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[54] **VIBRATORY FINISHING MACHINE**

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Related U.S. Application Data

[63] Continuation of Ser. No. 172,482, Aug. 17, 1971, abandoned.

[52] **U.S. Cl.** **51/163;** 51/313; 259/DIG. 42

[51] **Int. Cl.** **B24b 31/06**

[58] **Field of Search** ..... 51/163, 7, 313; 259/72, 259/DIG. 42, DIG. 15; 241/175; 74/87

[56] **References Cited**

UNITED STATES PATENTS

2,284,671	6/1942	Meinzer	74/87 X
3,100,088	8/1963	Podmore	51/163 X
3,400,495	9/1968	Balz	51/163
3,464,674	9/1969	Pick	259/72
3,570,192	3/1971	Ferrara	51/163
3,708,918	1/1973	Pool	51/163 X

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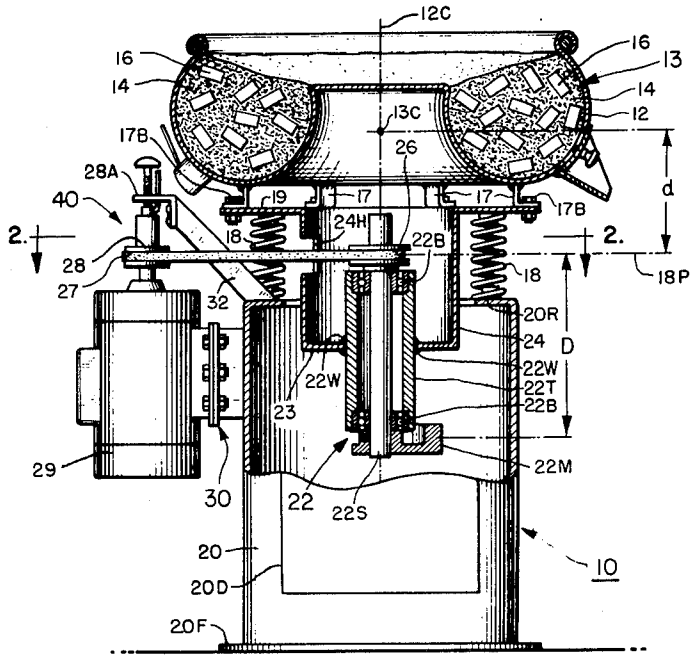
[57] **ABSTRACT**

A vibratory machine of the bowl type is disclosed having a spring mounted bowl for containing a workload, such as parts and media for deburring them, and a vibratory mechanism rigidly attached thereto having a single eccentric mass or weight at its lower point. The single mass is rotated about the central vertical axis of the bowl and is positioned at a greater distance below the null point than the center of the workload is above that point to cause vibratory gyroscopic motion to be imparted to the workload with little external vibration and with low force and wear on the vibratory mechanism.

10 Claims, 3 Drawing Figures



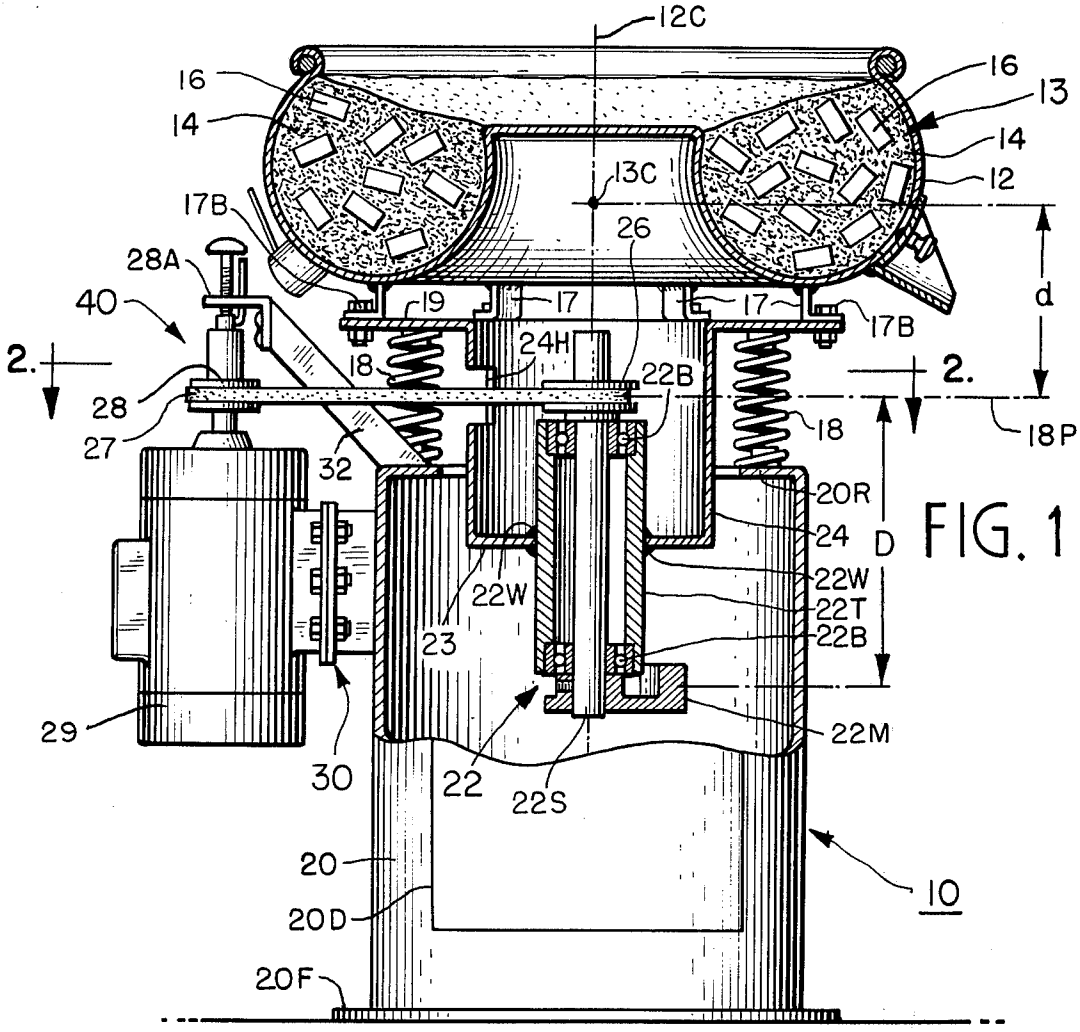


FIG. 1

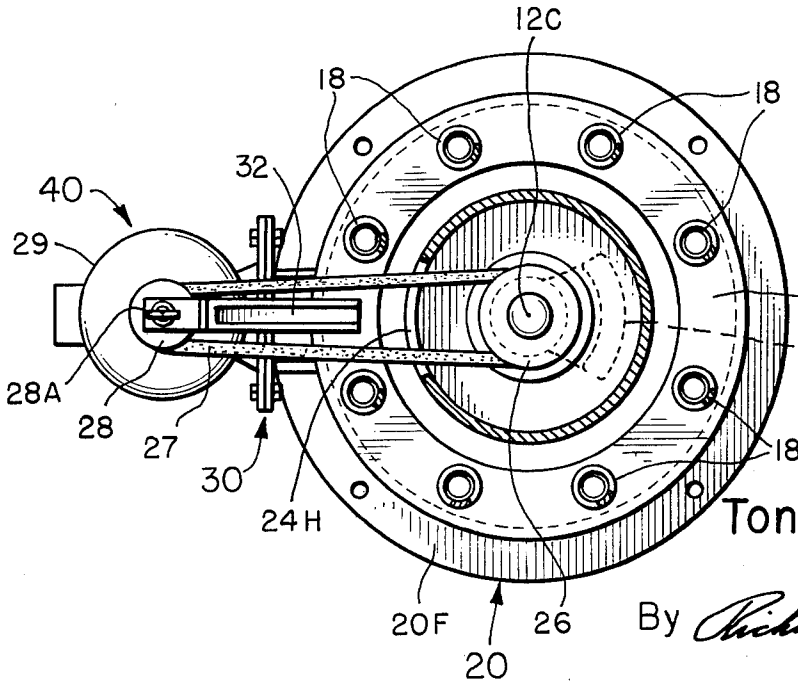


FIG. 2

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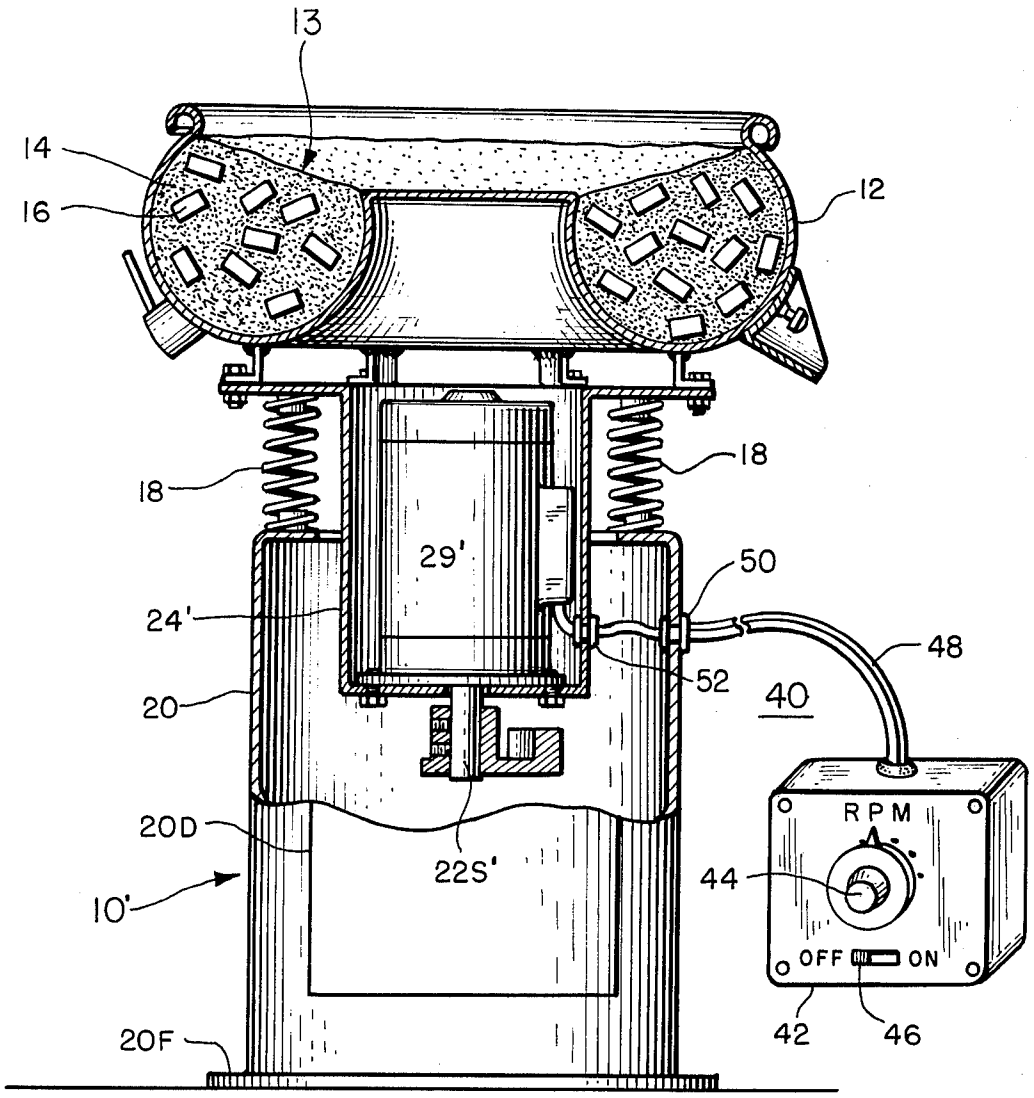

FIG. 3

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VIBRATORY FINISHING MACHINE

This is a continuation, of application Ser. No. 172,482 filed 8/17/71 now abandoned.

BACKGROUND OF THE INVENTION

The present invention is directed toward an improvement in vibratory machines of the type employed for deburring and finishing of parts and other uses.

The present invention employs less parts and, more significantly, less moving parts than conventional commercial machines and also achieves lower external vibration with less internal wear. Prior such machines employed a either plurality of rotating masses orbiting about different vertical positions, or employed one or a plurality of orbiting weights at or about the null point or the center of the moving mass.

SUMMARY OF THE INVENTION

A vibratory machine constructed in accordance with the present invention comprises a bowl defining a workload center in which media to be treated is received, means for resiliently mounting the bowl which establishes a null point below the workload center and a vibratory mechanism affixed to the bowl, distinguished by having a sole eccentric mass or weight which mass or weight is orbited at a displacement below the null point greater which the distance than the workload center is above the null point. Means for driving the vibratory mechanism are also provided, which means are preferably adjustable to orbit the eccentric mass or weight continuously over any desired speed of a range of speeds and to thus adapt the machine to different workloads without requiring any alteration in the weight.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with the further advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in the several figures of which like reference numerals identify like elements, and in which:

FIG. **1** is a side view, partially in section and with parts broken away to show interior parts, of a vibratory machine constructed in accordance with the present invention;

FIG. **2** is a plane view of the machine of FIG. **1** as seen from the plane **2–2** of that figure, looking in the direction of the arrows; and

FIG. **3** is a side view, similar to that of FIG. **1**, of an alternative embodiment of the invention.

DETAILED DESCRIPTION

Referring to FIG. **1**, there is depicted an improved vibratory machine constructed in accordance with the present invention and generally designated by the numeral **10.** The vibratory machine **10** has a hollow toroidally shaped bowl **12** which is open to the top to receive and hold a workload **13** to be vibrated. The workload **13** may be, as shown, deburring media **14** and work pieces **16.** Those familiar with this general type of vibratory machine will recognize that the machine **10** may be used with work load of numerous other types depending upon the end desired to be accomplished. Thus, this type of machine may be used for descaling,

deburring, radiusing, honing and burnishing as well as screening and grinding. As this is well known in the art, no further detailing will be here undertaken, it being understood that the term "workload" here and in the appended claims encompasses such loads.

The bowl **12** is affixed by means of legs **17** and bolts **17B** to a horizontal circular flange plate **19.** The underside of the plate **19** has seatings for and receives spiral or coil springs **18.** As better shown in FIG. **2,** there are eight such springs **18** spaced at equal separations around the circular flange plate **19.** The bottoms of the springs **18** are seated on a horizontal internal rim **20R** of the machine's base **20.** The base **20** includes an outward rim flange **20F** for seating on a flat surface which may be provided with bolt-receiving holes although it has been found that, because of the novel vibratory mechanism hereinafter explained, this is unnecessary as the machine does not normally tend to move about even under a full load and high speed. The base **20** may also be provided with a door **20D** for servicing the interior parts.

The bowl **12** is thus spring or resiliently mounted or supported on the base **20.** The springs **18** are arranged such that they define an approximately horizontal null plane **18P.** At the center of the bowl **12** and the springs **18** is an approximately vertical axis **12C** and at or about the interception of this axis **12C** and the plane **18P** is the vibratory null point which is also the approximate center of gravity of the entire spring mass. The bowl **12** contains a center of volume or center of mass for its workload **13,** which is designated **13C** and is above the plane **18P.** These planes and points are, of course, during vibration moving and thus, e.g., to say that the null point is at the interception of axis **12C** and the center plane of the springs is only approximately true, as the true null point will tend to move about this point depending upon various factors such as the weight of the workload and variations of mechanical tolerances. But for any practical machine, this point is known or determinable to engineering tolerances by those skilled in this art.

The distance between the work load center **13C** and the plane **18P** including the null point is defined in FIG. **1** as *d.*

In accordance with the present invention, the machine **10** is provided with a vibratory mechanism **22** which includes a single eccentric mass or weight **22M** for orbiting about the axis **12C** in a generally horizontal plane and which mass or weight is rigidly coupled to the bowl **12** located a critical distance D from the null point which distance is related to the distance *d* by the algebraic relation:

$$D/d > 1 \qquad (1)$$

That is the distance D is greater than the distance *d.* Applicant has found that this ratio may range up to five, but for greater values than this the machine tends to become unstable and requires greater mass or firm affixing of the base. Thus the formula (1) may, be rewritten for most practical machines as:

$$6 > D/d > 1 \qquad (2)$$

The present inventor has discovered that this construction yields good vibratory results on the workload **13** with low external vibration, while employing a minimum of moving parts.

In more detail, the particular mechanism **22** of the embodiment of FIGS. **1** and **2** includes a vertical shaft **22S** one end of which is affixed to the mass or weight **22M** to rotate it and the other end of which is affixed to a variable diameter pully **26.** The shaft **22S** is mounted in a pair of bearings **22B** which are between the pully **26** and the mass **22M.** The bearings **22B** are seated at the top and bottom of a vertical tube **22T** that surrounds the central portion of the shaft **22S** and thus has a central axis coincident with the axis **12C.**

At the vertical middle of the tube **22T,** it is welded at **22W** to a horizontal annular plate **23** which is formed intricately with the bottom edge of a larger vertically disposed drum segment **24** whose upper edge is similarly formed with the interior rim of the plate **19.**

In this manner the mass **22M** and the vibratory mechanism **22,** are rigidly coupled (through the plates **23,** drum **24,** plate **19** and legs **17**) to the bowl **12** to impart motion to the workload **13.**

Means **40** for rotating the shaft **22** are provided by a variable speed belt drive system, which includes a spring loaded variable pitch pulley **26,** mounted on the shaft **22S,** a pulley belt **27** and a manually adjustable variable pitch pulley **28.**

The mass **22M** and the shaft **22S** are rotatable over an infinitive variable range of speeds by means of the pulley system's manually adjustable pulley **28** which driven from an electric motor **29.** The motor **29** is bolted at **30** to the housing **20** and the pulley belt is horizontally (at plane **18P**) disposed through an opening **24H** through the side of drum **24.** The pulley **28** manual adjustment **28A** is also mounted to the base **20** via a standard **32** affixed to the plate **19** and extending upward through the belt **27.**

It should be noted that the pulley **26** turns about the null point and thus allows the moving spring mass and the fixed motor **29** to be effectively coupled. The motor **29,** pulley **28,** control **28A,** belt **27** and pulley **26** comprise one means for rotating the mass or weight **22M** at any selected speed within the range of speeds.

However, the shaft **22S** and mass or weight **22M** may be rotated by any convenient means, and may itself be the rotor of an electric motor.

Referring to FIG. **3** there is depicted another embodiment of the invention, generally **10'**, which this means **40** is an electric motor **29'** mounted rigidly to the sprung bowl **12** whose rotor **22S'** serves as the shaft **22S.** The motor **29'** is selectively variable in speed from a control console **42** which includes a speed selector dial **44** and an on-off switch **46.** The console **42** is connected to motor **29'** by means of a flexible insulated cable **48** which passes through a rubber bushing **50** into the housing **20** and through a second bushing **52** through the wall of the drum **24'.**

The speed control may be either of the inverter type, or rheostat type as is well known in the art.

Except for the alternative means **40** and the consequential elimination of the pulley system and its opening **24H** and mountings, the machine **10'** of FIG. **3** is identical to that of FIGS. **1** and **2.**

An operational machine **10** has been constructed and tested which provided excellent performance. For purposes of completeness in this disclosure but not for limitation, this particular machine will be hereafter described in detail. Those skilled in this art will realize that this is illustrative only and that many alternatives and equivalents may be employed without departing from the herein described invention.

This particular machine has a capacity of 1.5 cubic feet of workload having a total outer dimension of 24 inches and inner dimension of eight inches and a height of eight inches. The center of its workload was located approximately seven inches above the plane **18P** and its mass **22M** was 14 inches below that plane. The mass **22M** weighed two and a half pounds and had approximate center at a radius of four inches from the center of the shaft **22S.** The pulley **28** was a Maurey 6400M, the pulley belt **27** was 36 inches long (A–36 V belt) and the pulley **26** was Maurey 6400. The motor **29** was a one h.p., a.c., single phase (Reliance Electric Co.). With this arrangement a rotational speed range for the shaft and mass **22M** from 950 rpm to 2500 rpm was achieved. The springs were made of 5/16 inch diameter spring steel, five inches in height (unloaded) coiled in approximately seven turns of an approximate diameter of two inches. The bowl was constructed of 11 gage steel and the base of ¼ inch steel plate.

Although for definiteness of this disclosure this one size of machine was detailed, it should be noted that the invention may be employed in other size machines. Indeed, it is the intent of the present inventor to use the invention in 5, 10, 20 and 40 cubic feet capacity machines. Also, although here depicted with a circular arcing (in cross section) bowl, other shapes may be employed, e.g., those having vertical external side walls.

While particular embodiments of the invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. In a vibratory finishing machine of the type having a bowl into which a workload may be charged for being subject to continuous vibration, the bowl having a workload center, and which machine includes a base to which a sprung mass including at least the bowl, is resiliently supported such that a vibratory null point is defined a distance below the workload center, the improvement comprising:

a vibratory mechanism coupled to the bowl and comprising only a single rotatable eccentric mass or weight mounted for rotation about a point which center of rotation is located at a distance below the null point, which distance is greater than said distance between the workload center and the null point; and

means for rotating said eccentric mass or weight.

2. The invention of claim **1,** wherein:

said rotating means is selectively variable to rotate said eccentric mass (**22M**) at different rotational speeds.

3. The invention of claim **1,** wherein:

said vibratory mechanism includes a generally vertical shaft (**22S**) having one end affixed to said mass (**22M**) said shaft being journaled in bearings (**22B**) to a housing (**22T, 23**) rigidly affixed to the bowl (**12**).

4. The invention of claim 3, wherein:
said rotating means includes:
a motor (29) mounted to the base;
a drive pulley (28) coupled to said motor and driven thereby;
a driven pulley (26) coupled to said shaft for turning it and positioned approximately at the null point; and
a pulley belt connecting the drive pulley and driven pulley.

5. The invention of claim 3, wherein:
said rotating means includes:
a motor (29') rigidly mounted to the bowl (12) and having its rotor coupled to rotate said mass.

6. The invention of claim 5, wherein:
said motor is controlled by means (42) for varying its speed mounted off of the sprung mass, and coupled thereto by means of a flexible cable (48).

7. The invention as defined in claim 1, wherein:
said vibratory mechanism is part of the sprung mass and is rigidly coupled to said bowl to impart movement to it and its workload content;
the null point, workload center and center of rotation of said mass lie approximately along the same approximately vertical axis; and
said eccentric mass is mounted for rotation about said axis.

8. The invention of claim 7, wherein the ratio between the distance (d) from the null point to the workload center and the distance (D) from the null point to the center of rotation of said rotatable eccentric mass (22M) is in the range between 1 and 6.

9. The invention of claim 8, wherein:
said vibratory mechanism includes a generally vertical shaft (22S) having one end affixed to said eccentric mass (22M) said shaft being journaled in bearings (22B) to a housing (22T, 23) rigidly affixed to the bowl (12); and
said rotating means includes:
a motor (29) mounted to the base:
a drive pulley (28) coupled to said motor and driven thereby;
a driven pulley (26) coupled to said shaft for turning it and positioned approximately at the null point;
a pulley belt connecting the drive pulley and driven pulley; and
said rotating means is selectively variable at infinitely small increments over a range of speeds by means of having said drive pulley of the manually variable effective diameter type.

10. The invention of claim 8, wherein:
said vibratory mechanism includes a generally vertical shaft (22S) having one end affixed to said mass (22M) said shaft being journaled in bearings (22B) to a housing (22T, 23) rigidly affixed to the bowl (12);
said rotating means includes:
a motor (29') rigidly mounted to the bowl (12) and having its rotor coupled to rotate said mass; and
said motor is controlled by means (42) for varying its speed mounted off of the spring mass, and coupled thereto by means of a flexible cable (48).

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