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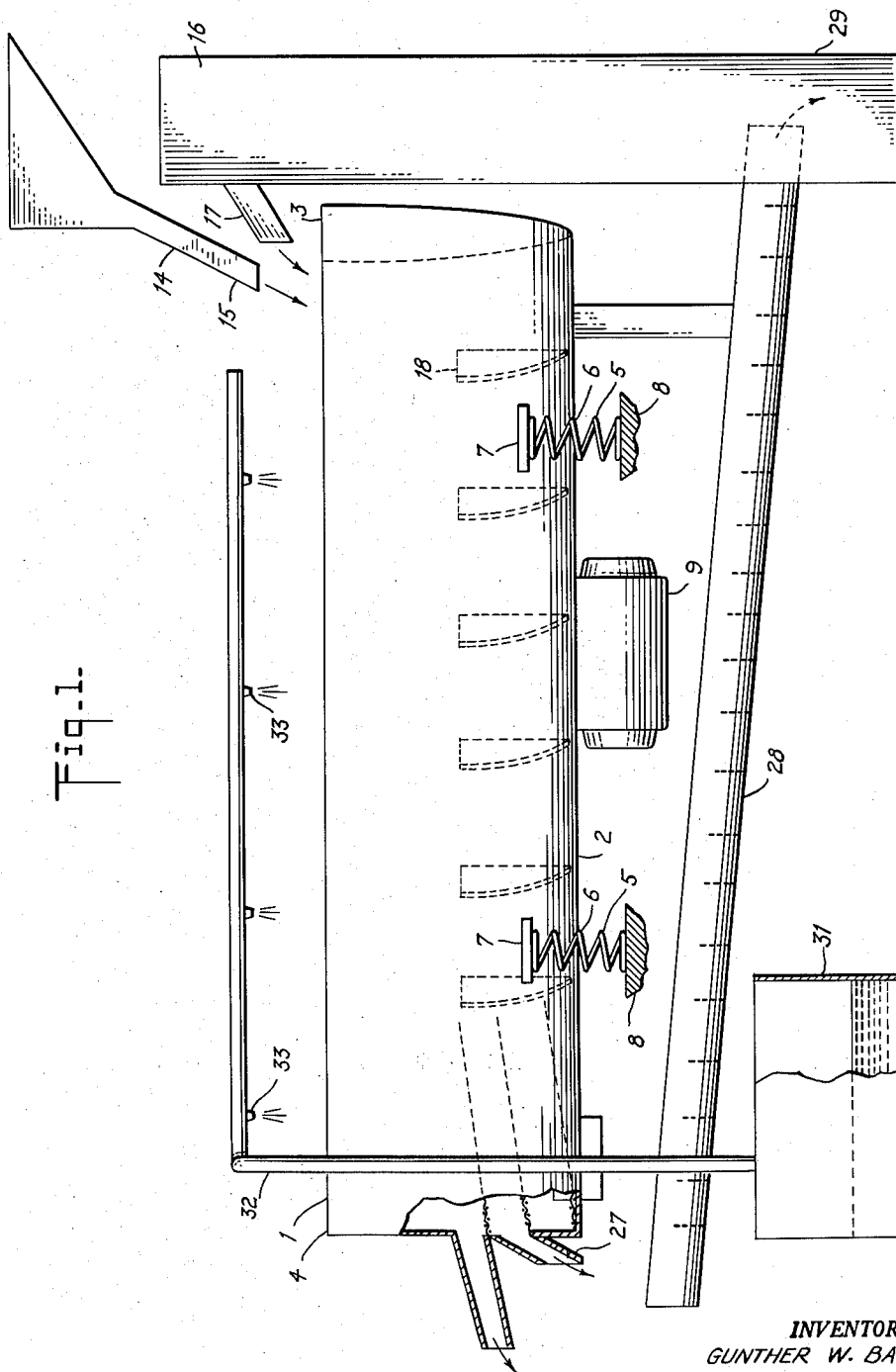
G. W. BALZ

3,071,900

CONTINUOUS FINISHING AND POLISHING MACHINE

Filed Feb. 13, 1961

6 Sheets-Sheet 1



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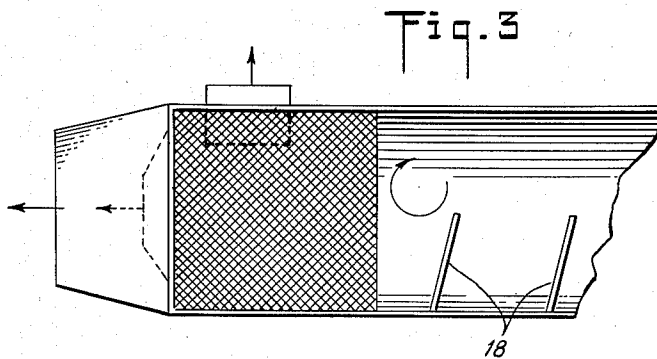
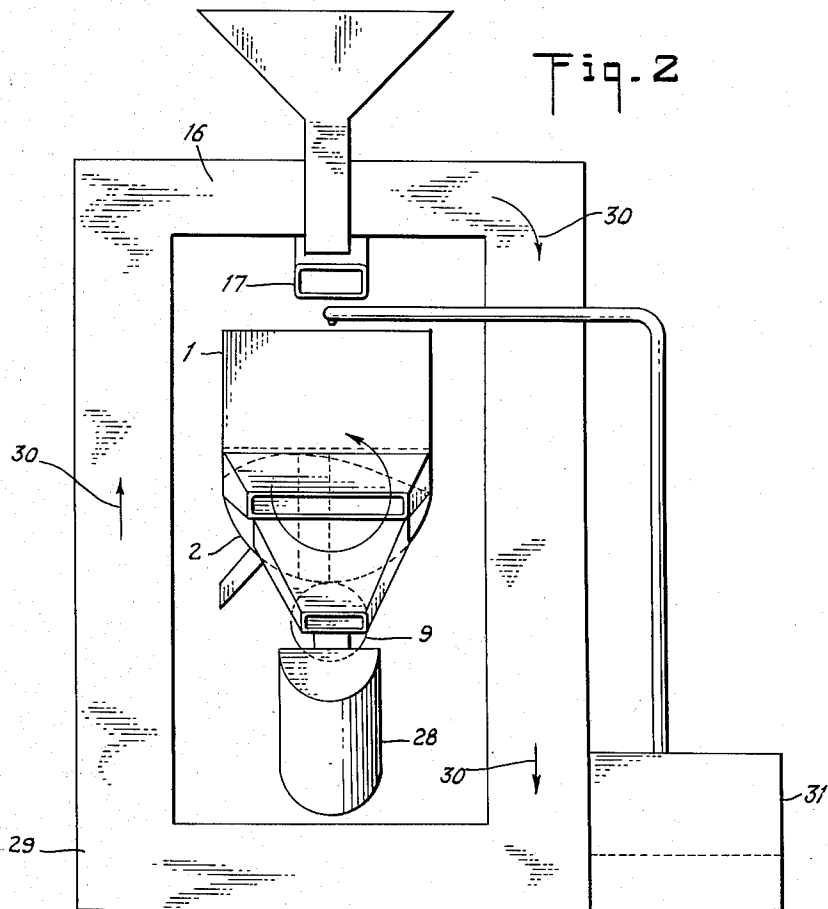
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CONTINUOUS FINISHING AND POLISHING MACHINE

Filed Feb. 13, 1961

6 Sheets-Sheet 2



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CONTINUOUS FINISHING AND POLISHING MACHINE

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Fig. 4

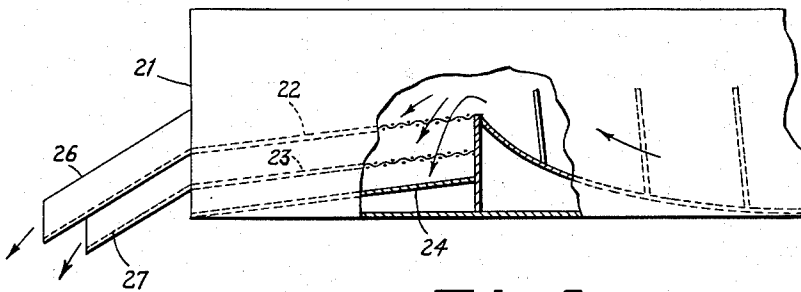


Fig. 5

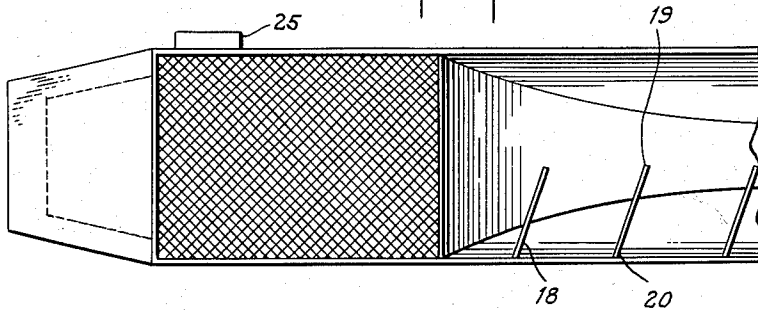
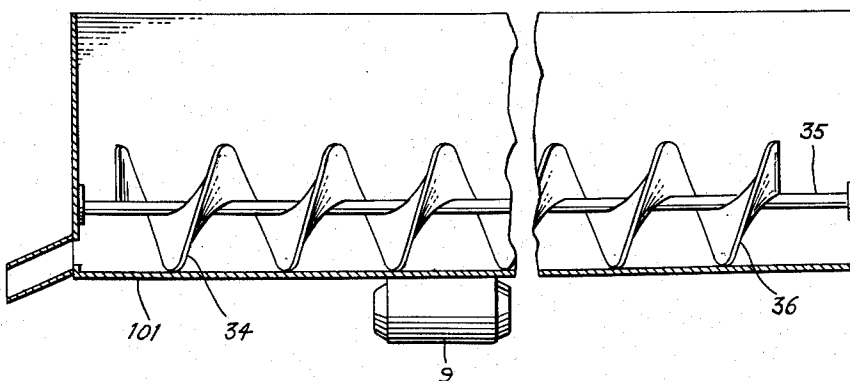


Fig. 6.



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6 Sheets-Sheet 4

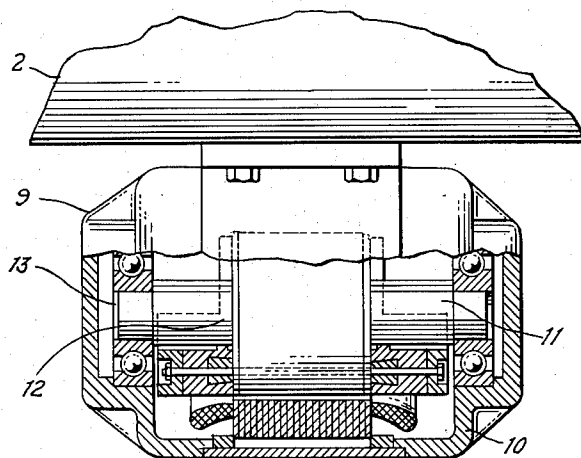


Fig. 7

Fig. 8

Fig. 10

Fig. 12

Fig. 14

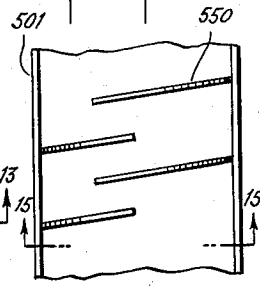
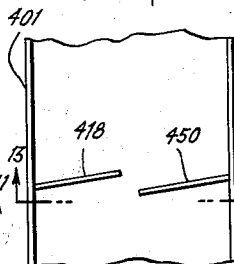
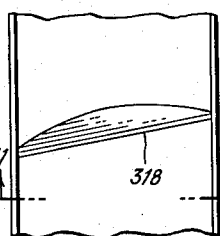
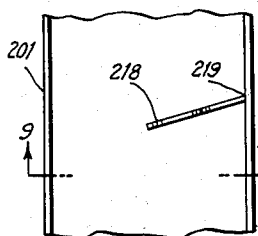
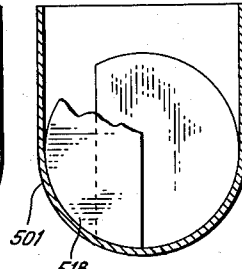
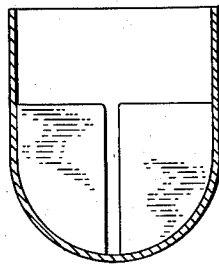
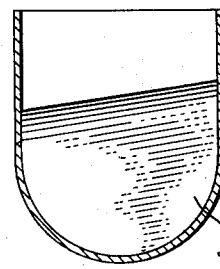
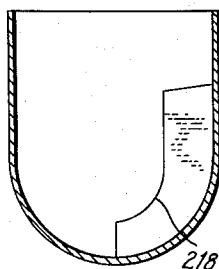


Fig. 9

Fig. 11

Fig. 13

Fig. 15



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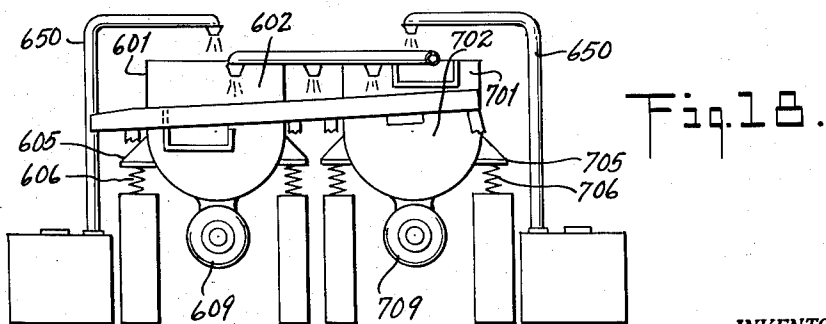
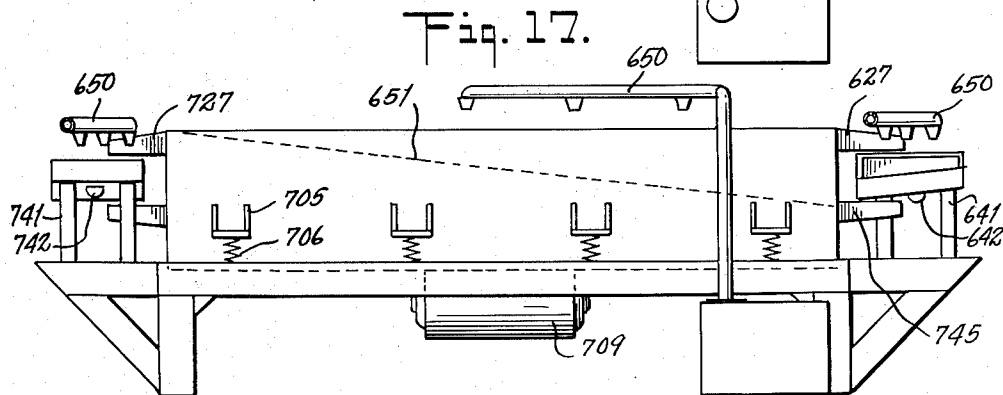
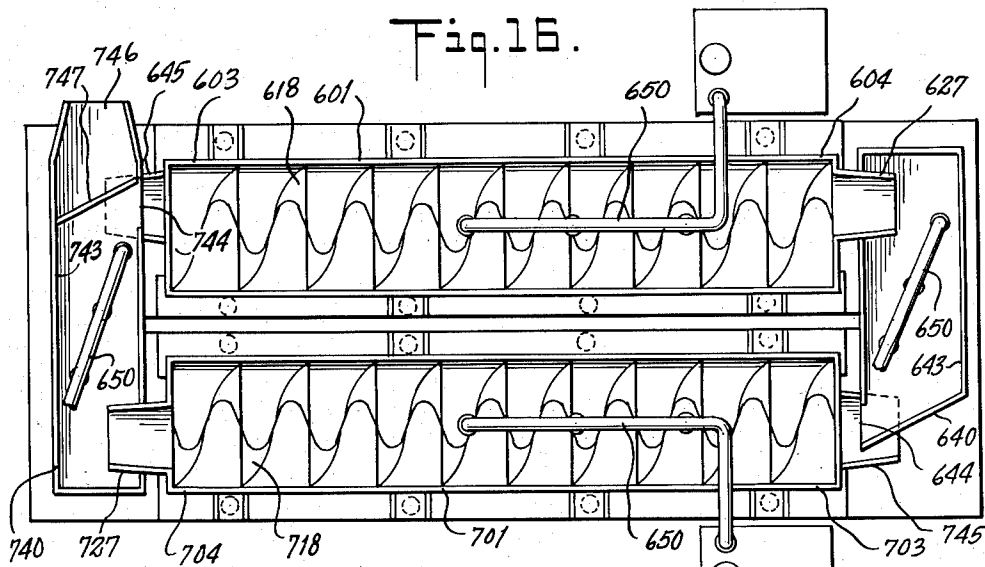
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CONTINUOUS FINISHING AND POLISHING MACHINE

Filed Feb. 13, 1961

6 Sheets-Sheet 5



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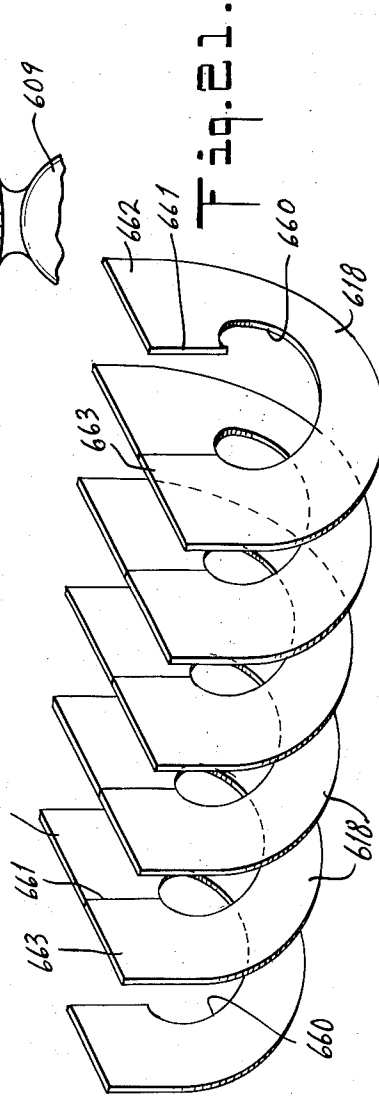
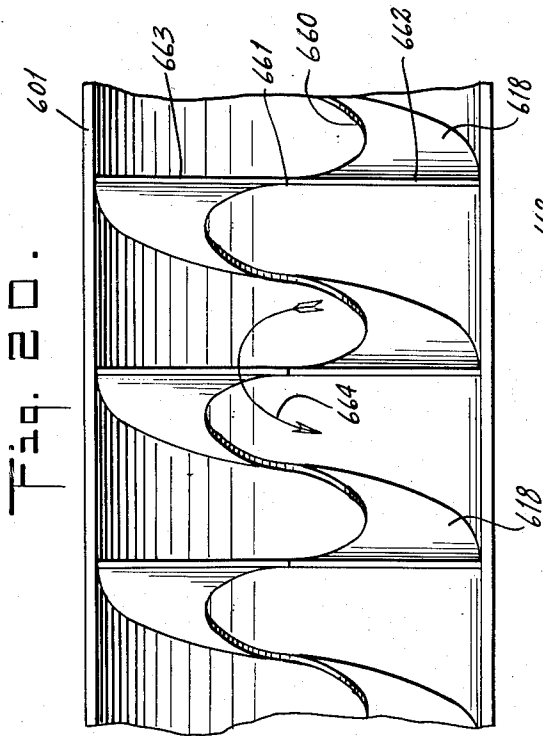
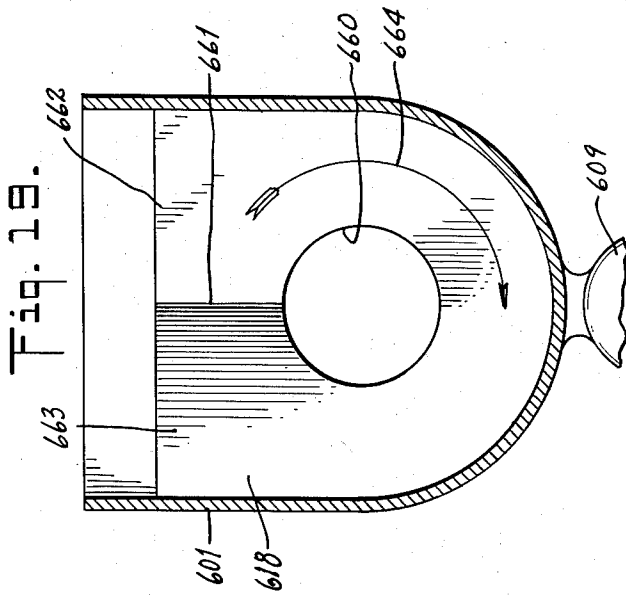
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CONTINUOUS FINISHING AND POLISHING MACHINE

Filed Feb. 13, 1961

6 Sheets-Sheet 6



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CONTINUOUS FINISHING AND POLISHING MACHINE

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Filed Feb. 13, 1961, Ser. No. 88,811
13 Claims. (Cl. 51-163)

This invention relates to cleaning, finishing and polishing machines and particularly to such machines in which the pieces to be finished or polished are deposited in the machine either alone or along with stone chips or other finishing or polishing material. This application is a continuation-in-part of my application Ser. No. 862,901 filed December 30, 1959 for Continuous Finishing and Polishing Machine, now abandoned.

Heretofore, such polishing and finishing have been accomplished in tumbling barrels or in batch machines in which vibrations are imparted to the pieces to be finished or polished and the finishing or polishing material, and in some cases attempts have been made to provide a continuous machine by tilting the container or barrel to provide a gravity feed.

In the present application the apparatus is continuous, the pieces to be finished or polished and the finishing or polishing material being introduced together at one end of the machine. The operation is then carried out and the finished pieces are fed positively and are then discharged from the other end. This is accomplished with a minimum of expenditure of power and easily and simply.

In one form of the invention the parts are so arranged as to provide extreme versatility in treatment with a minimum of parts providing in a single compact piece of equipment in which extreme efficiency can be achieved and in which variation in treatment can be imparted during the cycle of treatment.

In the drawings there is shown a preferred form of the apparatus and other forms which give highly satisfactory results. It is understood that these are merely exemplary of the invention and that the invention is not limited to the specific forms shown.

FIG. 1 is a side elevational view of apparatus embodying the invention;

FIG. 2 is an end view taken from the left end of FIG. 1;

FIG. 3 is a top plan view of the left end of the trough shown in FIGS. 1 and 2;

FIG. 4 is a side view of a different form of discharge end for the trough;

FIG. 5 is a top plan view of FIG. 4;

FIG. 6 is a view in section of another form of trough suitable for use in carrying out the invention;

FIG. 7 is a view of the vibrator employed in carrying out the invention;

FIGS. 8 and 9 are, respectively, a top plan view and an end view of one form of guide suitable for carrying out the invention;

FIGS. 10 and 11 are, respectively, a top plan view and an end view of another form of guide suitable for use in carrying out the invention;

FIGS. 12 and 13 are, respectively, a top plan view and an end view of another form suitable for use in carrying out the invention;

FIGS. 14 and 15 are, respectively, a top plan view and an end view of another form of guide suitable for use in practicing the invention;

FIG. 16 is a top plan view of another form of the invention in which a pair of troughs are disposed in parallel relation to feed in opposite directions with appropriate means for transferring the contents from the

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discharge end of one trough to the other and having means for permitting variations in treatment during the treatment cycle;

FIG. 17 is a side elevation of the machine of FIG. 16; FIG. 18 is an end view of said machine taken from the left end of FIGS. 16 and 17;

FIG. 19 is an end view of the trough showing the form of guiding vane;

FIG. 20 is a top view of a portion of the trough showing further details; and

FIG. 21 is a perspective view of a section of the guide vanes.

The invention consists generally in a finishing or polishing machine having a trough adapted to receive the pieces to be finished or polished and the finishing or polishing material such as stone chips. This trough has a rounded semi-cylindrical bottom and a receiving and a discharge end.

In the preferred form of the invention, a vibrator comprising a motor with a rotor having its axis parallel to the axis of the trough is mounted directly on the trough, and an eccentric weight adapted to impart rotary vibration to said trough and its contents is mounted on the rotor of the motor.

The vibrator comprising the motor and eccentric weight and the trough are supported as a unit on vibrating oscillating mounts which permit vibratory movement of the trough and its contents along with the vibrator.

When vibration is imparted by the motor, a rotary motion generally around the axis of the trough is imparted to the contents of the trough, and a plurality of generally transverse guiding vanes are mounted adjacent the bottom of the trough to cause the contents of the trough to move from the receiving end to the discharge end of the trough. These vanes are disposed at an angle to the axis of the trough and incline toward the discharge end and are disposed so that the contents of the trough in their orbital movement impinge on the side of the vanes which faces the discharge end of the trough. The vanes are thus inclined in a manner similar to screw threads so that a positive feed will be obtained without having to tilt the trough in the direction of desired movement of the pieces during treatment, and in fact the pieces may be fed through a trough, even though they have to be fed upwardly because of inclination of the trough. In fact by inclining the trough upwardly toward the discharge end or by positioning the discharge of the trough at a position above the bottom of the trough or above the level of the contents at the inlet it is possible to control the residence time of the contents of the trough and in the preferred form of the invention this is the usual practice.

Mounted directly on the end of the trough are screening means which are vibrated with the trough. These screening means receive and separate the pieces which have been finished or polished from the finishing or polishing material and also separate the pieces which have been finished or polished and the finishing or polishing material from fines and waste.

In some forms of the invention the means for separating the pieces from the polishing or finishing material will not be an integral part of the machine, and, of course, in cases where no finishing or polishing material is added and where the parts are merely tumbled together for cleaning or polishing purposes, separating means are not necessary.

Means are provided for conveying the finishing or polishing material back to the receiving end of the trough, where it is added to a supply of pieces to be finished and recirculated through the apparatus. The pieces and the finishing or polishing material may be added separately

to the trough, and will be in most instances, so that mixing occurs in the trough.

In one form of the invention two troughs are mounted in parallel relationship for feeding in opposite directions and at the ends means are provided for transferring the contents from one to the other. There may be means for separating the work pieces from the chips or the like and for adding different treating material to the work pieces during the transfer, all of which is described in detail hereafter.

The apparatus itself consists generally of a trough 1 which has a rounded semi-cylindrical bottom 2 and a receiving end 3 and a discharge end 4. This trough is adapted to receive the pieces to be finished or polished and the finishing or polishing material, such as rock chips or other similar abrasive.

The trough extends generally horizontally and is supported for free movement in space on vibration isolating mounts 5, each of which consists of a helical spring 6 bearing against an arm 7 which is secured directly to the trough and resting on a suitable fixed support 8. Generally there are four or more such supports, depending on the length of the trough.

In the preferred form of the invention, a vibrator 9 is mounted directly on the trough 1 to be supported therewith as a unit by the vibration isolating mounts. It consists, as shown in FIG. 7, of a vibratory motor 10 having a rotor 11 and carrying an eccentric weight 12. The eccentric weight 12 is mounted between the bearings, but it will be understood that it might be outboard of the bearings. The rotor is mounted so that its axis 13 extends generally parallel to the axis of the trough 2 so that the rotary vibrations imparted by the motor to the trough and its contents tend to impart a rotary or orbital motion to the contents of the trough around a generally horizontally extending axis, causing said contents to rotate generally about the axis of the trough.

At the receiving end 3 of the trough is a hopper 14 having a discharge 15 adapted to discharge the pieces to be finished or polished into the receiving end of the trough. A hopper 16 having a discharge 17 is provided for discharging the finishing or polishing material into the receiving end of the trough as well.

Within the bottom of the trough are fixed a plurality of guiding vanes 18. In the preferred form of the invention these extend generally transversely of the trough and, as shown in FIGS. 3 and 6, one end 19 of each vane is closer to the discharge end of the trough than the other end 20, so that each vane inclines generally toward the discharge end of the trough.

In the preferred form of the invention, the upstream ends 20 of the vanes are secured to the side walls of the trough while their free ends 19 extend substantially to the center line of the trough. It has been found that with this arrangement, as the pieces or the finishing or polishing material are rotated in the trough, there is a general overall movement from the receiving end to the discharge end.

In order to facilitate continuous operation of the apparatus, screening means indicated generally at 21 are mounted directly on the discharge end of the trough to separate the pieces after finishing from the finishing or polishing material and to separate the finishing or polishing material from the fines or waste. These means consist of an upper screen 22 sized and adapted to hold back the finished pieces while letting the polishing or finishing material through. A second screen 23 below is sized to retain the polishing or finishing material while letting the fines and waste through. The fines and waste pass to a platform 24 and then out through a discharge 25. A discharge 26 leads from the upper screen 22 to conduct the pieces away from the apparatus. A discharge spout 27 conducts the polishing or finishing material away from the trough, and in the preferred form of the invention the trough 27 discharges into a conveyor or trough

28 which carries the finishing material back to a bucket conveyor indicated generally at 29 which picks up the finishing or polishing material in a direction indicated by the arrows 30 in FIG. 2 carrying the material up to the hopper 16 for discharge through the spout 17 back into the trough 1.

Water may be supplied from a tank 31 through pipe 32 to nozzles which discharge into the trough.

In operation of this machine, the pieces to be finished and the finishing or polishing material are discharged into the receiving end 3 of the trough. The vibration of the trough by the vibrator 9 creates a rotary motion around the axis of the trough and as the vibration and rotary movements continue, the parts and polishing material are vibrated and tumbled together, thereby finishing or polishing the pieces and the entire mass is fed from the receiving end of the trough to the discharge end. The vanes may be adjustable to vary the residence time in the trough and the length of treatment and may be of different forms so that they can serve as a screw or helix in discharging the material.

In FIG. 6 another form of guiding vane is shown. This consists generally of a helix or screw 34 which extends axially of the trough 101 which in this case is not provided with the screens, although screens can be used in this form of trough. The helix consists of a central shaft 35 and the thread or guide portion 36 which is disposed adjacent the rounded bottom of the trough and extends axially.

In FIGS. 8 and 9 another form of vane is shown. This vane 218 extends transversely across the bottom of the trough. Both ends are fixed to the sides of the trough 201, which is similar to the trough 1. The upstream end is indicated at 220 and the downstream end at 219.

The vanes shown in FIGS. 8 and 9 are vertical. However, the vanes may slant as shown in FIGS. 10 and 11. Here the vane 318 slants, as can be seen from viewing FIG. 10.

In FIGS. 12 and 13 another form of vane is shown. Here in the trough 401, corresponding to the trough 1, are two vanes, the vane 418 corresponding to the vane 18, while a similar vane 450 extends from the other side of the trough. Both vanes are disposed at an angle and they are parallel. They do not meet at the center line.

In FIGS. 14 and 15 another form of vane is shown. The vanes in the trough 401 which correspond to the trough 1 extend to both sides of the trough. The vanes 518 correspond generally to the vanes 18. The vanes 550 correspond to the vanes 450 of FIGS. 12 and 13, but the inner end of the vanes overlap at the center line of the trough. They are in this case circular in form rather than semi-circular.

All of these vanes accomplish the same end, namely, of providing a continuous feed from the receiving end of the trough to the discharge end, so that a continuous rather than batch treatment may be employed, feeding in pieces of finishing or polishing material as needed, and operating the machine continuously without stopping to remove batches.

The feed is positive and effective and achieves finishing and polishing results which cannot be achieved through merely tilting the trough to cause the material to feed.

In operation of the machine, when it becomes desirable to unload the machine, the motor may be reversed, and when the end of the trough at the inlet is removed the entire machine may be emptied simply and efficiently.

In the form of invention shown in FIGS. 16, 17 and 18 there are one or two horizontal troughs 601 and 701 generally similar to the trough 1 each having a rounded semi-cylindrical bottom, 602 and 702 respectively, and each with its respective inlet or receiving end 603 and 703 and discharge end 604 and 704. These troughs are disposed generally horizontally and parallel to one another in closely spaced relation at the same level but with their

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receiving ends oppositely disposed, each adjacent the discharge end of the other.

Each trough is supported for free movement in space on vibration mounts respectively 605 for the trough 601 and 705 for the trough 701 which are respectively helical or coil springs 606 and 706.

Each trough has mounted directly thereon a vibrator 609 and 709 corresponding to the vibrator 9 of FIG. 1, each consisting of a motor having a rotor and an eccentric weight. The axis of rotation, as in the form of invention shown in FIG. 1, extends parallel to the axis of the trough on which it is mounted so that rotary vibrations imparted by the motor to the trough and its contents to impart an orbital movement to the contents of the trough around a generally horizontally extending axis.

Each trough has a plurality of guide vanes similar to those of FIG. 1 adapted to impart a longitudinal feeding motion or component to the contents of the trough as the trough is vibrated to impart orbital movement to its contents.

The vanes shown are the preferred form since they give complete and positive guidance to the contents of the trough during the operation of the machine. The vanes are in essence a continuous helix comparable to that shown in FIG. 6 but they are produced by joining the sections together which are anchored at the upper portion of the trough.

The vanes 618 and 718 are identical. Each consists of a flat piece of material which may be plastic or sheet metal, which is rounded at its bottom to conform generally with the contour of the bottom of the trough. Each has a central aperture 660 and the material is parted on the line extending upwardly therefrom as indicated at 661, forming two upper portions 662 and 663 which are secured as indicated in FIGS. 16 and 20. The sections 662 and 663 of adjacent sections are butted together so that in essence a continuous complete helix is formed extending from one end to the other of the trough.

By this arrangement it is possible to assure very positive guidance of the parts and contents through the trough since the parts generally tend to move in the outer portion of the orbit of movement of the contents of the trough. Thus, as they are guided through the trough, they are advanced from one turn of the helix to the next as they pass by the guide vanes. By producing these vanes as separate units it is possible to replace any worn section which needs replacement easily and simply.

The general path of movement of the contents of the trough is indicated by the arrow 664 in FIGS. 19 and 20 moving the material from the direction of the inlet end which is at the top of FIG. 20 toward the outlet end which is toward the bottom of FIG. 20.

The discharge end of each trough is more elevated than the bottom of the trough or the level of the contents of the trough at its inlet. The orbital movement of the contents of the trough imparted by the vibrator cooperating with the vanes however causes the contents to feed from the receiving end to the discharge end of each trough.

Means are provided at both ends of the troughs to feed the contents discharged from the outlet end of each trough to the inlet or receiving end of the other trough. The outlet end of each of the troughs 601 and 701 is provided respectively with a discharge spout 627 and 727 which discharges onto a conveyor. That at the discharge end of trough 601 is indicated at 640 and that at the discharge end of 701 is indicated at 740. Each consists of an inclined trough mounted for free movement in space and mounts 641 and 741 and having a suitable vibrator 642, 742.

Said conveyors 640 and 740 each has side walls 643 and 743, respectively.

The conveyor 640 is disposed to receive parts and finishing or polishing material from the spout 627 and inclines toward the trough 701. It has a discharge 644 which dis-

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charges directly into a receiving trough 745 which is mounted directly on and opens into the trough 701.

The conveyor 740 is positioned to receive parts and finishing or polishing material from the spout 727 of trough 701. It slants downwardly toward the trough 601 and has a discharge 744 which is adapted to discharge into inlet spout 645 mounted on trough 601 and opening into the receiving end thereof.

The conveyor 740 also has a discharge 746 from which finished pieces may be discharged and a switch partition 747 which may be positioned as shown in FIG. 17 to direct parts into the trough 601 or which may be positioned to close the discharge 744 to discharge finished parts from the apparatus.

Sprays 650 may be provided to wash the parts or supply other liquid media to them both in the troughs 601 and 701 and in the conveyors 640 and 740.

This particular arrangement of the elements of the machine makes it possible to provide equipment in a minimum of floor space and with this arrangement it is possible to have continuous operation in which the parts are circulated first through trough 601 and then through trough 701.

If desired screens may be provided in place of or forming part of the conveyors so that the finishing or polishing medium may be removed, for instance, at the end of treatment in trough 601. The parts may then be conveyed to trough 701 and different cleaning or polishing material may be incorporated.

When the machine is in operation the level of the contents of troughs is as indicated by the dotted line 651 in FIG. 17. Thus, as the troughs are vibrated the parts are fed along, and in case of FIG. 17, from right to left from the receiving to the discharging end and proper residence time is achieved.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof. It is therefore desired that the present embodiments be considered as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

I claim:

1. A finishing and polishing machine comprising a horizontally extending trough adapted to receive finishing or polishing material and the pieces to be finished or polished and having a receiving end and a discharge end and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough and having a rotor with its axis extending longitudinally and parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said rotor and adapted to rotate eccentrically about the axis of said rotor to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough about a horizontally extending axis, said trough and vibrator being supported as a unit for free movement in space, said trough having fixed adjacent the bottom thereof a plurality of generally transverse guiding vanes each disposed at an angle to the axis of said trough with one end closer to said discharge end than the other whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough, and screening means mounted on the discharge end of said trough and supported as a unit therewith for free movement in space to receive and to separate the pieces which have been finished or polished from the finishing or polishing material comprising an upper screen sized to hold back said pieces and a second screen disposed therebelow and sized to hold back said finishing or polishing material while passing waste and fines, and means at the receiving end of said trough for feeding parts and finishing and polishing material to said receiving end.

2. A finishing and polishing machine comprising a horizontally extending trough adapted to receive finishing or polishing material and the pieces to be finished or polished and having a receiving end and a discharge end and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator mounted directly on said trough with its axis extending longitudinally and parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said vibrator and adapted to rotate eccentrically about the axis of said vibrator to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and vibrator being supported as a unit for free movement in space, said trough having fixed adjacent the bottom thereof a plurality of generally transverse guiding vanes each disposed at an angle to the axis of said trough with one end closer to said discharge than the other whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough, and screening means mounted on the discharge end of said trough and supported as a unit therewith for free movement in space to receive and to separate the pieces which have been finished or polished from the finishing or polishing material, and means at the receiving end of said trough for feeding parts and finishing and polishing material to said receiving end.

3. A finishing and polishing machine comprising a horizontally extending trough adapted to receive finishing or polishing material and the pieces to be finished or polished and having a receiving end and a discharge end and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough having a rotor with its axis extending longitudinally and parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said vibrator and adapted to rotate eccentrically about the axis of said vibrator to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and vibrator being supported as a unit for free movement in space, said trough having fixed adjacent the bottom thereof a plurality of generally transverse guiding vanes each disposed at an angle to the axis of said trough with one end closer to said discharge end than the other whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough.

4. A finishing and polishing machine comprising a horizontally extending trough adapted to receive finishing or polishing material and the pieces to be finished or polished and having a receiving end and a discharge end and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough having a rotor with its axis extending longitudinally and parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said vibrator and adapted to rotate eccentrically about the axis of said vibrator to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and vibrator being supported as a unit for free movement in space, said trough having fixed in the bottom thereof a plurality of generally transverse parallel guiding vanes each extending from one side of the trough substantially to the center line thereof and at an angle to the axis of said trough and toward the discharge end thereof whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough.

5. A finishing and polishing machine comprising a

horizontally extending trough adapted to receive finishing or polishing material and the pieces to be finished or polished and having a receiving end and a discharge end and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator mounted directly on said trough with its axis extending longitudinally and parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said vibrator and adapted to rotate eccentrically about the axis of said vibrator to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and vibrator being supported as a unit for free movement in space, said trough having fixed adjacent the bottom thereof a plurality of generally transverse guiding vanes forming a generally helical guide feeding from the receiving end of said trough to the discharge end thereof.

6. A finishing and polishing machine comprising a horizontally extending trough adapted to receive finishing or polishing material and the pieces to be finished or polished and having a receiving end and a discharge end and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough having a rotor with its axis extending longitudinally and parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said vibrator and adapted to rotate eccentrically about the axis of said vibrator to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and vibrator being supported as a unit for free movement in space, with said discharge in a position elevated with respect to the bottom of said trough, said trough having fixed adjacent the bottom thereof a plurality of generally transverse guiding vanes each disposed at an angle to the axis of said trough with one end closer to said discharge end than the other whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough.

7. A finishing and polishing machine comprising a horizontally extending trough adapted to receive finishing or polishing material and the pieces to be finished or polished and having a receiving end and a discharge end and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough having a rotor with its axis extending longitudinally and parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said vibrator and adapted to rotate eccentrically about the axis of said vibrator to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and vibrator being supported as a unit for free movement in space, with said discharge elevated above the level of the contents of said trough at the receiving end when it has been charged, said trough having fixed adjacent the bottom thereof a plurality of generally transverse guiding vanes each disposed at an angle to the axis of said trough with one end closer to said discharge end than the other whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough.

8. A finishing and polishing machine comprising a pair of troughs adapted to receive finishing and polishing material and the pieces to be finished or polished, each having a receiving end and a discharge end having a discharge opening elevated with respect to the bottom of said

trough and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough and having a rotor with an axis parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said rotor and adapted to rotate eccentrically about the axis of said rotor to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and motor being supported as a unit for free movement in space, said trough having disposed therein a plurality of generally transverse guiding vanes, each disposed at an angle to the axis of said trough with one end closer to said discharge than the other, whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough, said troughs being disposed in parallel relationship to one another with the discharge end of one adjacent the receiving end of the other, and a pair of conveyors, one positioned to receive the discharge from each of said troughs and to convey discharged material to the receiving end of the other, one of said conveyors being provided with a separatory screen, for separating pieces to be finished or polished from the finishing or polishing material and the other being provided with means for directing the contents discharged thereon away from said finishing and polishing machine or into the receiving end of one of said troughs.

9. A finishing and polishing machine comprising a pair of troughs adapted to receive finishing and polishing material and the pieces to be finished or polished, each having a receiving end and a discharge end having a discharge opening elevated with respect to the bottom of said trough and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough and having a rotor with an axis parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said rotor and adapted to rotate eccentrically about the axis of said rotor to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and motor being supported as a unit for free movement in space, said trough having disposed therein a plurality of generally transverse guiding vanes, each disposed at an angle to the axis of said trough with one end closer to said discharge than the other, whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough, said troughs being disposed in parallel relationship to one another with the discharge end of one adjacent the receiving end of the other, and a pair of conveyors, one positioned to receive the discharge from each of said troughs and to convey discharged material to the receiving end of the other, one of said conveyors being provided with means for directing the contents discharged thereon away from said finishing and polishing machine or into the receiving end of one of said troughs.

10. A finishing and polishing machine comprising a pair of troughs adapted to receive finishing and polishing material and the pieces to be finished or polished, each having a receiving end and a discharge end having a discharge opening elevated with respect to the bottom of said trough and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough and having a rotor with an axis parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said rotor and adapted to rotate eccentrically about the axis of said rotor to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and motor being

supported as a unit for free movement in space, said trough having disposed therein a plurality of generally transverse guiding vanes, each disposed at an angle to the axis of said trough with one end closer to said discharge than the other, whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough, said troughs being disposed in parallel relationship to one another with the discharge end of one adjacent the receiving end of the other, and a conveyor positioned to receive the discharge from one of said troughs and to convey discharged material to the receiving end of the other, and having a separatory screen, for separating pieces to be finished or polished from the finishing or polishing material.

11. A finishing and polishing machine comprising a pair of troughs adapted to receive finishing and polishing material and the pieces to be finished or polished, each having a receiving end and a discharge end having a discharge opening elevated with respect to the bottom of said trough and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough and having a rotor with an axis parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said rotor and adapted to rotate eccentrically about the axis of said rotor to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and motor being supported as a unit for free movement in space, said trough having disposed therein a plurality of generally transverse guiding vanes, each disposed at an angle to the axis of said trough with one end closer to said discharge than the other, whereby as rotary vibrations and movement are imparted to said trough and its contents, said contents move from the receiving end to the discharge end of said trough, said troughs being disposed in parallel relationship to one another with the discharge end of one adjacent the receiving end of the other, and a conveyor positioned to receive the discharge from one of said troughs and to convey discharged material to the receiving end of the other.

12. A finishing and polishing machine comprising a horizontally extending trough adapted to receive finishing or polishing material and the pieces to be finished or polished and having a receiving end and a discharge end with a discharge raised with respect to the mean normal level of material in said trough and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough and having a rotor with its axis extending longitudinally and parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said rotor and adapted to rotate eccentrically about the axis of said rotor to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and vibrator being supported as a unit for free movement in space, said trough having fixed adjacent the bottom thereof a helical guide having a through central aperture extending generally axially of said trough and comprising a plurality of units each comprising substantially one turn of said guide and comprising a flat sheet extending generally transversely of the trough and having a central aperture and a cut extending vertically therefrom to form two terminals of said turn, said members being mounted from the top thereof with one terminal end in close proximity to a terminal end of the next member and the other terminal end spaced longitudinally of said trough and in line with and adjacent the terminal end of the next member.

13. A finishing and polishing machine comprising a horizontally extending trough adapted to receive finishing or polishing material and the pieces to be finished or

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polished and having a receiving end and a discharge end with a discharge raised with respect to the mean normal level of material in said trough and a semi-cylindrical rounded bottom extending longitudinally of the trough and a vibrator comprising a motor mounted directly on said trough and having a rotor with its axis extending longitudinally and parallel to the axis of said rounded bottom and carrying a weight disposed eccentrically to the axis of said rotor and adapted to rotate eccentrically about the axis of said rotor to impart rotary vibrations to said trough and its contents and to thereby impart an orbital motion to the contents of said trough around a horizontally extending axis, said trough and vibrator being

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supported as a unit for free movement in space, said trough having fixed adjacent the bottom thereof a helical guide having a through central aperture extending generally axially of said trough.

References Cited in the file of this patent

UNITED STATES PATENTS

1,741,019	Harrington	Dec. 24, 1929
2,143,610	Muller et al.	Jan. 10, 1939
2,319,007	McCarthy	May 11, 1943
2,554,022	Gould	May 22, 1951
2,912,800	Smith-Gorman	Nov. 19, 1959