Feb. 16, 1971 IETATSU OHNO 3,562,962

GRINDING APPARATUS

Filed Feb. 26, 1969 2 Sheets-Sheet 1

Fig. 1

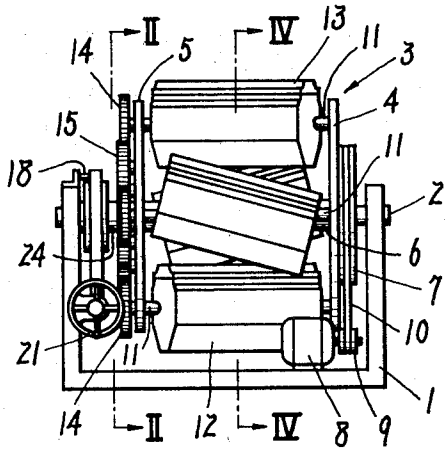


Fig. 2

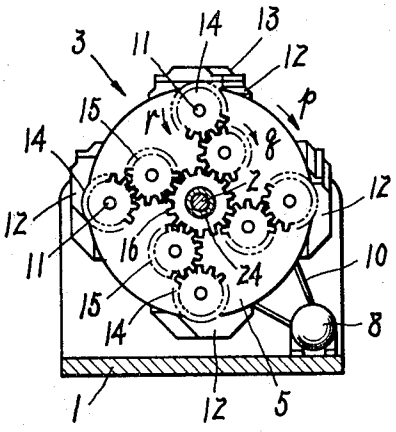


Fig. 3

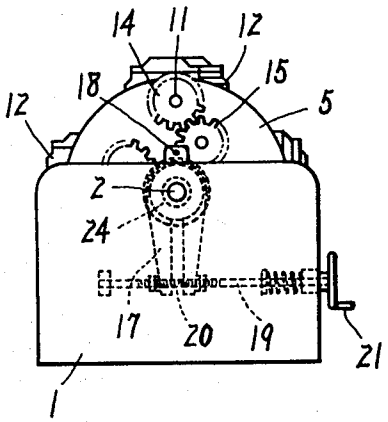
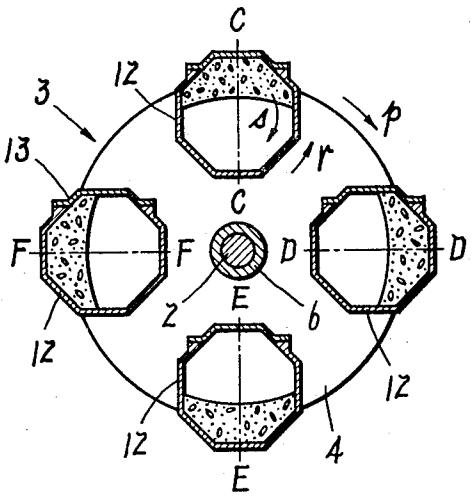


Fig. 4



Feb. 16, 1971 IETATSU OHNO 3,562,962

GRINDING APPARATUS

Filed Feb. 26, 1969 2 Sheets-Sheet 2

Fig. 5a

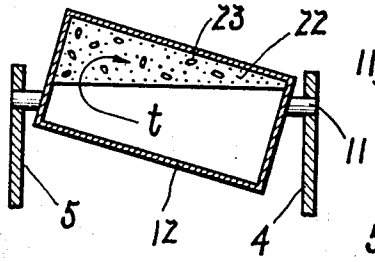


Fig. 5b

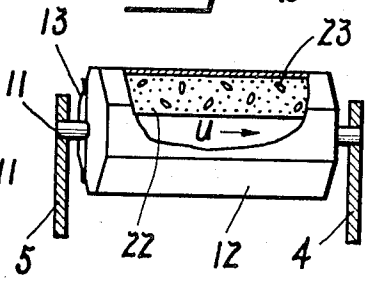


Fig. 5c

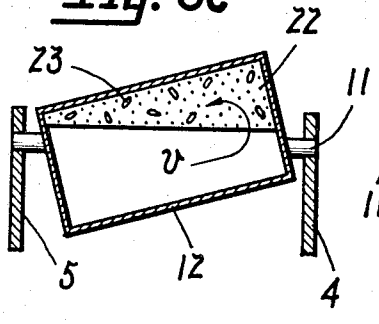


Fig. 5d

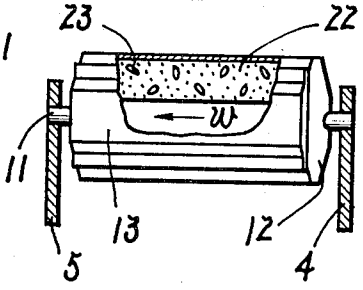


Fig. 6

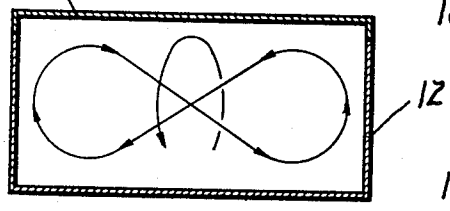
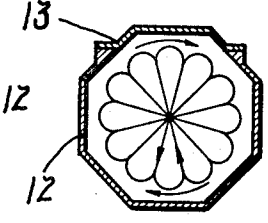


Fig. 7



United States Patent Office 3,562,962 Patented Feb. 16, 1971

3,562,962

GRINDING APPARATUS

Ietatsu Ohno, 14-2-406 Mure, Mitaka, Tokyo, Japan

Filed Feb. 26, 1969, Ser. No. 802,369
Int. Cl. B24b 31/02; B01f 9/00
U.S. Cl. 51—163 2 Claims

ABSTRACT OF THE DISCLOSURE

This invention is a grinding apparatus wherein on a revolving drum is mounted a container eccentrically at both ends on each shaft parallel with the shaft of said drum so that a flow in the form of the figure 8 may be given to abrasives and objects to be ground contained in said container.

This invention relates to grinding apparatus.

In the case of grinding such comparatively small articles of complicated forms as, for example, watch parts, hosiery needles and injection needles, when the objects to be ground and a proper abrasive are contained in a sealed container, the container is fitted to the peripheral edge part of a drum and said drum is rotated at a high speed, while the object to be ground and the abrasives are strongly pressed against each other by a centrifugal force, fine vibrations will be produced and therefore a grinding action will take place. In such apparatus, if a rotating motion is given to the above mentioned container, while the abrasives and others always tend to be positioned in the outer peripheral part of the drum by the centrifugal force, as the container rotates, the abrasives will relatively flow in the container. Therefore, the friction between the objects to be ground and the abrasives will increase and the grinding efficiency will improve. According to the present invention, in the above mentioned apparatus, each container is fitted as inclined to the outer peripheral part of the drum so that the grinding efficiency may further improve and at the same time even parts of complicated forms may be ground uniformly on the entire surface.

Therefore, an object of the present invention is to provide a grinding apparatus wherein the motion of the abrasives and objects to be ground is complicated so that the grinding efficiency may remarkably increase.

In the accompanying drawings:

FIG. 1 is a side view of a grinding apparatus according to the present invention;

FIG. 2 is a vertical sectional view on line II—II in FIG. 1;

FIG. 3 is an elevation of FIG. 1;

FIG. 4 is a vertical sectional view on line IV—IV in FIG. 1;

FIGS. 5*a* to 5*d* are sectional views respectively on lines C—C, D—D, E—E and F—F in FIG. 4;

FIG. 6 is a view showing the directions of the motion of the abrasives in the container;

FIG. 7 is a vertical sectional view of FIG. 6.

In explaining the present invention with reference to the accompanying drawings, in FIGS. 1 to 3 showing an embodiment of the present invention, a shaft **2** is fixed to a base **1** and a rotary drum **3** is loosely fitted to said shaft **2**. Said drum **3** is made by connecting and fixing two disks **4** and **5** through a shaft **6**, a pulley **7** is fixed to one disk **4** and a belt **10** is engaged on said pulley **7** and a pulley **9** of a motor **8** provided on the base **1**. Four rotary shafts **11** are rotatably fitted to the peripheral edge parts of said two disks **4** and **5**. The drum **3** is rotated at a speed, for example, of 200 r.p.m. through the belt **10** by the rotation of the motor **8**.

The rotary shafts **11** are parallel with the shaft **2** and are arranged symmetrically with respect to the shaft

2 but a cylindrical or polygonal container **12** having an opening in the top part is fitted to the middle part of each shaft **11** so that its rotating axis may be inclined. A lid **13** is provided on the opening in the top part of the container **12** so as to be removably fixed to the container **12** by any proper means. Four gears **14** fixed to the respective shafts **11** and four gears **15** journaled on said disk **5** are provided on the outside of the other disk **5** of the drum **3** and the gears **14** are respectively meshed with the gears **15**. A shaft **24** is journaled on the shaft **2**. A gear **16** is fixed to said shaft **24** and is meshed with the gears **15**. Said shaft **24** is surrounded with a forked piece **17** which is supported in the top part with the base **1** through a pin **18**. The oppositely threaded part **20** of a rod **19** is screwed through the forked piece **17** near the forward ends so that when a handle **21** provided at the other end of said rod **19** is rotated, the clearance of the forked piece **17** may be increased or decreased and, when said clearance is decreased, the shaft **24** may be held and fixed but, on the contrary, when said clearance is increased, the shaft **24** may freely rotate.

The lid **13** is removed, abrasives **22**, objects **23** and a proper amount of water are contained in the container **12** and then the lid **13** is again applied. In such case, when the shaft **24** is freed from the forked piece **17**, as the container **12** can rotate freely independently of the rotation of the drum **3**, the abrasives and objects to be ground can be put into each container **12** after directing the container in any proper direction and removing the lid **13**. Then, when the shaft **24** is held and fixed with the forked piece **17** and the drum **3** is rotated in the direction indicated by the arrow *p* in FIG. 2, the gears **14** and **15** will rotate respectively in the directions indicated by the arrows *r* and *q*. If the diameters of the gears **16**, **15** and **14** are the same, with one rotation of the drum **3**, the gear **14** will also make one rotation in the direction indicated by the arrows *r*. That is to say, as shown in FIG. 4, when the drum **3** rotates in the direction indicated by the arrow *p* and the container **12** revolves around the shaft **2**, said container **12** will rotate at the same angular velocity in the direction indicated by the arrow *r*. Further, the abrasives **22** and objects **23** to be ground within the cylindrical or polygonal container **12** always tend to be positioned in the outer peripheral direction of the container due to the centrifugal force by the above mentioned revolution. Therefore, within the container **12**, the abrasives **22** flows in the direction indiform of the figure **8** is given to abrasives and objects

As the container **12** rotates in the direction indicated by the arrow *r* as synchronized with the rotation of the drum **3**, it will be in such states as are shown in FIG. 5. By the way, FIG. 5 shows the sections of the respective containers. However, it is needless to say that, in case one container **12** has moved to the respective positions shown in FIG. 5, it will be also in the same states. That is to say, in the respective states in FIGS. 5*a*, 5*b*, 5*c* and 5*d*, the abrasives **22** and objects **23** to be ground always tend to be positioned outward of the drum **3** due to the centrifugal force as shown in FIG. 5. Therefore, the abrasives and objects to be ground reciprocate axially in the directions indicated by the arrows *t*, *u*, *v* and *w* within the container **12**.

Thus, in the apparatus of the present invention, as each cylindrical or polygonal container is fitted as inclined to the rotary shaft **11** and the shaft **2**, not only a rotary flow in such peripheral direction as is indicated by the arrow *s* but also a reciprocating flow in such lateral directions as are indicated by the arrows *t*, *u*, *v* and *w* takes place. Therefore, it is as shown in FIGS. 6 and 7 that a rotary centrifugal flow and a flow in the form of the figure **8** in the vertical, horizontal and diagonal direc-

tions are made. Thus the abrasives and the objects to be ground flow over all to be agitated.

As in the above mentioned embodiment, in the apparatus of the present invention, as each container **12** is fitted as inclined, a reciprocating motion in the axial direction can be caused to the abrasives and objects to be ground by the action of the centrifugal force. Therefore, the abrasives **22** and the objects **23** to be ground make a very complicated motion together with a rotary flow by the rotation of the container so as to be perfectly agitated. That is to say, the motion of the abrasives and objects to be ground in the container is severe and is not simple, therefore the grinding efficiency increases and objects to be ground of any complicated form can be ground uniformly in each part. Further, when bodies, for example, in the form of thin plates were ground with a conventional apparatus in which the motion was simple, the two bodies to be ground moved as pasted together with water and were not ground at all on the pasted surfaces in some case. On the other hand, according to the apparatus of the present invention, the motion is so complicated that such two objects to be ground will easily separate from each other and will be ground uniformly on the entire surfaces. The above described embodiment is of the case that the angular velocity of the rotation and the angular velocity of the revolution are the same. However, it is needless to say that they can be made different, for example, by selecting the diameters of the gears **12**, **10** and **9**. It is also possible to contain a plurality of containers in one container.

What I claim is:

1. A grinding apparatus comprising a rotary drum connected to a driving source and fitted on a shaft journaled on a base, a cylindrical or polygonal container provided on each of a plurality of rotary shafts parallel with the shaft of said drum, said container being fitted as inclined to said rotary shaft and means for giving a revolving motion to said rotary drum and at the same time giving a rotating motion to the container, whereby a flow in the form of the figure **8** is given to abrasives and objects to be ground contained in the container by the rotation of the rotary drum and the container.

2. A grinding apparatus according to claim **1** wherein a gear (**14**) on the shaft of each container, a gear (**15**) journaled on the disk of the drum and a gear (**24**) on a shaft provided coaxially with the shaft (**2**) of the rotary drum are meshed with one another and said gear (**24**) is to be able to be fixed or rotated by a clutch mechanism.

References Cited

UNITED STATES PATENTS

3,078,623 2/1963 Stanley ..... 51—164

FOREIGN PATENTS

685,711 1/1953 Great Britain.

HAROLD D. WHITEHEAD, Primary Examiner

U.S. Cl. X.R.

259—57