Nov. 16, 1943. R. J. CHAMPAYNE 2,334,172

RUBBING MACHINE

Filed July 28, 1941 2 Sheets-Sheet 1

Fig. 1

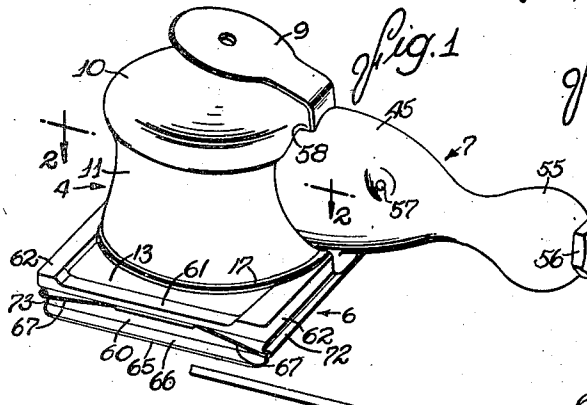

Fig. 2

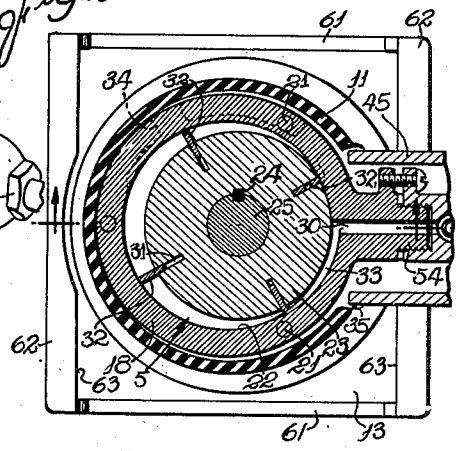

Fig. 3

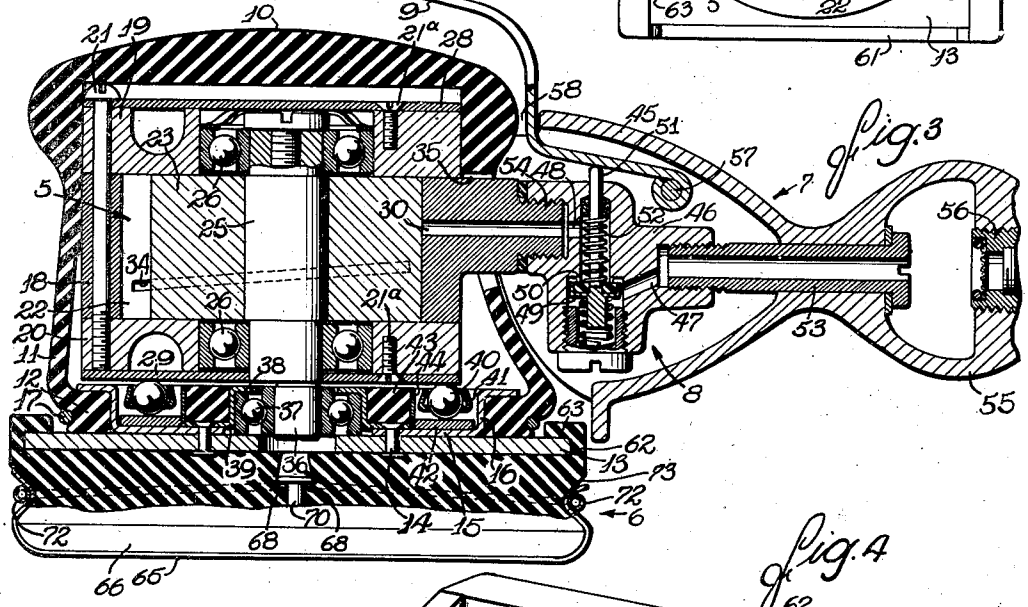

Fig. 4

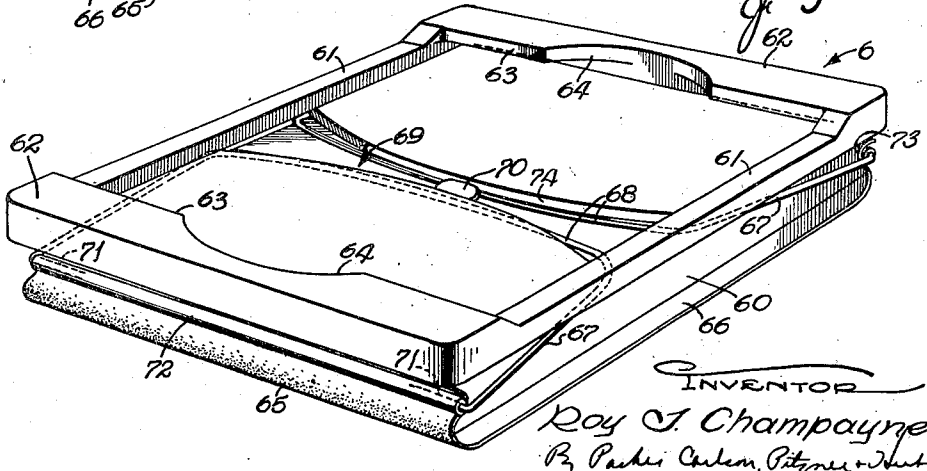

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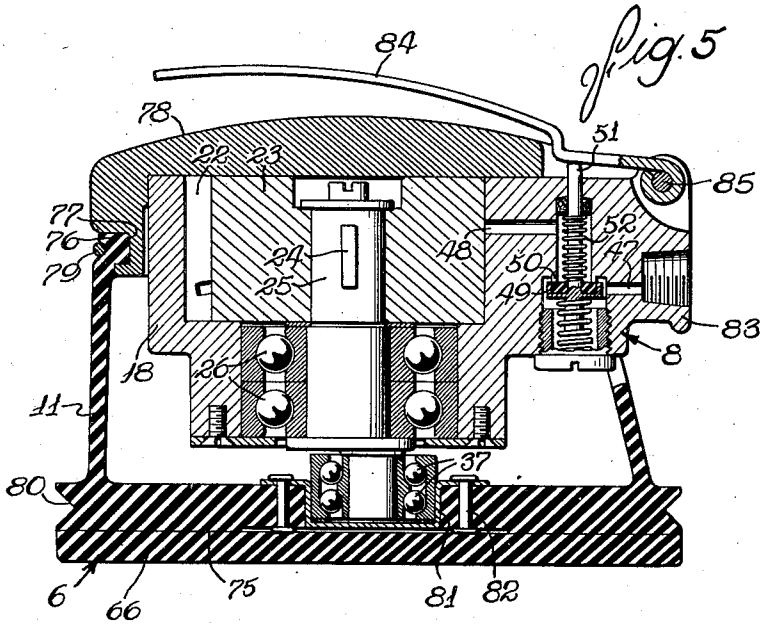
Fig. 5



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Patented Nov. 16, 1943 2,334,172

UNITED STATES PATENT OFFICE

2,334,172

RUBBING MACHINE

Roy J. Champayne, Rockford, Ill.

Application July 28, 1941, Serial No. 404,307

16 Claims. (Cl. 51—170)

This invention relates generally to portable surface finishing machines and more particularly to power driven machines of the type in which the rubbing element has a gyratory motion.

One object of the invention is to provide an improved machine of the above character embodying novel means for imparting positive gyratory movement to the rubbing element.

A more detailed object is to provide a flexible housing arranged in a novel manner to hold the rubbing element against rotation and also effectually exclude foreign matter from the working parts.

A further object is to provide a novel means for sustaining the thrust on the rubbing element.

Still another object is to provide for quick detachment and interchanging of rubbing elements on the machine.

The invention also resides in novel structural arrangements which contribute to the ruggedness of the construction and the ease with which the machine may be handled and controlled.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a perspective view of the improved rubbing machine.

Fig. 2 is a horizontal section taken along the line 2—2 of Fig. 1.

Fig. 3 is a diametrical section taken along the line 3—3 of Fig. 2.

Fig. 4 is a perspective view of the detached rubbing element.

Fig. 5 is a view similar to Fig. 3 illustrating a modification.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiments. It is to be understood, however, that I do not intend to limit the invention by such disclosure but aim to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

In the form shown in the drawings, the improved rubbing machine comprises generally a hollow housing 4 enclosing a rotary motor 5 of any suitable type and supporting at its open end a work performing or rubbing element 6 positively driven by the motor and caused to move bodily in a circular path of small diameter. Power is supplied to the motor through a handle 7 rigid with the motor casing and projecting laterally therefrom so that the tool may be grasped and held conveniently in one hand. The handle also encloses a control device 8 by which the operation of the motor is controlled, this device being actuated by a hand lever 9 mounted for convenient manipulation while the tool is held naturally in the operator's hand.

Proceeding now with a more detailed description of the machine as shown in Figs. 1 to 4, the housing 4 is of resilient character preferably comprising oil resistant synthetic rubber and having a thick rounded top 10 from which depends a thinner walled skirt 11 preferably flared outwardly slightly and formed around its lower end with a flange 12.

To provide a mounting for the rubbing shoe 6, the lower end of the skirt is closed by a flat plate 13 secured as by rivets 14 to a circular disk 15 having an upstanding annular L-shaped flange 16 overlying the skirt flange 12 which is thus disposed between the plate and the flange 16 where it is held firmly by a ring 17 tightened around the flange.

While the rubbing member 6 may be actuated by power from an external source transmitted mechanically into the housing, a self-contained source such as the motor 5 is preferably employed. This may be an electric motor, but as shown is actuated by pressure fluid, preferably compressed air. It comprises a rigid annular casing 18 closed at opposite ends by upper and lower end plates 19 and 20 clamped together by screws 21 so as to form a generally cylindrical chamber 22. The motor casing is thus shorter than the housing skirt 11 and its upper end is received snugly in the closed end of the rubber housing so as to be held frictionally against turning relative to this housing.

Disposed within the chamber 22 is a cylindrical rotor 23 of somewhat smaller diameter than the chamber. In this instance, the rotor is mounted directly on and fastened as by a key 24 to a shaft 25, the opposite ends of which project through the inner race rings of antifriction ball bearings 26. The outer races are supported in the end plates 19 ad 20 and held in place by a plate 28 and a hardened plate 29 fastened to the end plates by the screw 21a.

The rotor 23 is concentric with the shaft 25 but the two are eccentric with respect to the chamber 22 with one side of the rotor substantially in running contact with the chamber wall adjacent an air inlet port 30. The rotor is formed with a series of outwardly opening radial

slots 31 spaced annularly and each supporting a vane 32 for radial projecting into engagement with the chamber wall. During rotation, the vanes will follow the contour of the chamber, outward movement of the vanes occurring as a result of centrifugal force or by the leakage of air in behind the vanes. Compressed air entering through the port 30 acts on the projecting portions of the vanes and thus imparts rotary motion to the rotor. To insure initial starting, the wall of the chamber is provided with the gradually tapering air slot 33 extending from the inlet port in the direction in which the rotor turns.

The exhaust air flows out through a port 34 in the casing 18 opening into the interior of the housing 11 which, in turn, is vented to the atmosphere through an opening 35 through which the handle 7 extends.

Rotary power derived by the motor is applied positively to the rubbing shoe 6 to produce bodily gyratory motion of the latter about the shaft 25. This is accomplished through a crank formed by a projection or pin 36 on the lower end of the shaft and disposed parallel to but eccentrically of the shaft axis. The crank pin is operatively connected to the rubbing element by antifriction bearings 37 having their inner race ring carried by the shaft and the outer ring abutting against the plate 13. This ring is seated in the flange 38 of an annular stamping 39 secured on top of the disk 15 by the rivets 14.

Since the plate 13 is held against rotation by the housing skirt 11, the rubbing shoe 6 will necessarily follow the circular path described by the crank pin 36 when the shaft 25 is rotated, the range of movement being determined by the throw of the crank. Herein this is approximately $\frac{3}{16}$ of an inch.

Antifriction bearing means is provided for transmitting directly to the rigid motor casing the thrust incident to pressing the shoe against the surface to be finished. This means comprises a series of steel balls 40 held in an annular carrier 41 and disposed between the hardened plate 29 on the lower end of the motor casing, and a ring 42 seated within the disk flange 16. The bearing is centered yieldably by a ring 43 of rubber or other suitable resilient material surrounding the stamping 39 and enclosed by a split ring 44. The balls 40 thus transmit the axial thrust to the motor casing and are adapted to float laterally thereby avoiding any possibility of binding.

The machine is applied to the surface to be finished and manipulated by means of the handle 7. This comprises a hollow casting flared toward one end to form an annular shield 45. When the tool is equipped with a pressure fluid motor such as that illustrated, the control device 8 above referred to takes the form of a valve housed within the flared portion of the handle. The valve illustrated comprises a hollow casing 46 having inlet and outlet ports 47 and 48 between which communication is established and interrupted by a valve member 49 movable toward and from a seat 50. The valve member is on a stem 51 which is guided in the valve casing and is urged in the valve-closing direction by a compression spring 52.

Preferably the handle 7 is fastened to the rigid motor casing through the intermediary of the valve casing 46. For this purpose, a headed hollow screw 53 projects through the contracted portion of the handle casting and threads into the inlet of the valve casing. The outlet of this casing threads onto the reduced outer end of a stud 54 integral with the motor casing. Thus, with the valve casing abutting against the stud and the screw 53 tightened, the handle is attached rigidly to the motor casing.

Preferably the air line or hose by which pressure fluid is supplied to the motor is connected directly to the handle. To this end, a knob portion 55 is threaded for the reception of a connector 56 of suitable and well-known type.

As above stated, the motor is started and stopped by manipulation of the hand lever 9 which, in the present instance, is pivoted on the handle interiorly thereof, a cross pin 57 providing the pivot. Adjacent its fulcrum, the lever bears against the end of the valve stem and the free end is curved upwardly through a slot 58 in the handle portion 45 between the housing and the handle end so as to be disposed above the housing top 10. Thus, the lever is conveniently accessible when the tool is operated in the most natural manner, that is, when the handle 7 is held in one hand, the lever will be depressed and the valve opened as an incident to pressing the tool against the work with the other hand placed on the top 10 of the housing. When the operating pressure is relieved, the valve will close thus stopping the motor automatically. Or, when only a light pressure is required, the tool may be handled in one hand, by which the control lever may also be manipulated.

The rubbing shoe 6 is mounted on the plate 13 for quick detachment so as to permit the ready interchange of shoes equipped with different kinds of abrasive papers, for example, those used for wet or dry sanding. In the form illustrated, the shoe 6 comprises a rubber plate 60 having upstanding flanges 61 and 62 at the sides and ends adapted to snugly receive the plate 13. The end flanges have inturned upper edges 63 spaced from the top of the rubber plate to overlie and bear downwardly against the plate 13. These edges are cut away as indicated at 64 to provide recesses for enabling the end flanges to be gripped and bent downwardly to strip the end of the shoe off from the carrier plate 13 and thus remove the shoe. Advantage is thus taken of the flexible character of the rubber to insure a tight friction fit around the carrier and over the ends of the latter while permitting of ready detachment of the shoe from the carrier.

Abrasive or polishing material is carried on a sheet 65 detachably secured to the under side of the shoe 6 which may be covered with a layer 66 of sponge rubber cemented to the bottom of the shoe plate 60. The means herein shown for clamping the abrasive sheet to the plate comprises a pair of U-shaped wires 67 with their intermediate portions 68 disposed in an open ended channel 69 formed in the top portion of the rubber plate 60 just below the plate 13, the wires being fastened to the plate by a rivet 70. Preferably the side walls of the channel converge toward the center from each end. The ends 71 of each wire are turned inwardly and project into a tube 72 which is adapted to roll up and around the edge of the rubber plate 60 and fit into a groove 73. As an incident to this, the wire portions 68 engage the wall 74 resulting in compression of the rubber which thus affords the resiliency required to hold the abrasive sheet between the rollers 72 and the plate 60.

Where it is desired to reduce the overall dimensions or lighten the weight, the machine construction may be modified as shown in Fig. 5.

In this case, the annular flexible skirt 11 for holding the shoe 6 against rotation is molded integral with a rubber plate 75 which forms the shoe proper. The skirt is open at its upper end to permit of assembly of the bearings and motor therein and has a peripheral bead 76 seated in an annular external groove 77 in the open end of an inverted metal cup 78 abutting against the upper end of the motor housing. A wire 79 is tightened about the bead to fasten the skirt to the cup. The shoe plate 75 is notched as indicated at 80 or otherwise suitably fashioned for the attachment of abrasive sheets thereto.

In this instance, most of the thrust resulting from pressing the shoe against the surface to be rubbed is transmitted to the motor casing through the shaft and crank bearings 26 and 27. Accordingly, these are of the thrust type as shown, the crank bearing being seated in a flanged metal cup 81 disposed in an upwardly opening recess in the shoe plate 75 and fastened to the latter as by rivets 82. It will thus be seen that the major thrust is transmitted directly to the motor shaft and sustained by the bearings thereof. However, the substantial rigidity of the rubber plate 75 coacting with the skirt 11 insures the application of substantially uniform pressure on all parts of the shoe. In addition to this function, the skirt serves as before to hold the shoe against turning while flexing laterally to permit gyration of the shoe.

In this modification, the handle is omitted and the air hose is connected directly to the casing 83 of the valve 8 which casing may be cast integral as shown with the motor housing 18. The valve is actuated by a lever 84 pivoted at 85 on the valve casing.

It will be apparent from the foregoing that the improved rubbing machine is of simple and compact construction and of light weight so that it can be easily handled, yet extremely rugged and capable of withstanding hard usage. Due to the novel manner of enclosing the working parts, the machine may be used for either the wet or dry rubbing operations. Because of the positive manner in which the rubbing shoe is gyrated, substantial pressure may be applied to the work without danger of stalling the motor. Such a positive drive connection between the rubbing shoe and the motor shaft enables the gyroscopic action of the relatively heavy rotor turning at high speed to be utilized in minimizing vibration of the tool incident to high speed gyration of the rubbing shoe.

This application is a continuation in part of my copending application Serial No. 345,273, filed July 13, 1940.

I claim as my invention:

1. In a rubbing machine, the combination of a housing of flexible material having a depending skirt terminating in an inwardly projecting annular flange, a rubbing shoe including a generally circular plate having a peripheral flange receiving said first flange and connected thereto whereby said plate is held against rotation relative to the housing, and power driven means within said housing for moving said plate in a circular path.

2. A rubbing machine having, in combination, a rubbing shoe, an annular flexible skirt upstanding from said shoe, a power driven shaft within said skirt projecting toward said shoe and carrying a crank, and bearing means positively connecting said crank and said shoe and operable during rotation of said shaft to gyrate the shoe about the shaft axis in a circle determined by the length of the crank, said skirt acting to hold the shoe against rotation about its own axis.

3. In a machine of the character described, the combination of a power driven shaft having a portion eccentric to its axis of rotation, a work performing member, bearing means on said member concentric with said eccentric portion and providing a positive driving connection between the two operable to gyrate the member positively in an orbit determined by the throw of the eccentric portion, and means operatively connected to said member and acting to hold the same against rotation during its gyration.

4. A rubbing machine having, in combination, a cup-shaped housing having an end portion of flexible material, a power actuated rotary motor fitting in said housing against the closed end thereof and having a rigid casing and a shaft, a rubbing shoe connected to the open end of said housing, means driven by said shaft and gyrating said shoe, and antifriction bearings disposed between said shoe and one end of said casing to sustain the thrust incident to pressing said shoe against a work surface.

5. A rubbing machine having, in combination, a rigid non-rotatable casing, a power driven shaft therein, a rubbing shoe adjacent the end of said shaft, a positive driving connection between said shaft and shoe operating to gyrate the shoe during rotation of the shaft, flexible means connecting said casing and said shoe to hold the shoe against rotation during gyration thereof, and coacting bearing surfaces between said shoe and casing surrounding said shaft and operating independently of the shaft and said flexible means to sustain the thrust incident to pressing said shoe against a work surface.

6. A rubbing machine having, in combination, a rigid non-rotatable casing, a power driven shaft therein, a rubbing shoe positively gyrated during rotation of the shaft, a flexible connection between said casing and said shoe to hold the shoe against rotation during gyration thereof, and antifriction elements arranged between said casing and said shoe for floating movement laterally of said shaft and operable to transmit to the casing the thrust on the shoe.

7. A rubbing machine having, in combination, a rigid non-rotatable casing, a power driven shaft therein, a rubbing shoe positively gyrated during rotation of the shaft, a flexible connection between said casing and said shoe to hold the shoe against rotation during gyration thereof, an annular row of antifriction elements between said shoe and casing sustaining the thrust transmitted to said shoe by the application of pressure to said housing, and a ring of resilient material between said shaft and said elements to center the latter while permitting of floating of the elements laterally of said shaft.

8. A rubbing machine having, in combination, a rubbing shoe, a rigid casing, a rigid power driven shaft journaled in said casing, a crank rigid with said shaft and journaled in said shoe to provide a positive driving connection between the crank and shoe operating to gyrate the latter about the shaft during rotation of the latter, means for transmitting directly to said casing the thrust due to pressure applied to said shoe, and means connected at one end to said casing and at the other end to said shoe whereby to hold the latter against rotation during its gyratory movements.

9. A rubbing machine having, in combination, a rubbing shoe composed of rubber or the like,

an annular skirt molded integral with and upstanding from said shoe having an open upper end, a motor disposed within said skirt and connected to the upper end thereof, said motor having a shaft projecting toward said shoe and carrying a crank pin, and a bearing on said pin connected to said shoe for imparting bodily rotary motion to the shoe and directly sustaining the end thrust resulting from pressure applied to the shoe.

10. A rubbing machine having, in combination, a rubbing shoe composed of rubber or the like, an annular flexible skirt upstanding from said shoe having an open upper end, a power driven shaft, means within said skirt rotatably supporting said shaft, a crank pin on the end of said shaft, and a bearing on said pin connected to said shoe for imparting bodily rotary motion to the shoe and directly sustaining the end thrust resulting from pressure applied to the shoe.

11. A rubbing machine having, in combination, a housing having a flexible skirt, a rubbing shoe attached to the end of said skirt, a rotary motor having a rigid casing disposed within and nonrotatably connected to said skirt, means actuated by the motor shaft to gyrate said shoe positively during rotation of the shaft, said skirt having an opening in one side thereof, a handle projecting through said opening and connected rigidly within the skirt to said casing, and means within the handle for conducting motive power therethrough to said motor.

12. A rubbing machine having, in combination, a rubbing shoe, a rigid housing, means holding said shoe against turning relative to the housing while permitting of gyration of the shoe relative to the housing, a power driven shaft journaled in said housing to turn about an axis fixed relative thereto, said shaft having one end projecting from the housing toward said shoe, an eccentric on said projecting end, and bearing means carried by said shoe and providing a journal for said eccentric whereby to form a positive driving connection between said eccentric and said shoe for effecting relative turning of the eccentric and shoe about an axis which is fixed relative to the shoe and thereby cause positive gyration of the shoe during rotation of said shaft.

13. A rubbing machine having, in combination, a rubbing shoe, a rigid housing, means flexibly connecting said shoe and housing to permit of gyration of the shoe in a circle relative to the housing, a power driven shaft journaled in said housing to turn about an axis fixed relative thereto, said shaft having one end projecting from the housing toward said shoe, a crank on said projecting end, means providing a driving connection between said crank and said shoe for relative turning of said crank and shoe about an axis which is fixed relative to said shoe whereby to cause positive gyration of the shoe during rotation of said shaft, and anti-friction means separate from said flexible means acting, when said shoe is pressed against a work surface to transmit to said housing the resulting thrust directed endwise of said shaft.

14. A rubbing machine having, in combination, a rubbing shoe, a support, means connecting said shoe and said support to permit of gyration of the shoe in a circle relative to the support, a rotary driving shaft journaled in said support to turn about the axis of said gyration, and an eccentric connection between said shoe and said shaft operable to transmit the rotary motion of said shaft positively to said shoe and gyrate the shoe positively relative to said support and the shaft axis in synchronism with the rotation of said shaft, said connecting means holding said shoe against turning during its gyration.

15. A rubbing machine having, in combination, a rubbing shoe, a rigid support, means flexibly connecting said shoe and support to permit of gyration of the shoe relative to the support, a power driven shaft journaled on said support to turn about an axis fixed relative thereto, means providing a positive driving connection between said shaft and said shoe for relatively turning said shaft and shoe and effecting positive gyration of the shoe during rotation of said shaft, and means separate from said flexible means acting, when said shoe is pressed against a work surface, to transmit to said support the resulting thrust directed endwise of said shaft.

16. A rubbing machine having, in combination, a rubbing shoe, a rigid support, means holding said shoe against turning relative to said support while permitting of relative gyration between the two, a power driven shaft journaled on said support to turn about an axis fixed relative thereto, means providing a positive driving connection between said shaft and said shoe for effecting positive gyration of the shoe relative to the shaft during rotation of the shaft, and thrust sustaining menas associated with said connection and operable to transmit to said support through said shaft the major portion of the thrust applied to that portion of the shoe opposite said shaft when the shoe is pressed agains a work surface.

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