Nov. 17, 1959 L. G. SIMJIAN 2,912,803

ABRADING DEVICE

Filed Oct. 14, 1957

FIG. 1

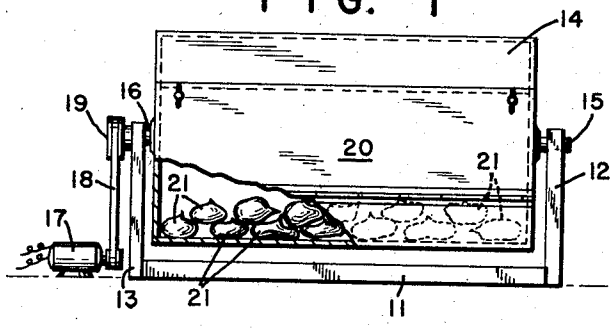


FIG. 2

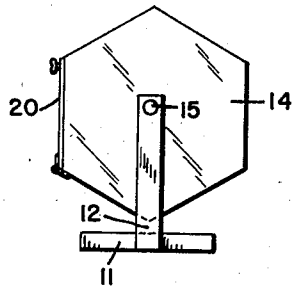


FIG. 3

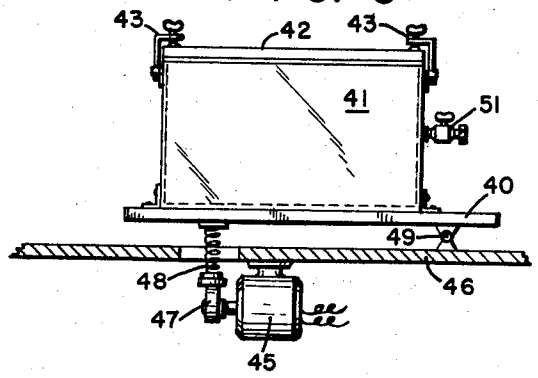


FIG. 4

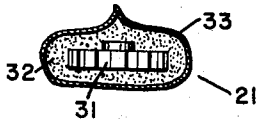
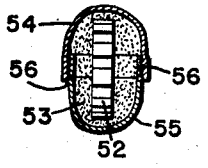


FIG. 5



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ABRADING DEVICE

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4 Claims. (Cl. 51—281)

This invention relates to abrading and polishing of articles by the general method of establishing relative oscillations between the surface of the article to be treated and abrasive particles in contact therewith. The invention has particular reference to a method which uses loose abrasive particles in contact with an article to be abraded or polished and applying relative motion between the article to be abraded and the particles surrounding the article.

One of the major difficulties in polishing irregular contours of an article lies in the necessity of bringing abrasive materials in contact with the irregular surfaces. For this reason, many irregular articles must be polished by hand without the use of the usual motor-operated buffing or abrading wheels. The present invention overcomes these difficulties by using a loose abrasive or polishing mixture in which the article to be polished is immersed. Specifically, the abrasive particles together with the article to be polished are confined in a closed flexible container and when applying motion to the flexible container, the container walls distort and the article is moved relative to the surrounding mixture, thus obtaining a polishing or abrading action.

The loose abrasive mixture employed may comprise small abrasive particles such as Carborundum, boron carbide, silicon carbide, aluminum oxide, diamond powder, hardened steel particles, barium ferrite, manganese-bismuth particles, or other particles which are adapted to abrade the surface of the object to be polished. Still further the abrasive particles may be mixed with a suitable amount of liquid such as oil, water, a cleaning fluid such as turpentine, carbon tetrachloride, trichlorethylene, etc. in order to prevent coagulation of the particles and to enhance the finished appearance of the surface of the article to be abraded.

One of the objects of this invention therefore is to provide a polishing arrangement which avoids one or more of the disadvantages and limitations of prior art arrangements;

Another object of the invention is to polish or abrade objects without resorting to manual manipulation;

Another object of the invention is to abrade the surface of irregularly shaped objects for the removal of scale, dirt, paint, burrs, etc;

Still another object of the invention is to provide an arrangement which is suitable for treating simultaneously a plurality of articles;

Another and further object of the invention is the provision of an apparatus which is adapted for polishing articles on a mass production basis;

Another and still further object of this invention is the provision of an apparatus which comprises flexible containers into which are placed the article to be abraded and loose abrasive particles. Means are employed for agitating the flexible container to cause motion of the article relative to the abrasive particles which are in contact with the article.

One form of the invention comprises a receptacle into

which are placed a plurality of loose flexible containers. Each of said containers encloses an article to be abraded and loose abrasive particles. The receptacle is agitated to cause motion of the flexible containers loosely confined within the receptacle thereby effecting relative motion between the articles to be abraded and the abrasive particles in contact with the surfaces of the articles.

The invention will be better understood from the following detailed description of several illustrative embodiments, reference being made to the accompanying drawings in which:

Figure 1 is a side elevational view, partly in section, of a typical embodiment of the present invention;

Figure 2 is an end elevational view of Figure 1;

Figure 3 is a side elevational view of still another typical embodiment of the present invention;

Figure 4 is a sectional view of the arrangement of a single article to be abraded; and

Figure 5 is an alternate design of the arrangement shown in Figure 4.

Referring now to Figures 1 and 2, numeral **11** identifies a base plate to which are attached two end brackets **12** and **13**. A drum or barrel **14** is equipped with shafts **15** and **16** and is supported for rotation in brackets **12** and **13** by means of conventional sleeve or ball bearings (not shown). An electric motor **17** is adapted to rotate the barrel **14** via a belt **18** and pulley **19**, the latter being fastened to shaft **16**. The barrel or drum which acts as the receptacle for the entire apparatus is depicted as being hexagonal in shape but it will be understood that the receptacle may be also of octagonal, round, rectangular, triangular or of any other suitable configuration without departing from the scope of the instant invention.

The receptacle is equipped with a suitable opening and access door **20** in order to gain access to the interior of the barrel.

The inside of the receptacle contains a plurality of loose flexible containers **21**, a typical illustration thereof being shown in Figure 4. An article to be abraded, such as a spur gear **31**, is surrounded by loose abrasive particles **32** and the article together with the abrasive particles are confined within a flexible container **33**. The container may be made of rubber, vinyl plastic, polyethylene, cellophane, or of any other suitable material which may be distorted by the application of external pressure. The container may be closed or sealed by heat sealing, by binding, clamping or by any other suitable means.

A single or a plurality of such containers is placed loosely into the receptacle **14** and subsequently the receptacle **14** is revolved by motor **17** to cause the container **21** to tumble within the barrel. Since these containers, or bags tumble against one another, their walls become squeezed and distorted upon impact with an adjacent container or upon impact on the receptacle and thus relative motion between the article and the abrasive particles in contact with the surfaces of the articles is achieved. This repetitive and irregular motion polishes the surface of the article immersed in the abrasive loose particles.

Figure 3 shows a variation of the apparatus depicted in Figure 1 and comprises a base plate **40** upon which is mounted a receptacle **41** having a top cover **42** which is held and sealed by means of clamps **43** to the receptacle. Gasket means between the receptacle and the top cover may be employed in order to effect a fluid tight seal for the purposes described later. A motor **45** is supported on a plate **46** and imparts motion to the base plate **40** via an eccentric cam **47** and spring combination **48** to cause the receptacle to vibrate when the motor is energized. Base plates **46** and **40** are mounted to one another by means of hinge **49** which acts as the pivotal

axis of the arrangement. This device may be considered similar to conventional shakers or vibrators and effects motion upon the receptacle and the articles confined therein. The receptacle 41 which contains the flexible containers in a loose manner so as to permit motion of the containers with respect to one another when vibratory motion is imparted to the receptacle is provided further with means to improve the operation of the abrading process. Numeral 51 identifies a valve which is threaded through the side of the receptacle and used to pressurize the receptacle with air, carbon dioxide, or other suitable fluid medium in order to increase the internal pressure. If the flexible containers are sealed prior to insertion into the receptacle with standard atmospheric pressure and if the receptacle 41 is pressurized to the extent of establishing above-atmospheric pressure, then there will exist a differential pressure across the flexible containers. This pressure differential will distort the walls of the flexible containers and produce additional surface pressure upon the article and the abrasive mixture, thus improving the efficiency of the abrasive action. It will be apparent to those skilled in the art that the same effect may be achieved by sealing the flexible containers under partial vacuum so that there will exist a higher pressure on the outside of the container than on the inside of the container.

Figure 5 shows another variation of the flexible container. A gear 52 is immersed in loose abrasive particles 53. Two half spheres, numerals 54 and 55 respectively, are threaded to one another at numeral 56. It will be apparent that the threads may be rigid or semi-rigid in character whereas the container enclosure away from the threads is flexible in order that it may be distorted during the application of mechanical motion. The container may be made for instance of rubber with metallic inserts for the threaded portions, or of similar material.

In all cases the abrasive action is obtained by virtue of the flexible walls of the container enclosing the article and loose abrasive particles being distorted repetitively by motion applied to the container. This motion may be achieved in a tumbling or kneading manner so as to cause sliding frictional engagement between the contour surfaces of the article to be abraded and loose individual abrasive particles.

While there have been described certain embodiments of the present invention it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the present invention which shall be limited only by the scope of the appended claims.

What is claimed is:

1. A method of abrading an article within a container comprising the steps of placing the article and abrasive particles in a flexible container, disposing said container in a receptacle so as to permit motion between said receptacle and the flexible container, and applying motion to said receptacle for causing said container to be in tumbling motion relative to said receptacle.

2. A method of abrading an article within a flexible container comprising the steps of placing the article to be abraded and loose abrasive particles in a sealed container having a partially flexible enclosure, loosely disposing said flexible container in a receptacle, applying a differential pressure between the inside and the outside of said sealed container and agitating said receptacle to cause motion between the receptacle and the sealed container and to cause the container enclosure to become repetitively distorted.

3. A method of abrading a plurality of articles contained within flexible containers comprising the steps of placing each article together with abrasive particles in a flexible container; disposing a plurality of said containers in a receptacle so as to permit motion between said receptacle and the flexible containers, and applying motion to said receptacle for causing said containers to be in tumbling motion relative to said receptacle.

4. A method of abrading a plurality of articles within flexible containers comprising the steps of placing each article to be abraded together with loose abrasive particles in a container having a partially flexible enclosure; closing each container; loosely disposing a plurality of said containers in a common receptacle; applying fluid pressure to the outside of all of said containers and agitating said receptacle to cause motion between the common receptacle and the plurality of closed containers to cause the container enclosures to become repetitively distorted.

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