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APPARATUS FOR SMOOTHING THE SURFACES OF ARTICLES

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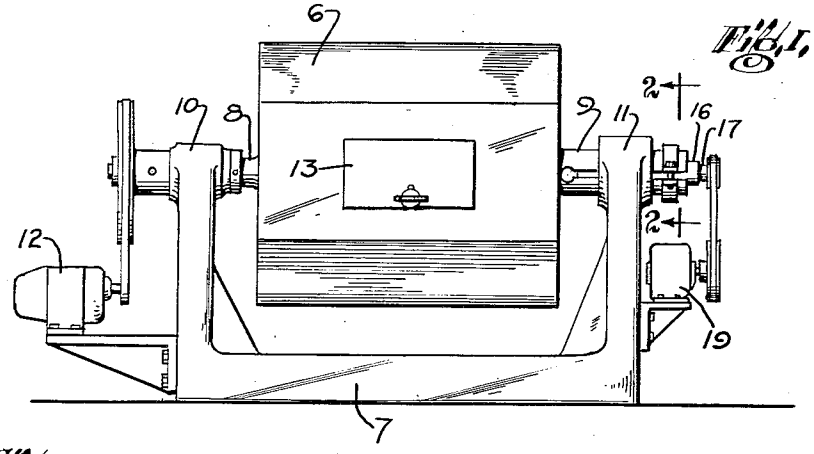


Fig. 1.

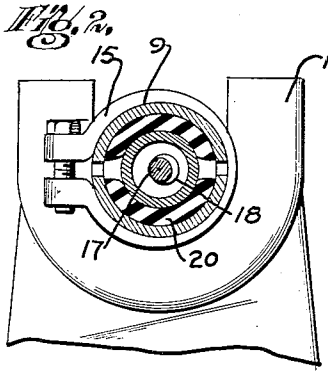


Fig. 2.

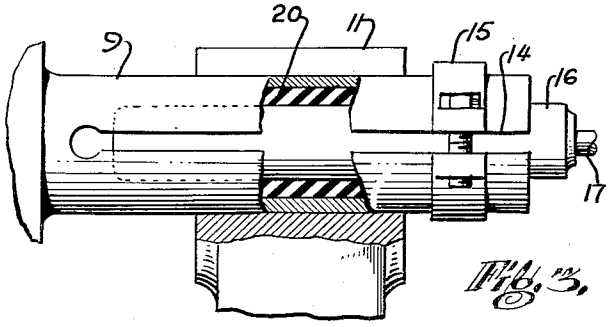


Fig. 3.

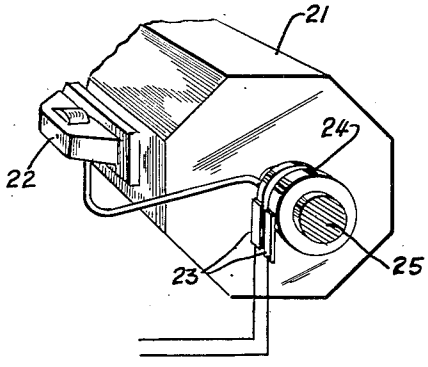


Fig. 4.

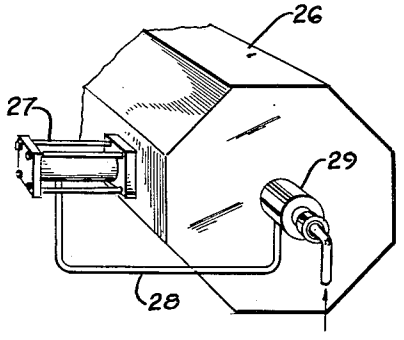


Fig. 5.

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APPARATUS FOR SMOOTHING THE SURFACES OF ARTICLES

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3 Claims. (Cl. 51—164)

My invention relates to a method and apparatus for smoothing the surfaces of articles through a modified tumbling action.

Many articles of manufacture are of such size and shape as to make it difficult and expensive to smooth the surfaces, as where burrs and scale are to be removed or burnishing is desired. Certain obstacles and disadvantages of such techniques as buffing have been overcome by use of a tumbling barrel, in which several articles may be smoothed simultaneously in a batch operation. By that method the articles are loaded into a barrel-like container with a suitable abrasive compound, and the container is rotated continuously until the desired surface qualities are achieved by attrition.

In some instances, as in deburring and burnishing metal parts, the tumbling action must be continued for a period of several hours to be effective. The method and apparatus of my invention provides similar results in only a fraction of that time.

The method I employ is to impart a vibratory motion of relatively high frequency to the admixture of articles and abradant simultaneously with the tumbling action. In that way particles of abradant in contact at any one time with the surface to be smoothed are caused to oscillate with a small amplitude and thereby enormously increase the amount of surface abrasion in a given period. At the same time the tumbling action causes continual shifting of parts and compound with respect to one another to afford random surface contact.

The apparatus for carrying out the method is a conventional tumbling barrel suitably modified with a vibrator capable of serving the charge under treatment.

Various types of vibrators available commercially are suitable for the purpose. In one form of apparatus a mechanical vibrator is disposed in the core of one of the horizontal trunnions on which the container rotates, to cause the container and its contents to vibrate from one end. In other forms I employ either an electromagnetic or pneumatic vibrator secured to the side of the container, with suitable slide or swivel connections at a rotating joint to permit operation of the vibrator throughout the barrel's revolution.

In the accompanying drawing, wherein there is illustrated apparatus suitable for carrying out my invention:

Figure 1 is a side elevational view of a tumbling barrel with a mechanical vibrator installed in the hollow portion of the right trunnion;

Figure 2 is an enlarged fragmentary view taken along line 2—2 in Figure 1;

Figure 3 is an enlarged, partially broken-away fragmentary view of the vibrator and trunnion in Figure 1;

Figure 4 is a partially schematic, fragmentary perspective view of another embodiment of the apparatus shown in Figure 1; and

Figure 5 is a fragmentary perspective view of a further embodiment of the apparatus shown in Figure 1.

Referring now to Figure 1, a tumbling barrel 6 is mounted for rotation in a U-shaped base frame 7, through

trunnions 8 and 9 journalled in bearings 10 and 11 respectively. Trunnion 8 is driven through a belt by a motor 12 to cause barrel 6 to rotate.

Barrel 6 is octagonal in section rather than circular, as that shape is considered to be advantageous in tumbling by causing the charge of materials to cling to the sides and be carried upwardly for a distance before dropping back into the remainder of the mixture. The barrel is provided with a door 13 mounted in one panel, for charging and discharging the batch.

The right-hand trunnion 9 is hollow and rests in a saddle-type bearing 11 (Figure 2), which affords sufficient retention under the dead weight of the charged barrel. The trunnion has a longitudinal expansion slit 14 surrounded by a clamp 15 to grip securely within the hollow portion of trunnion 9 a cylindrically-shaped mechanical vibrator 16 (Figure 3). Vibrator 16 is of a commercially available design wherein a rotatable shaft 17 has an elongated eccentric extension 18 which, when rotated, instills an unbalance and consequent vibration into the entire unit. Shaft 17 is belt-driven by motor 19 at a high velocity in relation to the velocity of the tumbling action through trunnion 8. A resilient liner 20 surrounds vibrator 16 inside trunnion 9.

In processing a batch of material with the apparatus described, tumbling barrel 6 is partially filled through door 13 with a quantity of articles to be treated and an appropriate amount of an abrasive compound suitable for the material being handled and the surface operation to be performed. Motor 12 is then turned on to cause the barrel to rotate and then motor 19 is turned on to actuate vibrator 16, which in turn causes vibrational movements to be translated to the right side of the barrel and thence throughout the admixture during the tumbling action. The frequency of vibration is related to the speed of rotation of shaft 17 and is usually in the order of several thousand cycles per minute, while its amplitude, though relatively very small, is a function of the design characteristics of the vibrator. The amplitude may be varied during operation by changing the dampening effect of resilient liner 20 through adjustment of clamp 15 surrounding trunnion 9. Thus the conditions of vibration and speed of tumbling may be changed externally as variations in charge and surface requirements warrant.

The vibratory action causes each particle of abradant in contact with the surface of an article being treated to oscillate at a relatively high rate on the surface while at the same time receiving the customary random translational movement along the surface due to the tumbling action. The net effect is to increase in large measure the amount of abrasion in a given time over what would otherwise be experienced with the tumbling action alone. In consequence the efficiency and economy of the process are improved manyfold through a reduction in the time required to achieve particular surface characteristics on the articles.

In a second embodiment of the apparatus shown in Figure 4, a tumbling barrel 21 is mounted similarly to barrel 6 in Figure 1, but instead of having a vibrator incorporated in one of the trunnions, it is mounted as a unit 22 on one of the side panels. Unit 22 is one of the commercially available electromagnetic vibrators actuated through a pair of contacts 23 in conjunction with slip rings 24 surrounding trunnion 25 of barrel 21. This construction enables the vibrator to function throughout the revolution of the barrel and accomplish the new method of smoothing the surfaces of acticles as described above for barrel 6.

An analogous form to the embodiment appearing in Figure 4 is shown in Figure 5, where a barrel 26 is provided with a pneumatic-type vibrator 27 fixed to one of its side panels. An air line 28 is fed through a swivel joint

29 on one of the trunnions for continuous action during rotation of the barrel, and the same results may be achieved as with the two forms of the apparatus previously described. If desired, more than one vibrator may be attached to the barrel in any of the forms, to increase the intensity of vibration throughout the whole charge of articles and abrasion compound.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. Apparatus for smoothing the surfaces of articles comprising a tumbling barrel mounted for rotation on a pair of horizontal trunnions, one of which is hollow, and a vibrator unit mounted in said hollow trunnion and adapted to vibrate said tumbling barrel when charged with said articles, said hollow trunnion including means for expanding and contracting the sides of said trunnion surrounding said vibrator unit, thereby to vary the amplitude of vibration of said vibrator unit.

2. Apparatus for smoothing the surfaces of articles comprising a tumbling barrel mounted for rotation on a pair of horizontal trunnions, one of which is hollow, a vibrator unit mounted in said hollow trunnion and adapted to vibrate said tumbling barrel when charged with said articles, and adjustable means for varying the amplitude of vibration of said vibrator unit.

3. Apparatus for smoothing the surfaces of articles comprising a tumbling barrel mounted for rotation on a pair of horizontal trunnions, one of which is hollow, a vibrator unit mounted in said hollow trunnion and adapted to vibrate said tumbling barrel when charged with said articles, and adjustable means for varying the amplitude of vibration of said vibrator unit, said adjustable means being operable while said apparatus is in operation.

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