Feb. 23, 1954 R. J. CHAMPAYNE 2,669,812

RUBBING MACHINE

Filed April 20, 1949 2 Sheets-Sheet 1

Fig. 1

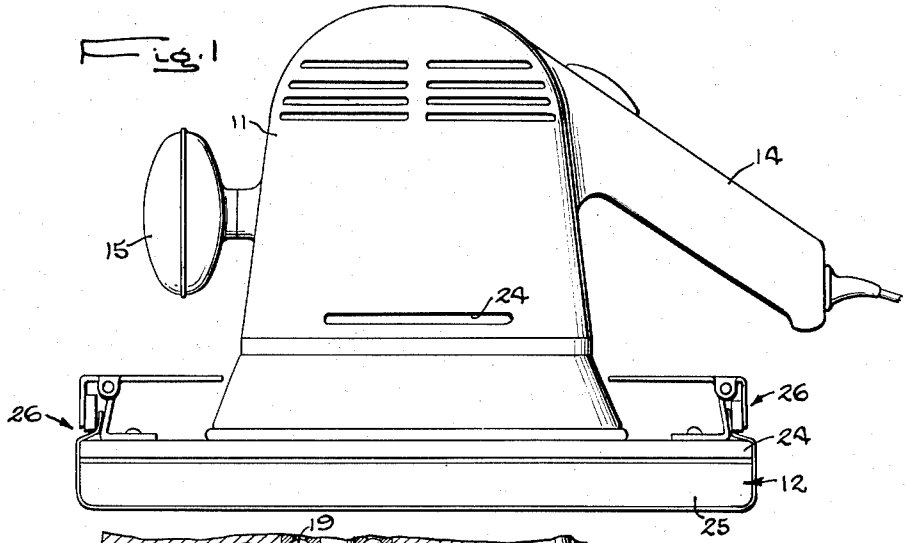
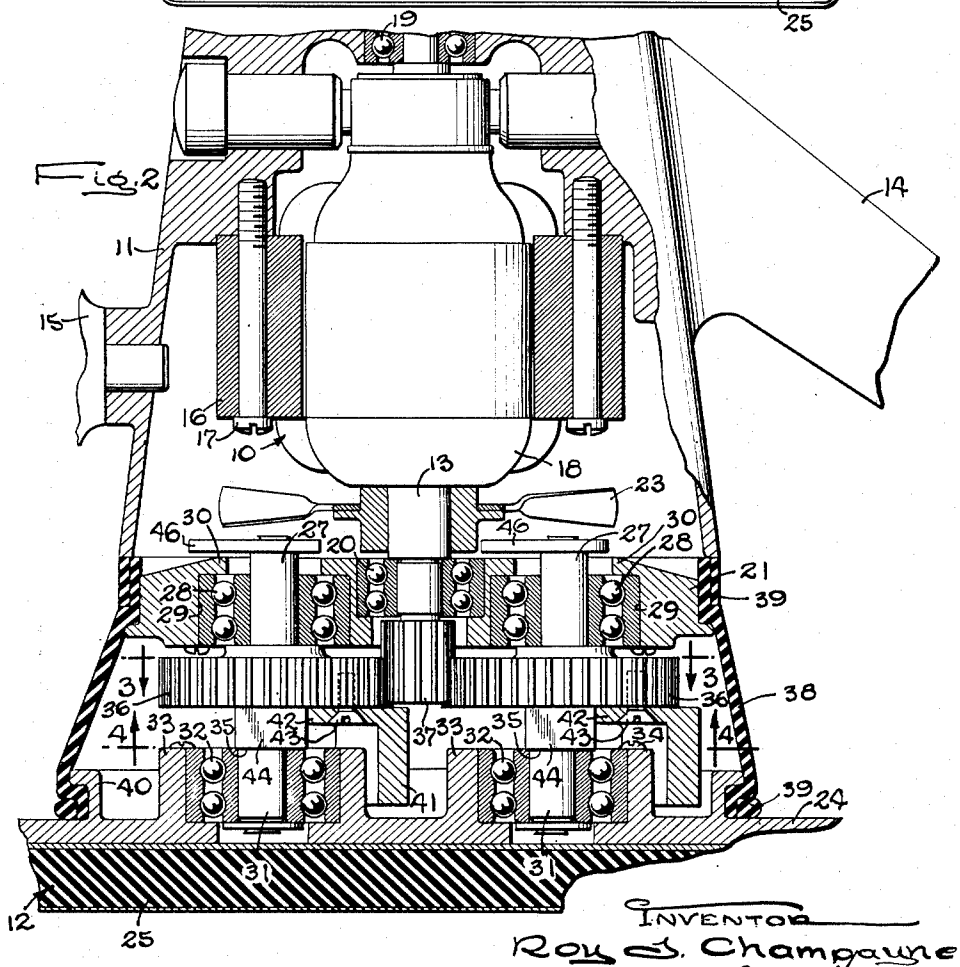


Fig. 2



INVENTOR
Roy J. Champayne
By Carlson, Pitzner, Hubbard & Wolfe
ATTORNEY

Feb. 23, 1954 R. J. CHAMPAYNE 2,669,812

RUBBING MACHINE

Filed April 20, 1949 2 Sheets-Sheet 2

Fig. 3

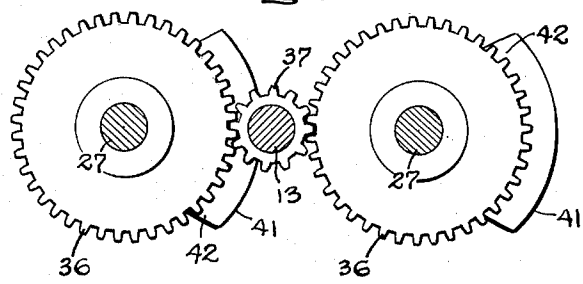
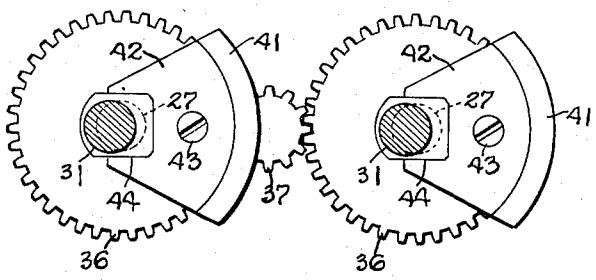


Fig. 4



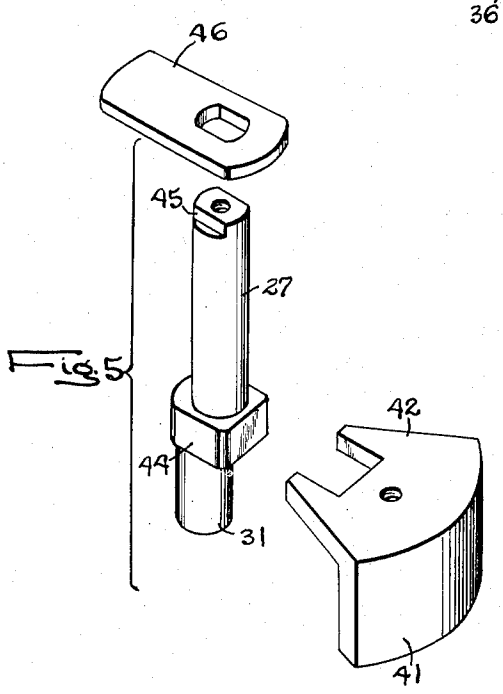
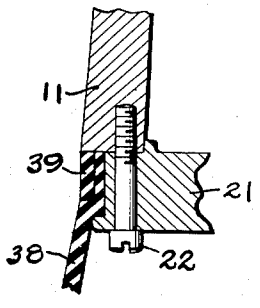


Fig. 5

Fig. 6



INVENTOR
Roy J. Champayne
By Carlson, Pitzner, Hubbard & Wolfe
ATTORNEY

Patented Feb. 23, 1954

2,669,812

UNITED STATES PATENT OFFICE

2,669,812

RUBBING MACHINE

Roy J. Champayne, Rockford, Ill.

Application April 20, 1949, Serial No. 88,511

1 Claim. (Cl. 51—170)

1

This invention relates to a rubbing machine driven by a rotary motor and has more particular reference to machines of the type employing a plurality of cranks for converting the rotary motion of the actuator into bodily gyration of a rubbing shoe while at the same time holding the shoe against turning.

To counterbalance the eccentric weight of the rubbing shoe in machines of the above character, it has been the practice heretofore to provide a single auxiliary weight of the same mass as the rubbing shoe and employ an additional pair of power driven cranks to gyrate the weight in out of phase synchronism with the rubbing shoe and in an orbit of similar size as to that of the gyrating shoe. As shown by Fisker Patent No. 2,247,993, the auxiliary counterbalancing weight may be a second rubbing shoe disposed alongside the first shoe. By locating the counterpoise between the rubbing shoe and its support as shown by Crosby Patent No. 2,395,537, lateral compactness may be achieved but at the sacrifice of over-all weight and increased complexity of the actuating and supporting parts.

I have discovered that in order to counterbalance a rubbing shoe which is gyrated by two cranks as described above, it is not necessary to employ a gyrating weight or a weight having the same mass as the rubbing shoe proper. Based on this discovery, the present invention is to substantially eliminate vibration of the rubbing machine by dividing the counterbalancing mass into a plurality of parts each having a simple rotary motion and disposed at a substantially larger radius than the radius of gyration of the rubbing shoe.

Another object is to locate the counterbalancing masses in a novel manner which materially reduces the over-all dimensions of the rubbing machine as compared to prior constructions.

A more detailed object is to divide the counterbalancing mass into a plurality of parts which revolve with the respective crank shafts and are spaced from the shaft axes a distance greater than the radius of gyration of the rubbing shoe whereby to achieve a corresponding reduction in the over-all weight of the tool.

The invention also resides in the novel structure and arrangement of the parts for achieving the foregoing objects while maintaining simplicity and ruggedness of the structure as a whole.

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

2

Figure 1 is a side elevational view of a rubbing machine embodying the novel features of the present invention.

Fig. 2 is a longitudinal central sectional view.

Figs. 3 and 4 are fragmentary sectional views taken respectively along the lines 3—3 and 4—4 of Fig. 2.

Fig. 5 is an exploded perspective view of one of the drive shafts and the counterweights thereon.

Fig. 6 is a detail sectional view.

For purposes of illustration, the invention is shown in the drawings incorporated in a portable self-contained rubbing machine driven by a rotary motor 10 housed within a casing 11 which supports a rubbing shoe 12 for bodily gyration. The shape of the casing is determined by whether the shaft 13 of the motor is to be disposed parallel to the rubbing shoe or perpendicular to the latter as in the present instance. Herein, the casing is generally dome-shaped and formed on opposite sides with a handle 14 and a knob 15 either or both of which may be gripped by the operator to carry the tool, guide it along a work surface to be sanded, or press the shoe downwardly against the work.

In the present instance, the stator 16 of the motor, which may be of the electric type, is secured in the casing by screws 17 and the shaft 13 of the rotor 18 is journaled to its upper end in a bearing 19 in the top of the casing. The shaft is centered relative to the shoe 12 and near its lower end is journaled in a bearing 20 mounted in a plate 21 which forms the bottom of the casing 11 and is detachably secured to the latter by a plurality of screws 22 (Fig. 6). Within the casing, the shaft 13 carries fan blades 23 for drawing cooling air through the motor and discharging the same outwardly through ports 24 (Fig. 1).

The rubbing shoe comprises a generally rectangular rigid backing plate 24 of light weight metal such as magnesium carrying a pad 25 of yieldable material. An abrasive sheet or other rubbing or brushing element may be attached to the bottom of the latter shoe. In the case of an abrasive sheet, the ends are bent upwardly and around the shoe ends and secured in clamps 26.

The shoe and the mechanism for converting the rotary motion of the motor into gyratory motion of the shoe is supported as a self-contained unit on the plate 21 and the gyrating mechanism is disposed between the shoe and the plate. This mechanism includes two parallel shafts 27 spaced

equidistantly from opposite sides of the motor shaft 13 and pressed through the inner race rings of ball thrust bearings 28 whose outer rings are pressed into holes 29 in the plate 21 and seated against inturned flanges 30.

Cranks 31 formed on the lower ends of the shafts 27 are journalled in ball thrust bearings 32 seated in annular flanges 33 upstanding from the top of the shoe plate 24 and disposed equidistantly from opposite ends of the shoe 12 along the longitudinal center line thereof. The shoe is thus disposed symmetrically with respect to the motor shaft. The outer race rings of the bearings 32 are held in the seats by screws 34 and the inner races bear against shoulders 35 on the shafts 27. The cranks are offset in corresponding directions so that the shoe is gyrated bodily in a circular orbit which, in this instance, is $\frac{3}{16}$ of an inch in diameter.

The shafts 27 are driven in unison and at a speed reduced from the motor shaft 13. While this may be accomplished in various ways, it is preferred to employ gears 36 fast on the shafts 27 meshing with teeth on the motor shaft. If the motor shaft were disposed horizontally or parallel to the shoe 12, the gears would be of the bevel type, but with the shaft disposed vertically, as shown, spur gears are employed and disposed immediately below bearings 28 so as to mesh on adjacent sides with opposite sides of a pinion 37 fast on the lower end of the motor shaft. To reduce noise, the gears 36 are preferably composed of non-metallic material such as fiber. A 3 to 1 speed reduction is employed in the present instance. The operating mechanism is enclosed by a removable skirt 38 preferably composed of flexible material such as rubber and clamped by bands 39 around the periphery of the support 21 and an upstanding flange 40 on the shoe plate 24.

With the parts arranged as above described, rotation of the motor shaft 13 will result in turning both of the cranks 31 in the same direction and in phase with each other. Power is thus applied to both end portions of the shoe 12 which is gyrated bodily in a $\frac{3}{16}$ inch orbit. Pressure applied to the casing 11 to hold the rubbing sheet against the work is transmitted to the casing through the shafts 27 and the four thrust bearings 28 and 32 between which the total thrust is divided.

To insure gyration of the shoe in a truly circular orbit and to prevent any substantial vibration of the handle 14 and other parts of the casing, the invention contemplates counterbalancing the unbalanced weight of the shoe 12 and the cranks 31 in a novel manner which minimizes the total weight of the tool, which provides optimum compactness, and which requires no changes or rearrangement of the simple power operator described above. In achieving these ends, I have found that it is unnecessary to form the counterweight in a single mass or to center the weight with respect to the shoe 12, or to gyrate the weight as has been the practice heretofore. Instead, I divide the counterweighting mass into a plurality of parts 41 of equal weight respectively carried by the two shafts 27 with the centers of gravity of the two masses disposed close to the plane of gyration of the center of gravity of the shoe 12 and spaced from the shaft axes distances which are several times the radius of gyration of the shoe.

In the present instance, the counterweights 41 are fixed to the shafts 27 immediately below

the gears 36 but the main mass of the weight is centered outwardly beyond the bearing flanges 33 and below the upper ends thereof so that the weights rotate in the annular space surrounding these flanges and within the shoe flange 40. Preferably, each weight comprises a curved or arcuate flange depending from a flat arm or sector 42 secured as by a screw 43 against the underside of the gear and itself forming part of the effective mass of the counterweight. Herein, the inner end of the arm is forked and straddles a squared portion 44 formed on the shaft between the gear and the crank 31, the weight being thereby accurately positioned angularly directly opposite from the crank. The two parts of the counterweighting mass thus mounted occupy space already available within the operator, and the size of the individual weights is reduced because of the location at a relatively large radius which may, as shown, be even greater than that of the gears by locating the pinion 37 with its lower end flush with or above the bottoms of the gears.

With the weights arranged as described above, the centers of their masses rotate in a plane which is offset only slightly above the plane of gyration of the center of gravity of the shoe 12 and therefore the eccentric weight of the shoe and the cranks may be substantially balanced by properly correlating the sizes and positions of the two weights 41 in relation to the unbalanced weight of the shoe 12 and the over-all weight of the tool. More accurate balancing and substantial elimination of vibration of the casing 11 may be achieved through the use of an additional counterweight rotatable in unison with the gyration of the shoe and acting in opposition to and balancing the force couple resulting from the inability to locate the weights 41 in the plane of the center of gravity of the shoe 12. Herein, two additional weights 46 are employed and spaced as far as possible above the weights 41 without interference with the rotating parts. To this end, the weights 46 are made in the form of relatively flat arms pressed onto the flattened upper ends 45 of the shafts 27 just above the supporting plate 21 and below the fan blades 23. Each arm projects from its shaft on the side thereof directly opposite the center of the lower weights 41 and thus during its rotation derives a centrifugal force which effectually overcomes the bending moment exerted on the shaft due to the axial offsetting of the mass centers of the weights 41 and the shoe 12.

It has been found in practice that the tool above described may be counterbalanced effectually by sizing the parts as shown in Fig. 2 and by employing main counterweights (parts 41 and 42) of only 2 ounces each, and secondary counterweights 46 each weighing only ½ of an ounce. The use of such small weights is made possible by virtue of the location of their effective masses at substantial distances from the axes of rotation. The total weight of the tool is 7½ pounds, and the gyrating shoe assembly weighs 1½ pounds.

I claim as my invention:

A rubbing machine having, in combination, a support, thrust bearings mounted in said support and having laterally spaced parallel axes, two parallel shafts journaled at one of their ends in said bearings with the other end portion of the shafts projecting from one side thereof, a rubbing shoe disposed beyond the outer ends of said shafts, cranks on the outer ends of said

first shafts journaled in said rubbing shoe near opposite ends thereof and operable to gyrate the shoe in orbits of equal diameters, a rotary motor mounted on said support between said shafts and having a drive shaft, means disposed between said bearings and said shoe and providing speed reduction drive connections between said motor shaft and each of said first shafts to turn the latter in the same direction, and two counterweights each fixed to one of said first shafts between the drive connection thereof and said shoe and eccentrically disposed on the sides of the shafts opposite said cranks, the masses of said weights and their effective radii being correlated

with the eccentric weight of said shoe and cranks to counterbalance such weight effectually during operation of said motor.

ROY J. CHAMPAYNE.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,247,993	Fisker	July 1, 1941
2,367,668	Champayne	Jan. 23, 1945
2,395,537	Crosby	Feb. 26, 1946
2,437,152	Burleigh	Mar. 2, 1948