and the frame at one end of the shoe, which mounting means is deflectible equally in the transverse and longitudinal directions relative to the shoe, and a transversely extending mounting means at the opposite end of the shoe which is deflectible to a substantially greater degree in the longitudinal direction than in the transverse direction of the shoe, a power driven rotatable member mounted on said frame, an intermediate shoe driving member, a yieldable pivot attaching one end of said driving member to said shoe for swinging motion parallel thereto, said driving member having its other end free for movement transversely of said shoe, an eccentric driven by said rotatable member, a driving connection between said eccentric and said driving member for driving said shoe with a substantially longitudinal oscillatory movement while said end is free for transverse movement, and an adjustable stop member mounted on said shoe which is movable from an open to a closed position, said stop member in the closed position resiliently engaging the free end of said intermediate driving member and causing the movement of said shoe to be modified whereby the movement of the shoe is elliptical at one end and substantially straight line oscillaton at the opposite end.

6. In a rubbing machine which is characterized by an oscillating shoe and a rigid frame for supporting said shoe, a flexible mounting means secured between the shoe and the frame at one end of the shoe which mounting means is deflectible equally in the transverse and longitudinal direction relative to the shoe, a transversely extending mounting means at the opposite end of the shoe which is deflectible more easily in the longitudinal direction than in the transverse direction of the shoe, a power driven rotatable member mounted on said frame, an intermediate shoe driving member yieldably and pivotally attached to said shoe for swinging motion parallel thereto and having a free end which is movable transversely of said shoe, an eccentric driven by said rotatable member, a driving connection between said eccentric and said intermediate member for driving said shoe with a substantially longitudinal oscillatory movement when the free end of said intermediate driving member is unrestrained, and an adjustable stop mounted on said shoe which is movable from an open to a closed position, said stop being positioned when closed to engage and resiliently restrain the free end of said intermediate driving member thereby causing the movement of said shoe to be modified from substantially longitudinal oscillation to an elliptical gyration at one end which progressively alters toward substantially straight line oscillation at the opposite end of said shoe.

7. In a rubbing machine, the combination of a rigid frame, a power shaft extending downwardly of said frame, a driven member rotatably mounted on said frame in laterally spaced relation to said power shaft and connected in driving relation therewith, said driven member having a portion eccentric to its axis of rotation, a rubbing shoe, flexible means connecting said rubbing shoe to said frame, an elongate intermediate shoe driving member having end portions spaced above said rubbing shoe, a bearing intermediate the ends of said shoe driving member and connecting said eccentric portion of said power driven member in driving relation therewith, and independent flexible connecting means between the opposite end portions of said shoe driving member and said shoe, the flexible connecting means at one end of said shoe driving member comprising manually separable members whereby to permit one end of said shoe driving member to be disconnected relative to said shoe.

8. In a rubbing machine, the combination of a rigid frame, a power shaft extending downwardly of said frame, a driven member rotatably mounted on said frame in spaced relation to said power shaft and connected in driving relation therewith said driven member having a portion eccentric to its axis of rotation, a rubbing pad, means flexibly connecting said rubbing pad to said support and permitting limited relative movement in all directions between said pad and said frame, an elongate intermediate driving member between said frame and said rubbing pad, a bearing intermediate the ends of said intermediate driving member and connecting said eccentric portion of said power driven member thereto, and independent means for flexibly connecting the opposite end portions of said intermediate driving member to said rubbing pad, the flexible connecting means at one end of said intermediate driving member comprising manually disconnectible members, and one of said members being movably mounted relative to said rubbing pad, whereby one end of said intermediate driving member may be disconnected relative to said rubbing pad.

9. In a rubbing machine, the combination of a rigid frame a power shaft extending downwardly in said frame, a driven member rotatably mounted on said frame and connected in driving relation with said power shaft, said driven member having a portion eccentric to its axis of rotation, a rubbing shoe, flexible means connecting said rubbing shoe to said support, an elongate intermediate shoe driving member having end portions spaced above said rubbing shoe, a driving connection between intermediate portions of said shoe driving member and said eccentric portion of said power driven member and independent means for flexibly connecting the opposite end portions of said shoe driving member to said shoe, the flexible connecting means at one end of said shoe driving member comprising separable members, and means for movably supporting one of said separable members comprising an elongate bar on which said member is mounted, bracket means on said shoe for supporting said bar for movement relative to said shoe and to said shoe driving member, and shifting and securing means associated with said bar whereby to permit one end of said intermediate shoe driving member to be connected or disconnected relative to said shoe.

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