Dec. 28, 1954 R. T. OSMAN 2,697,898

RECURRENT MOTION ABRADING APPARATUS

Original Filed March 6, 1950 2 Sheets-Sheet 1

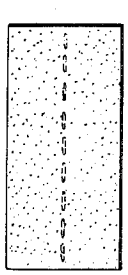


Fig. 8

Fig. 1

Fig. 7

Fig. 2

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Fig. 3

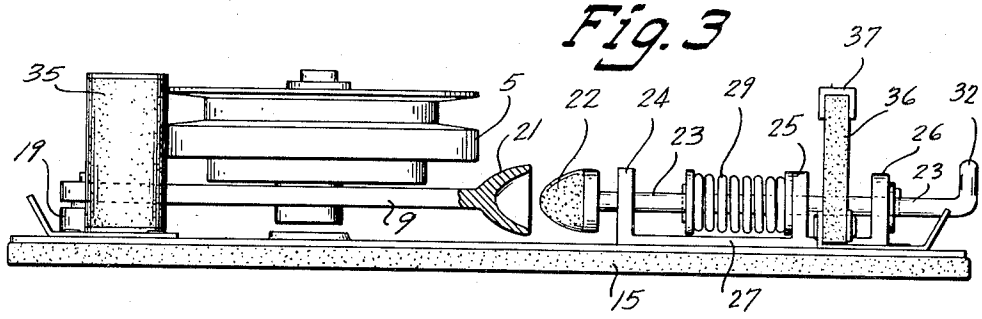


Fig. 4

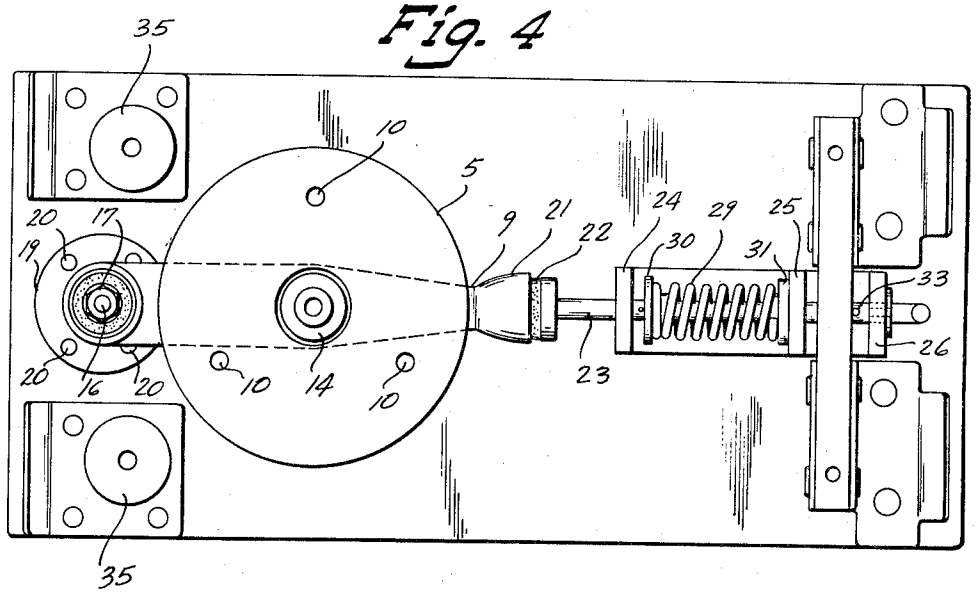


Fig. 5

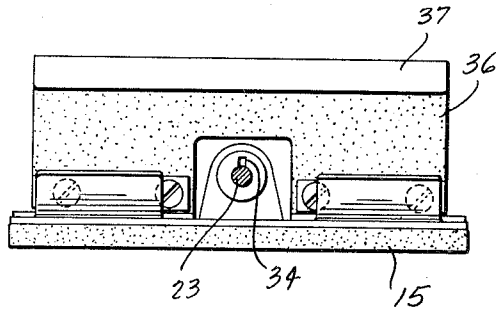
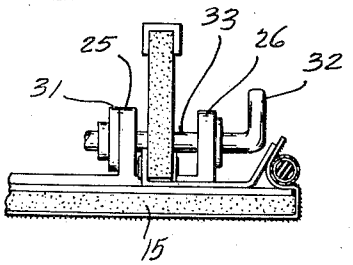


Fig. 6



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RECURRENT MOTION ABRADING APPARATUS

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Original application March 6, 1950, Serial No. 147,905. Divided and this application February 18, 1952, Serial No. 271,997

5 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 lateral and longitudinal movement with respect to a frame upon which a driving motor having an output shaft is mounted, a non-rotatable stub shaft being rigidly secured to the frame in spaced parallel relation to the output shaft to provide a mounting for a rotatable driving member surrounding the same, said driving member being connected in driven relation to said output shaft and having an eccentric journal, the latter being connected to and surrounding a journal post secured to the shoe to impart gyrating motion thereto.

This application is a division of my copending application for Oscillating Shoe Abrading Apparatus, Serial No. 147,905, filed March 6, 1950. The invention herein is also 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.

Various forms of apparatus have been proposed and employed in which an oscillating or gyrating abrading shoe has been mounted to be driven by rapidly rotating mechanism that is dependent upon an eccentric member for imparting the oscillating or gyrating movement. In such apparatus a crank shaft having considerable axial extent and carried by bearings both above and below the driven portion thereof is usually employed. The loading of the crank shaft is such as to impose harmful torsional vibration thereon and to impart undesirable rocking couples to the machine as a whole.

It is an object of this invention to provide in a recurrent motion abrading apparatus power translating means for producing gyration of the shoe, which means avoids use of a crank shaft with its inherent torsional weakness.

Another object of this invention is to provide in an apparatus of the class described, a driving means for producing gyration of the shoe which is compact in the vertical direction and in which the vertical spacing of the eccentric members is reduced to a minimum to limit the undesirable rocking couples resulting from such vertical spacing.

Still another object of this invention is to provide in gyrating shoe abrading apparatus a belt driven eccentric actuator for the shoe in which bearing means are disposed within the area over which load is applied by belt tension to permit such bearing means to be utilized to full advantage.

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 one particular form in which the invention may be embodied.

In the drawings:

Fig. 1 is a side view in elevation and partly in section of an abrading apparatus in which this invention is embodied,

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

Fig. 8 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** mounted for rotation on a post **14** which 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** so that the post **14** on member **9** 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 therein of a plug **22** formed of rubber or other resilient or flexible 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 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 toward the left with respect to rod **23** by a key as 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 the flange **26** shown in Fig. 5, the rod **23** may be turned by handle **32** through an arc of 90 degrees to bring 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**.

When the plug **22** is held in engagement with cup **21** a 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 **9** 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**, 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 a flat transverse mounting member **36** of yieldable rubber composition which acts as a vertical positioning and thrust transmitting mounting

which guides the rear end of the shoe **15** for 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 **9** around with it in a circular gyrating movement at a point directly concentric with screw **6**. 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 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 **13** with reference to the forward and rear ends of shoe plate **15**, and because of the 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. 7. 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 members **21** and **22** are within immediate control of the operator, by manipulation of handle **32**, and may be separated or disengaged 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. 8.

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.

I claim:

1. In a rubbing machine, a supporting frame, a power driven shaft mounted on said frame, a gyratable rubbing shoe, deflectable mounting means securing said shoe to said frame for lateral and longitudinal movement with respect to said frame, a supporting shaft secured to said frame and extending downwardly therefrom, a mounting bearing carried on and surrounding said shaft, a driving member having an internal downwardly facing socket in which said mounting bearing is seated whereby said driving member is rotatably supported on said shaft, power transmission means connecting the power driven shaft to said driving member, said driving member having an internal upwardly facing eccentric bearing seat, an eccentric bearing mounted in said eccentric bearing seat beneath and eccentrically disposed with respect to the axis of rotation of said mounting bearing, and an upstanding shoe driving post secured to said shoe and receiving thereon said eccentric bearing for causing said shoe to gyrate when said driving member is rotated.

2. In a rubbing apparatus, a frame, a driving motor having an output shaft mounted toward one end of said frame, a gyratable rubbing shoe, deflectable mounting means securing said shoe to said frame for lateral and longitudinal movement with respect to said frame, a supporting stub shaft secured toward the end of said frame opposite said motor, a mounting bearing secured in rotatable relation on said stub shaft, a driving member having an internal recess for receiving said bearing whereby said driving member is mounted upon said bearing for rotating movement, power transmission means connecting said output shaft to said driving member, said driving member having an internal recess which is eccentric relative to said first mentioned internal recess and which is immediately adjacent thereto, an eccentric bearing mounted in said eccentric recess and eccentrically disposed with respect to said mounting bearing, and a shoe driving shaft receiving said eccentric bearing and joined to said shoe which is adapted to transmit gyrating movement thereto upon rotation of said driving member.

3. In a rubbing machine, a frame, a driving motor mounted on said frame and having a vertical output shaft extending downwardly through said frame, an output sheave mounted on said output shaft, a gyratable rubbing shoe, deflectable mounting means securing said shoe to said frame for limited lateral and longitudinal movement with respect to said frame, a supporting shaft secured to said frame and extending downwardly relatively thereto, a driving member comprising a pulley having a bearing mounted therein which is received on said supporting shaft to connect said driving member therewith for rotation relative thereto, a transmission belt drivingly connecting said output sheave and said pulley, said driving member also having a second bearing therein which is eccentric to said supporting shaft, and an upwardly extending shoe driving post secured to said shoe and receiving thereon said second bearing to form an eccentric driving connection between said shoe and said driving member for causing said shoe to gyrate upon rotation of said motor output shaft.

4. In a rubbing machine having a supporting frame, an oscillatable rubbing shoe, flexible means connecting said shoe to said frame for oscillating movement in a fixed plane, a power driven shaft mounted in said frame, a depending support shaft mounted on said frame in offset relation to the power driven shaft, an upstanding post on said rubbing shoe having its axis offset relative to the axis of said support shaft, a drive member rotatably supported on said depending shaft and connected to said upstanding post, said drive member comprising upper and lower portions secured in face-to-face relation, a shaft receiving recess in said upper portion and a post receiving recess in said lower portion, said shaft and post receiving recesses being in offset relation and each terminating in an internal bearing receiving recess, bearings in said internal recesses which are mounted on said shaft and said post, respectively, and a driving connection between said power driven shaft and said drive member.

5. In a rubbing machine having a supporting frame, a rubbing shoe, flexible means connecting said shoe to said frame for oscillating movement relative thereto, a power driven shaft mounted on said frame, a depending support shaft mounted on said frame in offset relation to the power driven shaft, an upstanding post on said rubbing shoe having its axis offset relative to said support shaft, a drive member rotatably connected to said depending shaft and said upstanding post, said drive member comprising upper and lower portions, a shaft receiving recess extending into said upper portion and a post receiving recess extending into said lower portion, said shaft and post receiving recesses terminating in internal bearing receiving recesses which are in eccentric relation, bearings in said internal recesses which are connected to said shaft and said post, respectively, and a driving connection between said power driven shaft and said drive member.

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