Jan. 10, 1961 J. D. HELBIG ET AL 2,967,315

HAND-PROPELLED POLISHING MACHINE

Filed Jan. 28, 1957 2 Sheets-Sheet 1

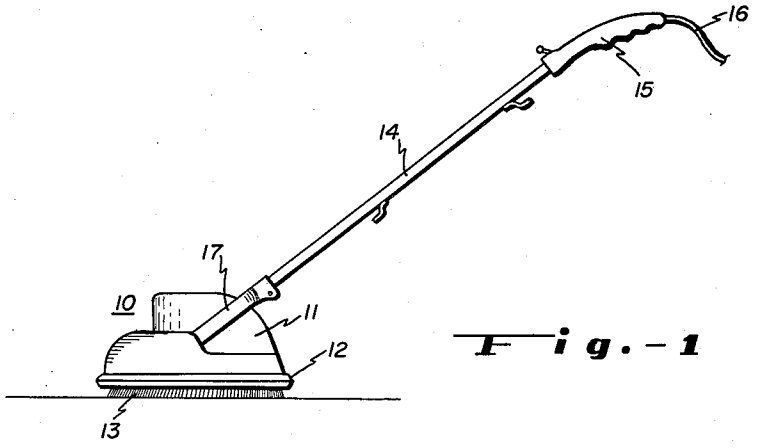


Fig. - 1

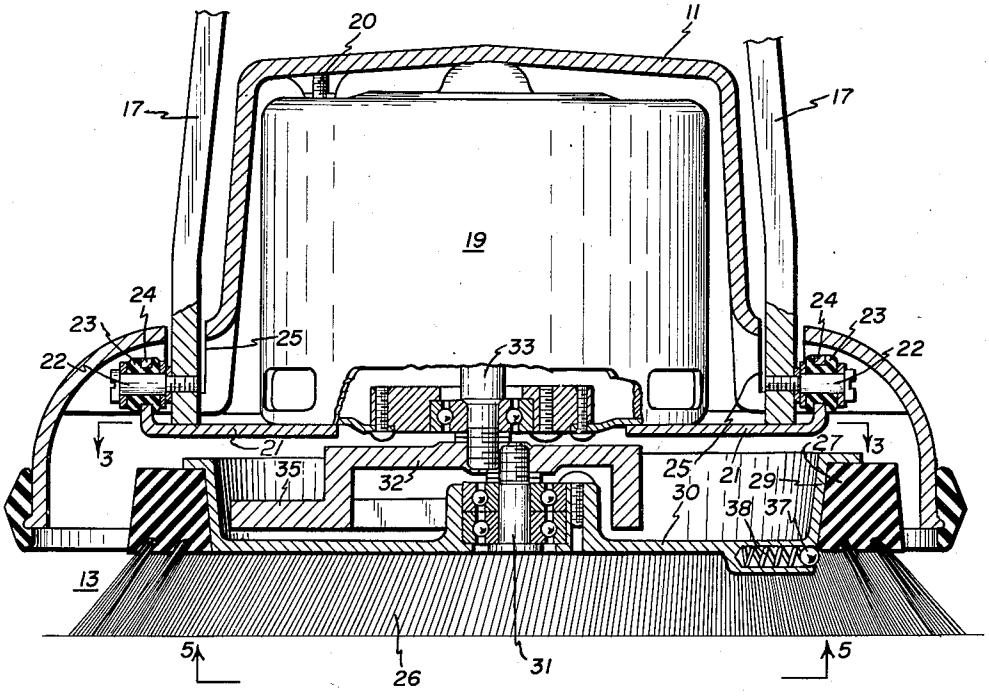


Fig. - 2

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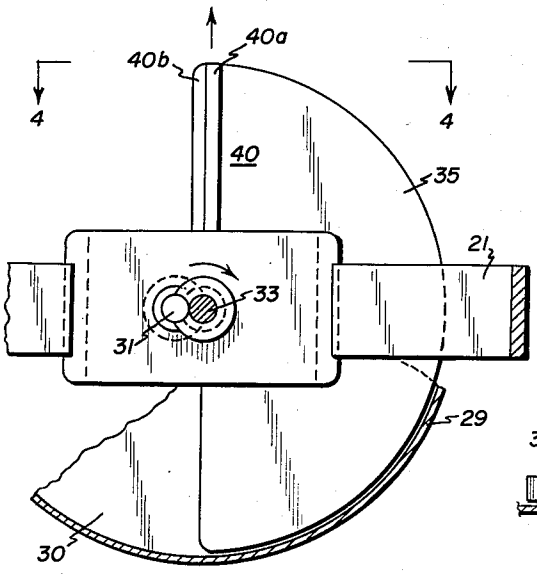


Fig.-3

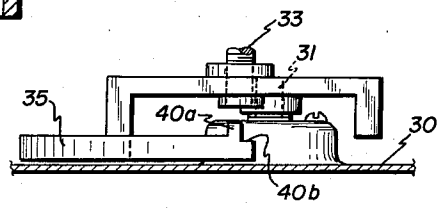


Fig.-4

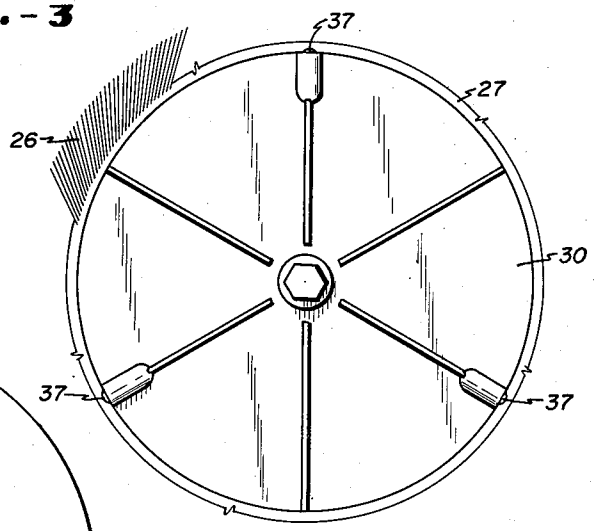


Fig.-5

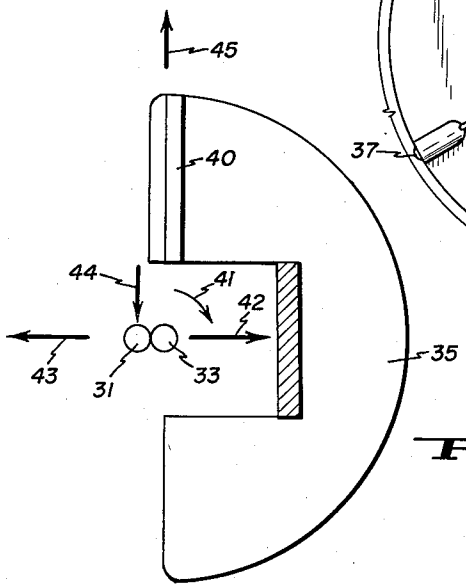


Fig.-6

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HAND-PROPELLED POLISHING MACHINE

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6 Claims. (Cl. 15—49)

This invention relates to polishing machines or abrading apparatus and particularly to an improved hand-propelled floor polishing machine of the single head type.

Various forms of floor polishing machines have been provided heretofore which have single rotary or oscillatory heads. When single head machines have been designed for manipulation by hand, and particularly for home use, difficulties have been encountered because of vibration and also because of the tendency of the machine to travel or drive itself over the floor and render it difficult for the operator to guide and control its course. The single-head machines have the advantage of simplicity of construction over that employed in the multiple-head machines, and, accordingly, it is an object of the present invention to provide a single-head hand-propelled polishing machine including an improved arrangement for securing ease of handling and freedom from vibration.

It is another object of this invention to provide an improved floor-polishing machine of the single-head oscillatory type.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Briefly, in carrying out the objects of this invention in one embodiment thereof, a hand-manipulated floor-polishing machine is provided with a single head which is freely rotatable upon a short arm eccentrically driven directly by the motor of the polisher. The head is formed to provide a hollow or cup surrounding the end of the drive shaft and the eccentric mounting, and a counterweight for balancing the eccentricity is mounted within the hollow so that both the head and the counterweight have their centers of gravity in substantially the same plane normal to the axis of rotation of the shaft. A second counterweight is provided spaced ninety degrees from the common axis of the first counterweight and the eccentric and is made of size such that it effectively balances out the reactive force which occurs upon engagement of the head with the surface to be polished during operation. In addition to these features, the manipulating handle is secured to the body of the polisher by resilient connections which lie substantially in the plane of the center of gravity of the unit normal to the axis of rotation of the motor, and, when a brush is employed, the bristles are mounted so that all slope in the same direction substantially tangential to the brush circle. This combination of features provides a polishing machine which is remarkably free of vibration and is extremely easy to manipulate over the surface to be polished.

For a better understanding of this invention, reference may be had to the accompinying drawings, in which:

Fig. 1 is an elevation view of a hand-manipulated floor-polishing machine embodying the invention;

Fig. 2 is an enlarged front sectional elevation view of the motor and head assembly;

Fig. 3 is a partial sectional view along the line 3—3 of Fig. 2;

Fig. 4 is a rear elevation view along the line designated 4—4 in Fig. 3;

Fig. 5 is a bottom view of the polishing head; and

Fig. 6 is a diagram illustrating the operating characteristics of the counterweights.

Referring now to the drawings, the polishing machine illustrated in Fig. 1 comprises a body portion 10 including a casing 11 having a rubber bumper guard 12 and a freely rotatable polishing brush or head 13 extending below the casing 11 for engagement with the floor or other surface to be polished. The machine is manipulated by a handle 14 having a grip 15 and arranged to be connected to a suitable source of electrical power through a cord 16 extending from the end of the handle. The handle 14 is secured to the machine by a yoke or bifurcated member 17 which is pivotally mounted on the mechanisms so that the handle 14 may be raised and lowered through a predetermined arc.

The details of construction of the machine are shown in Figs. 2 through 5. The driving motor of the machine, indicated at 19, is surrounded by the casing 11 and the casing is attached to it by bolts 20 which pass through the motor housing and engage the casing at the top thereof. The two arms of the yoke 17 are attached to the motor on extension members 21 by bolts 22 suspended in rubber grommets 23 mounted in holes in upturned ends 24 of the members 21. The bolts 22 are securely attached to the lower ends of the yoke arms 17 and the rubber grommets 23 provide a resilient connection between the handle and the machine. When the yoke 17 is pivoted about its lower ends, it moves in slots 25 provided in the casing 11 for this purpose. The polishing head 13 comprises a ring of bristles 26 secured in a rim or annulus 27 which is snapped into position on an inclined flange 29 of a disc or wheel 30. The wheel 30 is provided with a ball-bearing hub mounted on a pivot pin 31 secured to a plate 32 mounted at the lower end of the shaft 33 of the motor 19 for rotation therewith. The pivot 31 is eccentric with respect to the motor shaft 33, and the polishing head is freely rotatable about the pivot. Thus, as the motor rotates, all portions of the polishing head describe small circles and the head is operated with an oscillating motion which may be described as non-linear translatory movement.

In order to counterbalance the eccentric rotating mass of the polishing head, the mounting member 32 is provided with a counterweight 35 which is shown in Fig. 3 as semicircular in form, extending from a part offset from the portion to which the shaft 33 is secured, diametrically opposite the crank arm or axis of the pivot 31. The counterweight 35 operates within the hollow formed by the flange 29 of the disc 30. In order to minimize the torque couples which might otherwise exist about axes normal to the axis of the motor 33, both the counterweight and the polishing head assembly including the disc 30 and the attached head 13 are arranged so that their centers of gravity lie in substantially the same plane normal to the axis of the motor 33; this plane lies within the hollow portion of the head about the pivot end 31. For ease in attaching and detaching the ring 26, the disc 30 is provided with a plurality of spring-pressed ball plungers 37 which are biased outwardly by compression springs 38 and hold the lower edge of the rim 27 in position on the flange 29, but afford ready removal when the rim 27 is pressed downwardly away from the flange 29. In the arrangement illustrated, as shown in Fig. 5, three of the spring-pressed ball members 37 are provided at 120 degree intervals around the circumference of the disc 30.

During the operation of the polishing machine, the

motor 19 is energized to rotate the shaft 33 at a high speed, and, when the brush 13 is out of engagement with the surface to be polished, the forces due to rotation of the eccentric head are substantially balanced out, the counterweight 35 and head 13 being of substantially equal moment and rotating opposite each other about the shaft 33. The arrangement of the counterweight 35 within the hub of the head so that the centers of gravity of the head of the counterweight are in substantially the same plane minimizes the torque couples about axes normal to the shaft 33 and further serves to minimize vibrations set up by operation of the machine.

When the head 13 is in engagement with the floor or other surface to be polished, reaction forces occur between the floor and the brush which forces are transmitted to the machine and are exerted against the machine to produce unbalanced conditions and vibration. In order to minimize the vibrations caused by these reaction forces and thereby decrease the total vibration present in the machine during the polishing operation a second or auxiliary counterweight, indicated at 40, is provided; the auxiliary weight in the embodiment illustrated comprises an upward extension 40*a* and a continuation 40*b* both cast as portions of the weight 35 and extends generally along an axis at ninety degrees to the symmetrical axis of the main portion of the weight 35 through its pivot on the shaft 33. The shaft 33, during operation, is rotated in a clockwise direction as viewed from the top in Fig. 3. It will thus be seen that, when the brush 13 is in engagement with the floor below the machine, the reactive forces caused by this engagement will be exerted downwardly against the shaft 31 as viewed in Fig. 3, the shaft moving instantaneously upwardly as viewed in this figure. The instantaneous force on the weight 40 is upwardly away from the shaft 33 and is thus opposite to the instantaneous reactive force occurring upon engagement of the brush with the floor. By selecting the size of the weight 40 to counterbalance the average force resulting from the reaction of the machine on the floor, this reaction may be substantially balanced out while the head is in engagement with the floor. The complete counterweight system thus provides a resultant force vector comprising a main component directly opposite and equal to that of the eccentric assembly and a small lateral component at ninety degrees leading the eccentric axis in the direction of rotation of the shaft. The resultant vector thus leads the eccentric axis by somewhat less than one hundred eighty degrees. Thus, when the head is lifted from the floor the counterweight system is unbalanced due to the weight 40 which produces vibration in an otherwise balanced system; this latter vibration is not objectionable, however, since it exists only during rare occasions when the machine is lifted from the floor and the motor operated. The effect of the auxiliary counterweight is thus to balance out forces which otherwise would be unbalanced and produce additional vibration during the operation of the machine in engagement with the work. The effect of any vibration which may exist due to varying conditions during the operation of the machine is minimized by the resilient mounting of the yoke 17 on the machine by means of the soft rubber gaskets or grommets 23 which reduce the vibration transmitted to the operator's hand.

The balancing out of the several forces existing due to the rotation of the equipment when in engagement with the floor is indicated in the diagram, Fig. 6, which shows the counterweights 35 and 40 with vectors representing the magnitude and direction of the forces. The rotation of the shaft 33 is clockwise as indicated by an arrow 41. The outward force of the counterweight 35 is represented by a vector 42 and that of the head by an equal vector 43. The reactive force resulting from engagement of the head with the floor is represented by a vector 44 and the balancing force of the counterweight 40 by a vector 45.

The machine, when employed with a brush, as in the illustrated embodiment, operates more smoothly when the bristles of the brush are all sloped in one direction as shown and extend outwardly and also backwardly with respect to the direction of rotation of the motor shaft. It will readily be understood, however, that the polishing machine is not limited to operation with brush or bristle heads but may employ any of the usual types of polishing or abrading heads now available.

Various modifications and other applications of the invention will be apparent to those skilled in the art, therefore, it is not desired that the invention be limited to the particular construction illustrated and described, and it is intended by the appended claims to cover all modifications which fall within the spirit and scope of the invention.

We claim:

1. A hand-propelled floor polisher or the like comprising a polishing head, a motor for said polisher having a shaft projecting therefrom, means including a bearing and a detachable pin for pivotally mounting said head eccentrically of said shaft and affording free rotation of said head about its pivotal axis, said head having a hollow portion therein opening upwardly and extending about its pivotal axis, the center of gravity of the head lying in a plane normal to the pivotal axis of the head and extending through the hollow portion of the head, said mounting means including a plate secured to the motor shaft, which plate includes an offset portion lying within said hollow portion of said head laterally of said bearing, and a counterweight secured to said offset portion on the side of said mounting means opposite said pivotal axis and with its center of gravity substantially in said plane within the hollow portion of said head whereby said counterweight and said head rotate with their centers of gravity substantially in the same plane for balancing the rotating portions of said head with minimum force couples about axes transverse to the axis of rotation of said shaft.

2. A hand-propelled floor polisher or the like as set forth in claim 1 including a handle resiliently secured to said motor at points lying substantially in a plane perpendicular to the axis of rotation of said shaft and passing through the center of gravity of said polisher.

3. A hand-propelled floor polisher or the like comprising a motor having a rotary shaft, a work head, means for mounting said head on said shaft for free rotation about an eccentric axis parallel to that of said shaft, and a counterweight on said shaft for balancing the moment of said head about said shaft and for substantially overcoming the reactive force against said shaft occurring upon engagement of said head and a work surface, the center of gravity of said counterweight lying radially of said shaft in a position with respect to the direction of rotation of said shaft which leads the eccentric axis less than one hundred eighty degrees whereby the resultant force on said shaft comprises a first component directly opposite the force produced by rotation of said head about the shaft and a second component leading said eccentric axis by ninety degrees in the direction of rotation of said shaft for opposing the reactive force occurring upon engagement of the head with a work surface.

4. A hand-propelled floor polisher or the like comprising a motor having a rotary shaft, a work head, means for mounting said head on said shaft for free rotation about an eccentric axis parallel to that of said shaft, and a counterweight system for said head comprising a first portion having its center of gravity in the common plane of said eccentric and shaft axes and having a moment equal and opposite to that of said head and a second portion having a center of gravity lying laterally of said plane and leading said eccentric axis by substantially ninety degrees in the direction of rotation of said shaft whereby said second portion produces a force in opposition to the reactive force against said shaft

which occurs upon engagement of said head with a work surface.

5. A hand-propelled polisher or the like as set forth in claim 4 wherein said work head comprises a body having a hollow portion extending around said eccentric axis of the head, the center of gravity of said head lying on a plane normal to the eccentric axis of the head and extending through the hollow portion of the head and wherein the center of gravity of said counterweight system lies substantially in said normal plane within said hollow portion.

6. A hand-propelled floor polisher or the like comprising a polishing head, a motor for said polisher having a shaft projecting therefrom, means for mounting said head on said shaft for free rotation about an axis eccentric to that of said shaft, said head having a hollow portion therein opening upwardly and extending about its pivotal axis, the center of gravity of the head lying on a plane normal to the pivotal axis of the head and extending through the hollow portion of the head, said mounting means including a plate secured to the motor shaft,

which plate includes an offset portion lying within said hollow portion of said head laterally of said bearing, and a counterweight secured to said offset portion on the side of said mounting means opposite said pivotal axis and with its center of gravity substantially in said plane within the hollow portion of the said head, whereby said counterweight and said head rotate with their centers of gravity substantially in the same plane for balancing the rotating portions of said head with minimum force couples about axes transverse to the axis of rotation of said shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

1,497,921	Levedahl	June 17, 1924
1,957,790	Mavis et al.	May 8, 1934
2,023,588	Heckroth	Dec. 10, 1935
2,545,635	Steibel	May 20, 1951
2,727,262	Gerber	Dec. 20, 1955
2,774,199	Emmons	Dec. 18, 1956