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SURFACE TREATING MACHINE

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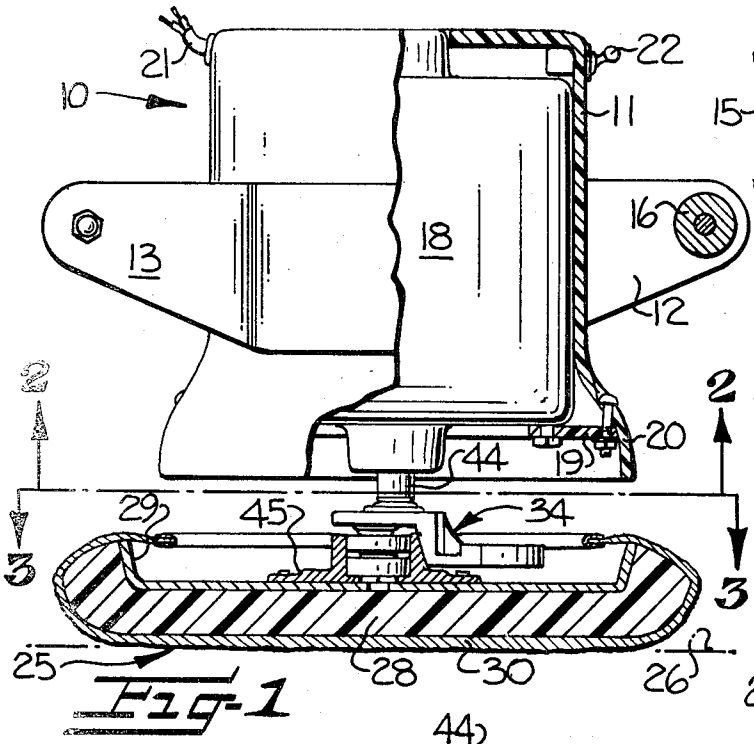


Fig-1

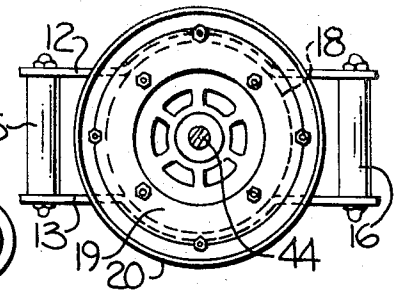


Fig-2

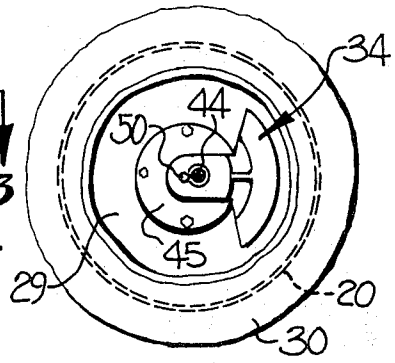


Fig-3

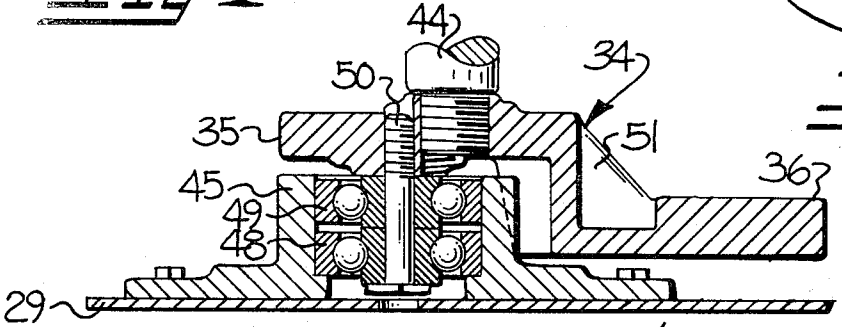


Fig-4

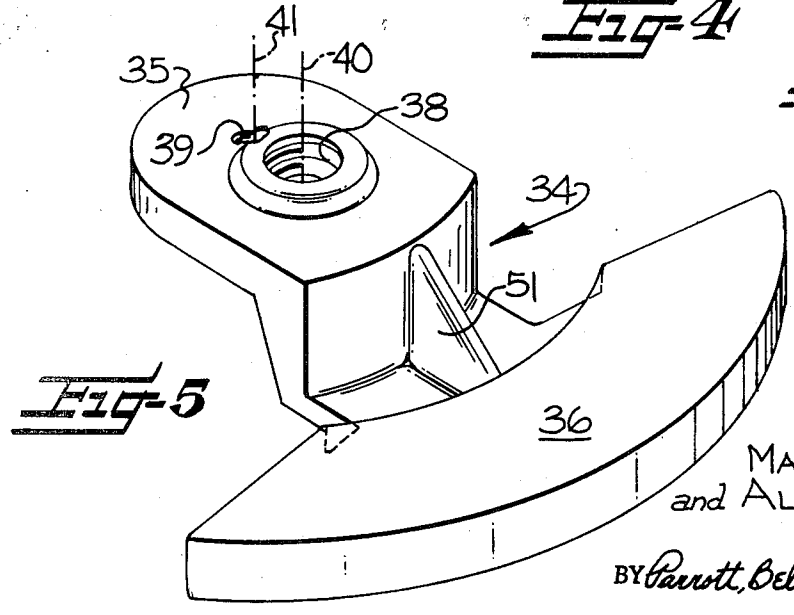


Fig-5

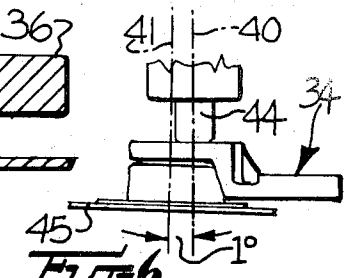


Fig-6

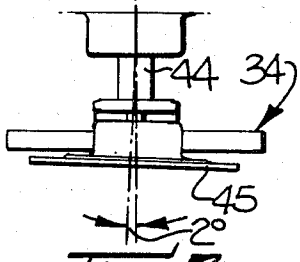


Fig-7

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SURFACE TREATING MACHINE

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ABSTRACT OF THE DISCLOSURE

A surface treating machine wherein a surface engaging tool is driven in orbital motion and wherein the surface engaging tool is mounted in skewed relation to the rotational axis of the drive shaft from which motion is derived so as to obtain wiping contact with the surface being treated and to avoid excessive heating during surface treatment.

Surface treating machines such as polishers, buffers, sanders and the like are employed in a wide range of manufacturing processes and consumer services. While different problems arise in the use of these various surface treating machines, certain common problems may best be described with reference to the polishing of a surface being treated, such as the application and buffing of a wax coat. For example, it is conventional practice to protect the exterior finish of an automobile by the application of coats of wax and to impart a lustrous appearance to such surface by buffing the wax coat. The surface treating machines available for use in applying and buffing such wax coats have employed a surface engaging tool or head which is driven in rotation at relatively high speed by direct connection with the shaft of an appropriate motor, such as an electric motor.

As is well known to operators of service establishments such as service stations and car washes, such a conventional buffer can do serious damage to the finish of an automobile if placed in the hands of an inexperienced worker. In particular, the speed of relative movement between the surface engaging tool and the painted surface of the automobile is sufficiently high as to frictionally generate heat at relatively high rates. Unless care is taken by the operator of the buffer, heat generated in this manner is sufficient to mar the painted finish of an automobile, in a manner known to the trade as "burning." The necessity of placing a conventional buffer only in the hands of an experienced worker has significantly increased the cost of labor encountered by service establishments in proving waxing and polishing service.

It has been noted that the high-speed rotary movement of the surface engaging tool of a conventional buffer differs markedly from the motion used in applying and polishing a wax coat by hand. More particularly, the usual hand motion is a rocking orbital motion, in which the hand is moved in a general orbital path over the surface to be treated and is simultaneously rocked somewhat from side to side to vary the contact between a polishing cloth or other tool held in the hand and the surface engaged thereby. The difficulty noted in connection with conventional rotating buffers and the like has never been encountered with hand polishing, but the high labor cost of a hand-applied and polished surface treatment has made reliance upon hand motion economically disadvantageous.

While the discussion to this point has been particularly directed to problems encountered in the polishing of the surface being treated, as in the application and buffing of a wax coat, it is recognized that orbital motion has heretofore been used in certain surface treating operations and notably in the sanding and finishing of wooden

articles such as furniture. While orbital motion surface treating machines have been adopted for these processes in an effort to approximate the usual hand motion, the surface treating machines so used position the entirety of the rubbing surfaces of the surface engaging tools thereof in contact with the surface being treated. Thus the problems of heating or overloading of the rubbing surface materials are encountered in the use of such surface treating machines as well in the use of purely rotary polishers.

Having in mind the difficulties heretofore encountered with surface treating machines of the high-speed rotary type, it is an object of the present invention to provide a surface treating machine of the orbital motion type wherein the relative motion betwen the rubbing surface of a surface engaging tool driven by the treating machine and the surface being treated thereby approximates the wiping motion of hand polishing and excessive heating during surface treatment is avoided. In realizing this object of the present invention, a surface engaging tool having a rubbing surface for treating a surface engaged thereby is constructed and arranged in a particular manner, so that it is free to rotate while being driven in orbital motion and also moves with a rocking and wiping motion. In the surface treating machine in accordance with the present invention, the desired motion for the surface engaging tool is attained by providing that the tool is operatively connected to an eccentric mounting means for free rotation relative thereto about an axis spaced from and directed at a predetermined skew angle to an axis about which the eccentric mounting means is driven by the drive shaft.

Some of the objects and advantages of the invention having been stated, others will appear as the description proceeds, when taken in connection with the accompanying drawings, in which

FIG. 1 is an elevation view, in partial section, of a surface treating machine in accordance with the present invention;

FIG. 2 is an inverted plan view, in reduced scale, of portions of the machine of FIG. 1, taken generally as indicated by the line **2**—**2** in that figure;

FIG. 3 is a plan view, in reduced scale, somewhat similar to FIG. 2 of other portions of the machine of FIG. 1, taken generally as indicated by the line **3**—**3** in FIG. 1;

FIG. 4 is an enlarged scale elevation view, in partial section, through a portion of the machine of FIG. 1, illustrating in detail an eccentric mounting means and a portion of a surface engaging tool;

FIG. 5 is an enlarged scale perspective view of the eccentric mounting means of FIGS. 1 and 4;

FIG. 6 is a reduced scale elevation view similar to FIG. 4, particularly illustrating a skew angle between certain elements of the machine of FIG. 1; and

FIG. 7 is a view similar to FIG. 6, taken from a direction perpendicular to the direction from which FIGS. 6, 4 and 1 are taken.

Referring now more particularly to the drawings, a surface treating machine **10** in accordance with the present invention is there disclosed (FIG. 1) and the particular details thereof which result in approximation of the wiping motion of hand polishing will be described hereinafter. In order to permit an operator of the machine **10** to hold and traverse the machine across a surface being treated, the machine includes a housing **11** formed by any suitable means, such as injection molding of plastic material, and having a pair of laterally extending handle mounting arms **12** and **13**. Extending between the arms **12** and **13**, on opposite sides of the housing **11**, are a pair of handgrip bars **15** and **16**, secured to the arms **12** and **13** in any appropriate manner. Supported within the housing **11** is a drive means, illustrated as being an elec-

tric motor **18**. In the embodiment shown, the electric motor **18** is secured in place within the housing **11** by a mounting flange **19** bolted to one end of the frame of the motor **18** and to a flared depending skirt portion **20** of the housing **11**. The electrical motor **18** receives current through suitable conductors **21**, wired through a snap switch **22** which provides an operator of the surface treating machine **10** with control over energization of the motor **18**.

The surface treating machine **10** includes a surface engaging tool, generally indicated at **25**, having a rubbing surface for engaging and moving relative to the surface being treated. Preferably, the rubbing surface of the surface engaging tool **25** is substantially planar, and defines a principal plane for the tool **25**, indicated in FIG. 1 by a dash line **26**. Where the surface treating machine **10** is to be employed in waxing and polishing painted surfaces of automobiles, it is preferred that the surface engaging tool **25** be constructed of a body of foam or sponge material **28** secured to and supported by a pan-like reinforcing member **29** of fiber glass or thin metal sheet. A suitable polishing bonnet **30** is positioned encompassing the foam member **28** and reinforcing member **29** and is made of an appropriate polishing material, such as terry fabric. In use, the bonnet **30** directly engages the surface to be treated and relative movement between the bonnet **30** and the surface imparts the desired buffing and polishing effect.

In order to drive the tool **25** in orbital motion, an eccentric mounting means, preferably in the form of a member as generally indicated at **34**, provides an operative connection between the motor **18** and the tool **25**. The eccentric mounting member **34** includes an axis defining portion **35** and a counterweight portion **36**, for purposes to be described more fully hereinafter. The axis defining portion **35** has a pair of openings formed therein, preferably as drilled and tapped holes **38** and **39**. As pointed out more fully hereinafter, each of the holes **38** and **39** is formed about a predetermined central axis, respectively identified as the axes **40** and **41** (FIG. 5).

In order to drive the eccentric mounting member **34** in rotation, the member **34** is secured to the shaft **44** of the electric motor **18**, for rotation with the shaft **44** about a first axis defined thereby. The operative connection between the eccentric mounting member **34** and the drive means shaft **44** is made by threaded engagement of a free end of the shaft **44** with the larger drilled and tapped hole **38** of the two holes formed in the axis defining portion **35** of the eccentric member **34**. The direction of threading for the shaft end and the cooperating threaded opening **38** are chosen in predetermined relation to the direction of rotation in which the mounting member **34** is driven by the motor **18**, in order to insure that eccentric member **34** does not become loosened from the shaft **44** during use of the treating machine **10**.

To insure that the surface engaging tool **25** has imparted thereto orbital motion and that wiping contact between the rubbing surface of the tool **25** and the surface being treated is obtained, the tool **25** is operatively connected to the eccentric mounting member **34** for free rotation relative thereto about an axis spaced from the axis of rotation of the drive shaft **44** and directed at a predetermined skew angle thereto. This operative connection between the surface engaging tool **25** and the eccentric mounting means **34** preferably is attained through the use of a mounting means including, in part, a boss **45** secured to the reinforcing member **29** of the tool **25**, at a central location thereof (FIG. 1 and 4). The mounting boss **45** defines a relatively large diameter central opening therein, sized to receive therewithin the outer races of a pair of antifriction bearings **48** and **49**. The inner races of the bearings **48** and **49** are penetrated by a mounting bolt **50**, which enters into and engages the smaller diameter threaded opening **39** in the axis determining portion **35** of an eccentric member **34**. By means of the connection of the mounting bolt **50** to the eccentric mounting member **34**, the inner races of the bearings **48** and **49** are held fixed in relation thereto and rotate with the eccentric member **34** about the first axis as defined by the drive shaft **44** of the motor **18**. Due to the connection of the mounting boss **45** and thus the tool **25** with the outer races of the bearings **48** and **49**, the tool **25** is free to rotate relative to the eccentric member **34** about a second axis, defined by the central axis **41** of the smaller diameter threaded opening **39** and the central axis of the mounting bolt **50** and the bearings **48** and **49** which are aligned therewith.

In order to provide a rocking, wiping action for the rubbing surface of the tool **25** as the same moves with orbital motion over a surface to be treated, the first and second axes extend at a skew angle relative to each other. Preferably, skewing of the first and second axes is obtained by skewing the central axes **40** and **41** of the threaded openings **38** and **39** in the axis determining portion **35** of eccentric member **34**. Such skewing is accomplished during machining of the eccentric member **34**, and results in positioning the principal plane **26** of the rubbing surface of the tool **25** at an angle other than a right angle to the first axis as defined by the drive shaft **44**. This nonperpendicular relationship results in contact between the rubbing surface of the tool **25** and the surface being treated being a wiping motion approximating the wiping motion of hand polishing and in the drawing beneath the tool **25** of a flow of air which serves to cool the rubbing surface of the tool and the surface being treated, thereby avoiding the burning problem which has heretofore been encountered with high-speed rotary buffers and the like.

In an operating embodiment of the surface treating machine **10** of the present invention, the skew angle between the first and second axes is doubly skewed. That is, as measured when porjected into one or more planes, the skew angle will be found to have varying values. Thus, in order to fully state the direction and magnitude of skew, it is preferred that the skew angle be designated as projected to each of two planes for measurement. In connection with measurement of the skew angle in this matter, it is pertinent to point out other additional characteristics of the eccentric mounting member **34** and surface treating tool **25** which contribute to attainment of the desired operating characteristics for the machine **10**.

In particular, in order to assure smooth orbital movement of the surface engaging tool **25**, it is preferred that the center of gravity of that tool lies directly on the second axis, about which that tool rotates relative to the eccentric mounting member **34**. In the illustrated embodiment and as constructed in an operating embodiment of this invention, the center of gravity is located substantially in the plane of the reinforcing member **29**, and thus is spaced a predetermined distance upwardly of the rubbing surface at which the surface undergoing treatment is engaged. The center of gravity of the counterweight portion **36** of the eccentric mounting member **34** preferably is located relative to the larger threaded opening **38** in a position diametrically opposite the smaller opening **39**, as being approximately at the juncture of the vertical reinforcing web **51** and the outer radial mass of the counterweight portion **36**. As may be noted from FIGS. 1 and 4, the center of gravity of the eccentric mounting member **34** is spaced a predetermined distance above the principal plane **26** of the rubbing surface of the tool **25** which distance is greater than the distance of spacing of the center of gravity of the tool **25** itself. Further, due to the skewing of the axes **40** and **41** about which the rotation of the eccentric mounting member **34** and the polishing tool **25** rotate, movement of the centers of gravities is in nonparallel planes. That is, the plane defined by the path of movement of the center of gravity of the eccentric member **34** is not parallel to the plane defined by the path of movement of the surface engaging tool **25**.

In defining the specific angles of skew between the first and second axes, it is necessary to define the particular planes to which the skew angle is to be projected for measurement. Inasmuch as a plane is defined by the location of a line and a point, reference to this geometrical fact is used in defining the planes to which the skew angle is projected for measurement. A first plane for projection of the skew angle may be defined by the line of the first axis of rotation, namely the central axis of the driving shaft **44**, and the center of gravity point of the eccentric mounting member **34**. In the drawing, the view of FIG. 6 is taken as though in a plane parallel to a projection plane as so determined. For purposes of illustration, the skew angle has there been exaggerated so as to be more readily apparent. In an operating embodiment of the machine **10**, the skew angle as so measured in a first plane of projection is at least about 1°. For convenience, the second plane to which the skew angle is projected for measurement is taken as a plane through the first axis and directed perpendicular to the plane employed in measurement as represented by FIG. 6. That is, the second plane for propection and measurement of the skew angle extends through the central axis of the drive shaft **44** and at right angles to a plane through that axis and the center of gravity of the eccentric mounting member **34**. FIG. 7 is a representation of the pertinent elements of the surface treatment machine **10** as viewed in a plane parallel to the second projection plane, with the skew angle between the axes of rotations exaggerated for purposes of ready comprehension. In the operating embodiment of the present invention, the angle of skew between the first and second axes as measured in the second plane of projection is at least about 2°.

In brief summation, it is believed apparent that a surface treating machine has now been disclosed which permits attaining a wiping contact with the surface being treated, which wiping contact more nearly approximates the wiping of hand polishing and permits entrainment of cooling air flow between the rubbing surface of a surface engaging tool and the surface being treated, thereby precluding excessive generation of heat by friction.

In the drawings and specification, there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

What is claimed is:

1. A surface treating machine of the orbital motion type wherein wiping contact is obtained with the surface being treated and excessive heating during surface treatment is avoided, the machine comprising:

drive means including a shaft defining a first axis and driven in rotation thereabout,

eccentric mounting means secured to said shaft for rotation therewith about said first axis,

a surface engaging tool having a rubbing surface for treating a surface engaged thereby, and

means mounting said surface engaging tool on said eccentric mounting means for free rotation of said surface engaging tool about a second axis spaced from and skewed relative to said first axis, for orbital motion about said first axis upon said eccentric mounting means being driven in rotation by said drive means, and for rocking movement of said rubbing surface relative to a surface engaged thereby, in approximation to the wiping motion of hand polishing and so as to entrain cooling air between said rubbing surface and the surface being treated.

2. A surface treating machine according to claim **1** wherein said rubbing surface of said surface engaging tool is at least substantially planar and defines a principal plane of said tool and further wherein said principal plane extends in nonperpendicular relation to said first axis.

3. A surface treating machine according to claim **1** wherein said rubbing surface of said surface engaging tool defines a principal plane of said tool, said tool has a center of gravity lying substantially on said second axis and spaced a first predetermined distance from said principal plane, and said eccentric mounting means includes a counterweight portion having a center of gravity lying on the opposite side of said first axis from said second axis and spaced a second predetermined distance from said principal plane, said first and second distances being unequal.

4. A surface treating machine of the orbital motion type wherein wiping contact is obtained with the surface being treated and excessive heating during surface treatment is avoided, the machine comprising:

drive means including a shaft defining a first axis and driven in rotation thereabout,

eccentric mounting means secured to said shaft for rotation therewith about said first axis and including a counterweight portion,

a surface engaging tool having a rubbing surface for treating a surface engaged thereby and defining a principal plane of said tool, said surface engaging tool being operatively connected to said eccentric mouning means for free rotation relative thereto about a second axis on the opposite side of said first axis from said counterweight portion and spaced from and skewed relative to said first axis,

the operative connection between said surface engaging tool and said eccentric mounting means driving said surface engaging tool in orbital motion about said first axis upon said eccentric mounting means being driven in rotation by said drive means, with said principal plane in nonperpendicular relation to said first axis for rocking movement of said rubbing surface relative to a surface engaged thereby, in approximation to the wiping motion of hand polishing and so as to entrain cooling air between said rubbing surface and the surface being treated.

5. A surface treating machine according to claim **4** wherein said skew angle between said first and second axes is at least about 1° when measured as projected to a plane determined by said first axis and the center of gravity of said counterweight portion.

6. A surface treating machine according to claim **4** wherein said skew angle between said first and second axes is at least about 2° when measured as projected to a plane through said first axis and perpendicular to a plane determined by said first and the center of gravity of said counterweight portion.

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