

May 26, 1964

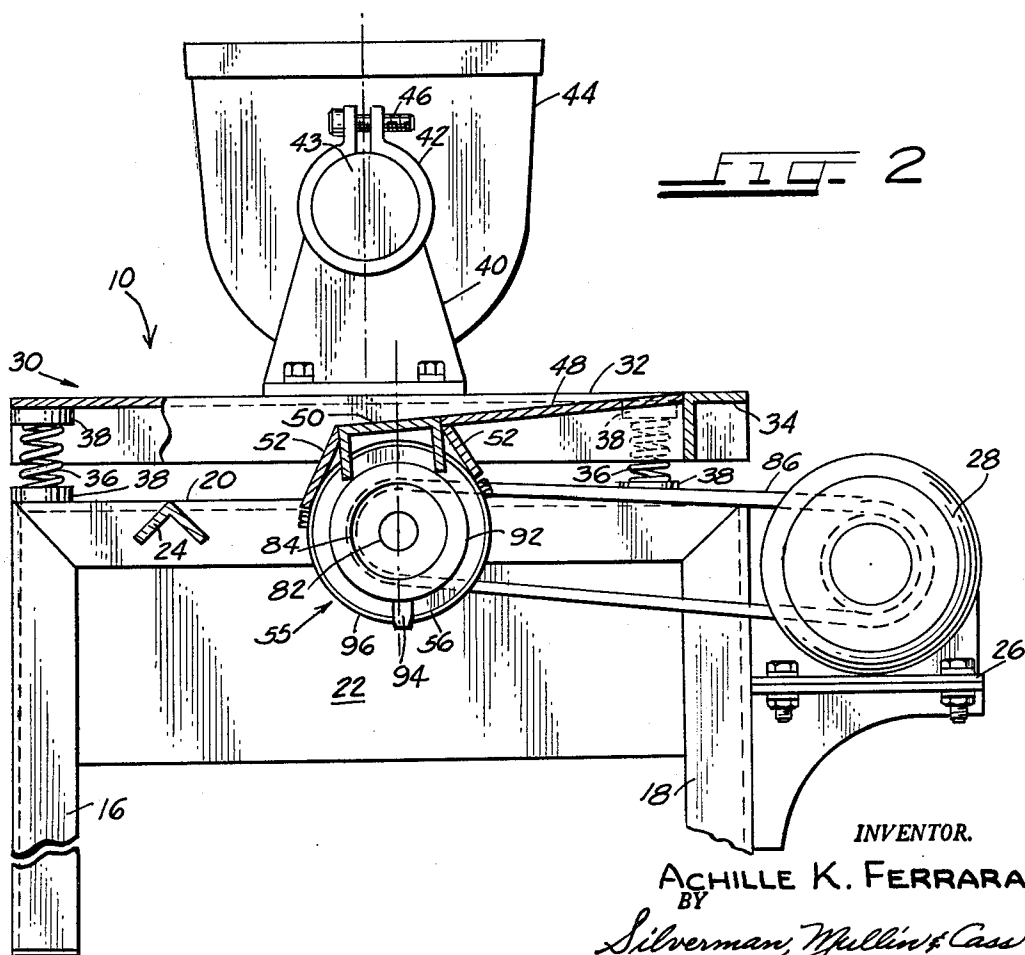
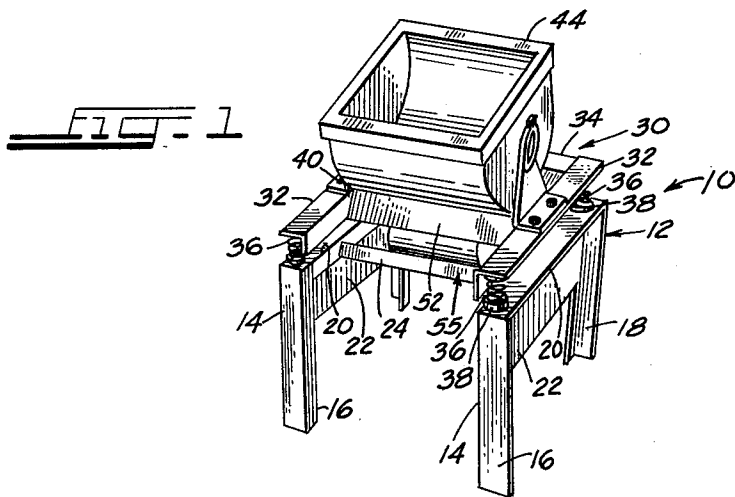
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3,134,207

VIBRATORY FINISHING MACHINE

Filed Oct. 5, 1961

2 Sheets-Sheet 1



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FIG. 3

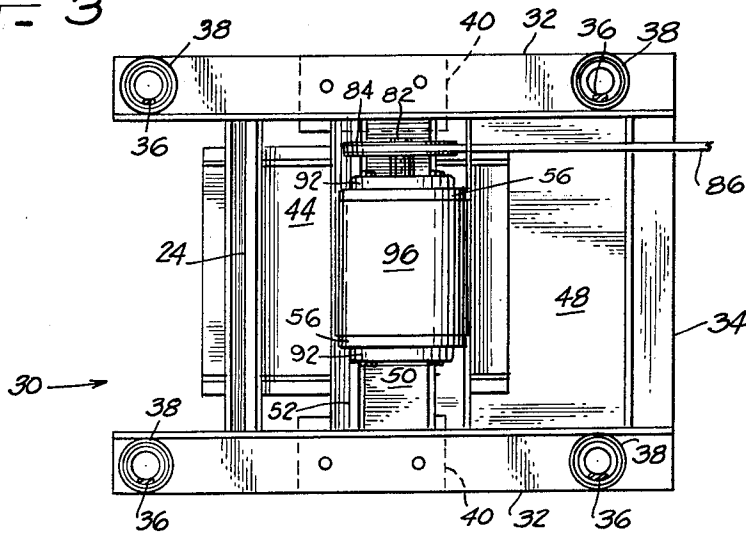


FIG. 4

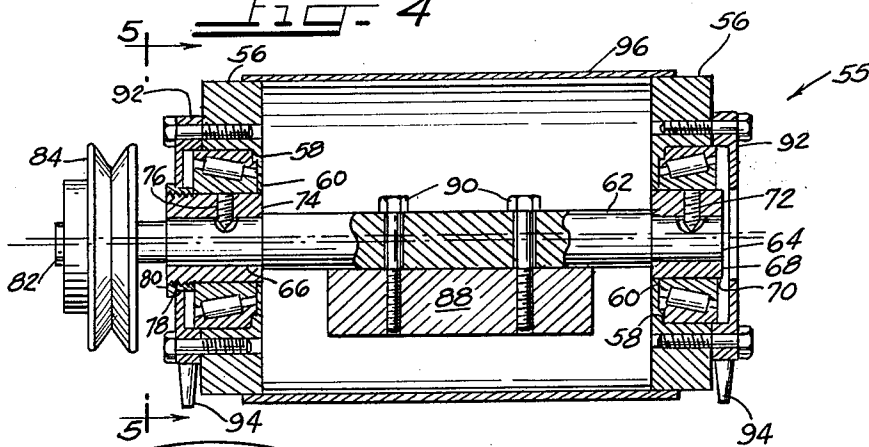
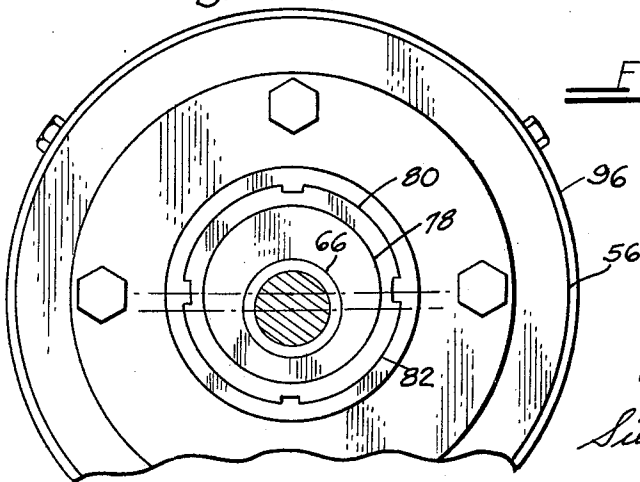


FIG. 5



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VIBRATORY FINISHING MACHINE

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9 Claims. (Cl. 51-163)

This invention relates generally to improvements in vibratory machines of the type which are used for various finishing operations such as polishing, deburring, burnishing, degreasing, and the like. More particularly, the invention relates to a vibratory machine of greatly simplified construction wherein the vibratory motion may nonetheless be controlled with a high degree of precision.

In recent years, vibrating machines have become increasingly popular and important in the manufacture of a multitude of metallic articles, said machines being advantageously employed to polish, deburr, burnish, degrease, or otherwise finish the articles. In general, such vibrating machines comprise a drum having a vibrating mechanism connected thereto, and in a typical operation, a substantial number of the particular articles to be finished is placed in the drum along with a suitable polishing media. The polishing media may comprise any suitable abrasive agent such as granite, aluminum oxide, sand, chipped marble, steel balls, detergents, etc. When the vibrating mechanism is operated, the mixture of media and articles is agitated within the drum, resulting in a rubbing action which polishes or otherwise finishes the articles.

Although numerous vibratory machines have heretofore been provided, the same were nonetheless characterized by a variety of disadvantageous features. Thus, for example, in certain of the prior machines, the motion of the mixture within the drum was so violent that scratching, nicking, denting or other damage often resulted to the articles. In other devices, the motion was so placid that even if it were possible eventually to obtain a desired finish, the time required for the operation was prohibitive. Similarly, the motion was often uneven so that uniformity of finish among the mass of articles was seldom achieved. In the latter regard, it has been determined that the most efficient finishing is obtained when the entire mixture of articles and media is caused to revolve circularly within the drum.

It is, therefore, an important object of this invention to provide a vibratory finishing machine in which a positive revolving action of the mixture of articles and media is achieved simultaneously with the vibratory action.

Another important object is to afford a vibratory finishing machine of the character described in which the vibratory action is sufficient to maintain the desired positive revolving action described, but is nonetheless desirably gentle and capable of being controlled with high precision. To achieve this object, the drum is rigidly mounted on a spring-supported free-floating table, and the vibratory mechanism is located beneath the table with its central axis somewhat displaced from the center axis of the drum.

A further object is to provide a vibratory finishing machine of the character described in which the amplitude of vibration of the vibratory mechanism may be readily adjusted to fit the requirements of any particular finishing operation.

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Among other disadvantages of the prior vibratory machines was the fact that their operation resulted in great amounts of noise and vibration which were transmitted to the surrounding supporting structures. Frequently, expensive and permanent shock and sound absorbent mounting had to be employed in an effort to reduce the noise and vibration to a tolerable level. Even where such special mounting beds were not required, the machine still required permanent anchoring to the floor or other supporting structure. In addition, the prior machines generally were quite large, heavy, expensive and complicated in structure and operation.

Another important object, therefore, is to provide a vibratory finishing machine of the character described whose operation produces an absolute minimum of noise and vibration.

A further object is to afford a vibratory finishing machine of the character described which is extremely lightweight and capable of being made in small sizes which are completely portable. Such small machines thus may be moved readily from place to place and, if desired, used as bench machines.

Still another object is to provide a vibratory finishing machine of the character described which requires no permanent anchoring to the floor or other supporting surface, so that the same simply may be removably placed upon such supporting surface.

Yet another object is to afford a vibratory finishing machine of the character described which requires no special shock absorbent mounting beds or the like.

Still a further object is to provide a vibratory finishing machine of the character described which is greatly simplified in construction to insure trouble-free operation. A related object is to provide such a vibratory finishing machine in which maintenance or repair, when required may be performed quickly and readily.

Yet a further object is to afford a vibratory finishing machine of the character described which may be inexpensively fabricated and yet is most durable and efficient for the purposes intended.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel features of construction, arrangement and a combination of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportion, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

For the purpose of facilitating an understanding of my invention, I have illustrated in the accompanying drawings a preferred embodiment thereof, from an inspection of which, when considered in connection with the following description, my invention, its mode of construction, assembly and operation, and many of its advantages should be readily understood and appreciated.

Referring to the drawings in which the same characters of reference are employed to indicate corresponding or similar parts throughout the several figures of the drawings:

FIG. 1 is a perspective view of an improved vibratory finishing machine embodying the principles of the invention;

FIG. 2 is an enlarged fragmentary side elevational view, partially in section, and showing particularly the structure of the table and the relationship of the machine's various parts and specifically showing the displacement of the center axis of the drum with respect to the center axis of the vibratory mechanism;

FIG. 3 is a bottom plan view of the table with the vibrating mechanism and drum connected thereto but with the supporting frame removed therefrom;

FIG. 4 is a longitudinal cross sectional view of the vibrating mechanism; and

FIG. 5 is an enlarged fragmentary end elevational view, partly in section, of the vibrating mechanism taken substantially on the plane of line 5—5 in FIG. 4 and viewed in the direction indicated.

Referring now to FIG. 1 of the drawings, the reference character 10 indicates generally a vibratory finishing machine embodying the principles of the invention. The machine 10 comprises a supporting frame indicated generally by reference numeral 12. Said frame may include a pair of parallel spaced support members such as 14, 14. Each of the support members 14 may be channel-shaped in configuration and include a pair of vertical legs 16 and 18 interconnected by a top horizontal web 20. Reinforcing or bracing plates such as 22 may likewise interconnect the legs 16 and 18 as indicated.

The support members 14, 14 are rigidly connected together in spaced relationship by any suitable means such as an angle bar 24 positioned adjacent the front end of the supporting frame 12 (see FIG. 2). A suitable rigidifying platform 26 may connect together the rear vertical legs 18, 18, and a motor 28 is mounted thereon for driving the vibratory mechanism which will subsequently be described.

Removably mounted on the supporting frame 12 is a vibrating table indicated generally by the numeral 30. The vibrating table 30 comprises a channel-shaped member having a pair of horizontal legs 32, 32 interconnected by a rear web 34. A plurality of coil springs 36 is positioned, one at each corner, between the supporting frame 12 and vibrating table 30 as indicated in FIGS. 1 and 2 of the drawings. It will thus be appreciated that the vibrating table 30 is capable of substantially free and vertical motion with relation to the supporting frame 12. For purposes of retaining the springs 36 in operational position, the bottom surface of the horizontal legs 32 and the top surface of the horizontal webs 20 are provided with a corresponding number of aligned pairs of annular, cup-like spring-retaining collars 38.

Medially secured to the top surfaces of the horizontal legs 32 of the vibrating table 30 is a pair of aligned upright standards 40, 40. Each of the standards 40 is provided at the upper end thereof with an annular split bearing 42. Stub shafts, such as 43, are affixed centrally, one to each of the sidewalls of the drum 44, and the stub shafts 43 are rotatably journaled in the bearings 42 as shown in FIGS. 1 and 2 of the drawings. Threaded locking means, such as the bolts 46, are provided for locking the drum 44 in any desired position. Thus, for example, the drum 44 may be locked in the upright position of FIG. 2 for an operational cycle, and then upon completion of the cycle, the drum may be pivoted or tilted forwardly to empty the contents thereof. In smaller machines, where the tilting feature is not important, other type standard mountings may be utilized.

Turning to FIGS. 2 and 3 of the drawings, it will be seen that a plate 48 is secured to the rear web 34 of the vibrating table 30 and extends downwardly toward the center of the machine. The plate 48 is likewise secured to the horizontal legs 32 of the table 30 so that the same extends therebetween. Secured to the free end of the plate 48 is a channel-shaped bridge 50 and a pair of outwardly and downwardly tapering rigidifying flanges 52, 52 is welded or otherwise secured to said bridge.

Both the bridge 50 and the flanges 52 are likewise connected to the horizontal legs 32 and extend therebetween.

Dependingly secured to the bridge 50 and flanges 52 is a vibrating mechanism indicated generally by the numeral 55, and which will be described with particular reference being had to FIGS. 4 and 5 of the drawings. The vibrating mechanism 55 comprises a pair of circular end plates 56, 56 which are rigidly secured to the bridge 50 and flanges 52 as by welding, or the like. In order to accommodate the end plates 56, the bridge 50 is provided with suitable notches (not shown). Each of the end plates 56 is formed with a central bore 58 in which is nicely fitted a roller bearing, such as 60.

A vibrating shaft 62 is rotatably journaled through the bearings 60. The vibrating shaft 62 is provided with reduced diameter stubs or shafts 64 and 66 at opposite ends thereof. Removably secured on the stub 64 is an eccentric collar 68 having an annular flange 70 for retaining the associated bearing 60. The eccentric collar 68 is removably secured to the stub 64 by any suitable means such as the set screw 72, for reasons which will become apparent as the description proceeds.

An eccentric collar 74 of identical eccentricity with the eccentric collar 68 is removably secured to the stub 66 by means of a set screw 76. It will be noted, however, that the eccentric collar 74 is of uniform diameter so that the same does not have a flange comparable to the annular flange 70 of the eccentric collar 68. The eccentric collar 74 instead is provided with a threaded portion 78, and a locking nut 80 is screwed on said threaded portion. The locking nut 80 retains the associated bearing 60 in operational position and serves a second function which subsequently will be described.

The stub 66 terminates outwardly in a further reduced diameter drive shaft 82 which is suitably coupled to a pulley 84, said pulley being in turn coupled to the motor 28 by means of an endless drive belt 86 (see FIG. 2). Eccentric counterweights such as 88, of a suitable weight corresponding to the amount of eccentricity between the vibrating shaft 62 and the eccentric collars 68 and 74, are attached to said vibrating shaft by means of bolts such as 90. End covers such as 92, each having a grease fitting such as 94, may be bolted to the end plates 56 to afford a lubricating seal for the bearings 60. To complete the vibrating mechanism 55, a cut-out cylindrical casing 96 may be bolted to the end plates 56 for purposes of encasing the entire unit.

In operation, rotation of the vibrating shaft 62 causes a vibratory motion to be transmitted through the bearings 60 and end plates 56 directly to the vibrating table 30 and drum 44 mounted thereon. Upon starting up of the motor 28, vibratory motion of the table 30 itself upon the springs 36 is discernible. However, it is most important to note that the longitudinal axis of the vibrating shaft 62 is offset from the central axis of the drum 44, and that both of these members occupy an off-center position with relation to the table 30 (see FIG. 2). As a result of this novel positioning of the vibrating mechanism 55 in relation to the drum 44, the vibratory motion is soon transmitted substantially exclusively to the mixture of articles and polishing media within the drum. The mixture thus assumes a most desirable vertically circular and gentle path of motion. Since all vibratory motion is limited substantially exclusively to the mixture within the drum, all other extraneous and undesirable vibration of the various parts of the machine is eliminated. It thus will be appreciated that the machine does not require anchoring to the supporting floor, and that virtually all noisy vibration which would otherwise be transmitted to the floor is eliminated.

The total salutary effect of the described out-of-alignment relationship between the vibrating shaft 62 and the center axis of the drum may best be appreciated by observing the phenomena which occur in machines of this type. A mixture of articles and polishing media

necessarily comprises a fluid or shiftable mass. Thus, when such a mass is positioned in the drum 44 at rest, the mass has a natural tendency to flow and rest evenly on the bottom surfaces of the drum. In this condition of rest, the center of gravity of the mass is coincident with the center axis of the drum. However, when the vibrating mechanism is operated, the fluid mass has a tendency to flow or build up toward the back wall of the drum (to the right as viewed in FIG. 2 of the drawings). When the mass is so positioned, the center of gravity thereof is of course shifted toward the back of the drum and away from the center axis thereof. In this condition, a centrally positioned vibrating mechanism loses its mass-vibrating efficiency and in fact tends to produce uneven gyratory motion and troublesome vibrations and noises in the entire machine. However, the off-center positioning of the vibrating shaft 62 compensates for this problem by positioning the center of the vibratory energy at the approximate center of gravity of the shifted mass during operation of the machine. As a result, a most efficient, even, localized and gentle vibratory motion of the mass alone is obtained, with vibration of the frame and supporting structure reduced to a minimum. Moreover, the operational stresses and requirements of the motor, mechanism and entire machine are desirably kept to a minimum.

When it is desired to repair the vibrating mechanism 55 or change the amplitude of vibration to suit a particular finishing operation, the same may be simply achieved in the following manner. The casing 96 and counterweights 88 are removed by removing the appropriate bolts. If the locking nut 80 is now unscrewed from the collar 74, the entire vibrating shaft 62 may be removed as a unit from the end plates 56 by pulling the same outwardly to the right as viewed in FIG. 4 of the drawings. The vibrating shaft 62 may now be replaced by a new shaft of identical structure, or by a new shaft bearing a matched pair of eccentric collars 68 and 74 having a greater or lesser degree of eccentricity. Similarly, if it is desired to change the amplitude of vibration while using the same vibrating shaft 62, it is necessary simply to remove the eccentric collars 68 and 74 therefrom by means of the set screws 72 and 76, and then attach a new pair of eccentric collars having the desired degree of eccentricity. Where the degree of eccentricity is changed, it will be necessary, of course, to correspondingly change the counterweights 88.

From the foregoing description and drawings, it should be apparent without further description that I have provided a novel vibratory finishing machine of greatly simplified construction and operation. The novel off-set relationship of the vibrating mechanism to the drum, coupled with the spring-supported free floating mounting of the vibrating table, results in a gentle and efficient vibratory motion which is limited substantially exclusively to the mixture within the drum. Undesirable vibration and noise is thus eliminated so that the machine may be made portable for un-anchored positioning wherever desired. The vibrating shaft may be readily removed as a unit so that servicing or adjustment of the amplitude of vibration may easily and quickly be accomplished. The ready interchangeability of the eccentric collars on the vibrating shaft permits the finishing operation to be controlled with a high degree of precision, and in this regard, the machine may likewise employ a variable speed motor.

It is believed that my invention, its mode of construction and assembly, and many of its advantages should be readily understood from the foregoing without further description, and it should also be manifest that while a preferred embodiment of the invention has been shown and described for illustrative purposes, the structural details are nevertheless capable of wide variation within the purview of my invention as defined in the appended claims.

What I claim and desire to secure by Letters Patent of the United States is:

1. A vibratory machine comprising a frame, a vibrating table removably and resiliently mounted on said frame, a drum rigidly mounted on said vibrating table, and a vibrating mechanism including an eccentrically journaled vibrating shaft rigidly secured to said vibrating table in depending relation therewith, the longitudinal axis of said shaft being slightly displaced horizontally from the center axis of said drum, said vibrating mechanism comprising a pair of end plates rigidly secured to said vibrating table, each of said end plates being formed with a central bore therethrough, and annular bearings positioned in said central bores, said vibrating shaft being journaled in said bearings whereby the vibratory motion thereof is transmitted directly through said bearings, end plates, vibrating table, and drum to a material positioned in said drum.

2. The vibratory machine of claim 1 in which said vibrating shaft includes a reduced diameter stub shaft at opposite ends thereof, and a pair of eccentric collars of matched eccentricity removably mounted one on each side of said stub shafts whereby said collars may be readily removed and replaced.

3. The vibratory machine of claim 2 in which one of said eccentric collars is provided with an annular flange for retaining its associated bearing, the other of said eccentric collars being formed with an externally threaded portion, and a locking nut removably mounted on said threaded portion whereby said vibrating shaft is removable from said end plates as a unit.

4. The vibratory machine of claim 3 in which a counterweight is removably secured to said vibrating shaft.

5. The vibratory mechanism of claim 4 in which a pair of end covers is removably connected to said end plates, said end covers being formed with lubricating fittings and affording lubricating seals for said bearings, and a protective casing is removably positioned over said end plates.

6. A vibratory machine comprising a frame, a vibrating table, a plurality of coil springs positioned between said vibrating table and said frame to removably and resiliently mount said table on said frame whereby said table is capable of substantially free vibratory motion with relation to said frame, a pair of spaced upright standards mounted on said vibrating table, each of said standards having an annular split bearing, a drum, a pair of stub shafts being pivotally journaled in said split bearings, and a vibrating mechanism including an eccentrically journaled vibrating shaft rigidly secured to said vibrating table in depending relation therewith, the longitudinal axis of said shaft being slightly displaced horizontally from the center axis of said drum.

7. The vibratory machine of claim 6 in which threaded locking means is associated with said split bearings for locking said drum in any desired position.

8. A vibratory machine comprising a supporting frame including a pair of spaced horizontal members, a plurality of annular spring-retaining collars on said horizontal members, a coil spring removably positioned in each of said spring-retaining collars, a horizontal vibrating table having a pair of spaced apart side members removably mounted on said coil springs, cooperating annular spring-retaining collars secured to the bottom surface of said side members in aligned relationship to said first mentioned spring-retaining collars, a depending channel-shaped bridge connected to said side members medially of the length thereof, a pair of downwardly tapering rigidifying flanges connected to said bridge, a vibrating mechanism including a pair of circular end plates rigidly secured to said bridge and flanges and a vibrating shaft eccentrically journaled in said end plates, and a drum rigidly mounted atop said vibrating table, the longitudinal axis of said vibrating shaft being slightly offset from the center axis of said drum whereby the vibratory motion of said

vibrating shaft is transmitted substantially exclusively to a material positioned in said drum.

9. A vibratory machine comprising a frame, a vibrating table resiliently mounted on said frame, a drum rigidly mounted on said table and including a front wall and a rear wall, and a vibrating mechanism secured to said table in depending relation therewith, said vibrating mechanism including an eccentrically journalled shaft whose longitudinal axis is horizontally displaced from the center axis of said drum but not beyond the horizontal extremities of said front and rear walls.

References Cited in the file of this patent

UNITED STATES PATENTS

1,901,122	Robins	Mar. 14, 1933	15
1,908,104	Bell	May 9, 1933	
2,009,126	Wettauer	July 23, 1935	
2,222,776	Linke et al.	Nov. 26, 1940	
2,415,993	Cottrell	Feb. 18, 1947	
2,423,019	Haines	June 24, 1947	20

2,469,484
2,555,688
2,728,614
2,757,544
2,771,179
2,809,473
2,819,046
2,928,544
2,964,186
2,973,606
2,977,813
2,997,814
3,020,683
3,037,327
3,045,397
3,073,079

665,523
811,439

Thimon	May 10, 1949
Flam	June 5, 1951
Rink	Dec. 27, 1955
Becker	Aug. 7, 1956
Musschoot	Nov. 20, 1956
Heaphy	Oct. 15, 1957
Jandris	Jan. 7, 1958
Roubal	Mar. 15, 1960
Ferrara	Dec. 13, 1960
Brandt	Mar. 7, 1961
Brandt	Aug. 29, 1961
Brandt	Aug. 29, 1961
Brandt	Feb. 13, 1962
Ferrara	June 5, 1962
Hesslenberg	July 24, 1962
Balz	Jan. 15, 1963

FOREIGN PATENTS

Germany	Sept. 27, 1938
Great Britain	Apr. 8, 1959