

May 22, 1951

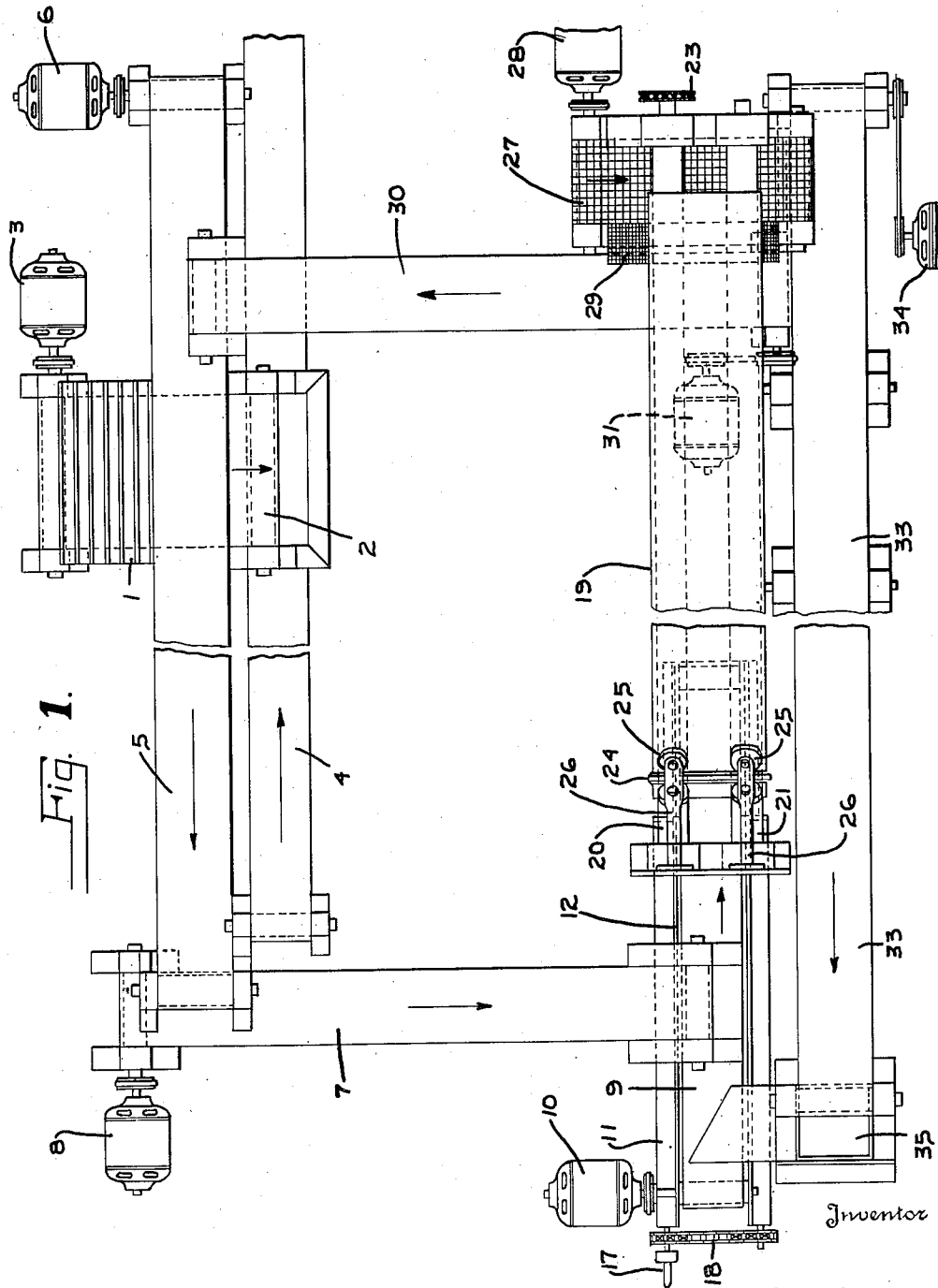
R. E. GOULD

2,554,022

CONTINUOUS TUMBLING PROCESS

Filed June 5, 1947

3 Sheets-Sheet 1



Inventor

ROBERT E. GOULD

Semmes, Keegin, Robinson + Semmes
Attorneys

May 22, 1951

R. E. GOULD

2,554,022

CONTINUOUS TUMBLING PROCESS

Filed June 5, 1947

3 Sheets-Sheet 2

Fig. 2.

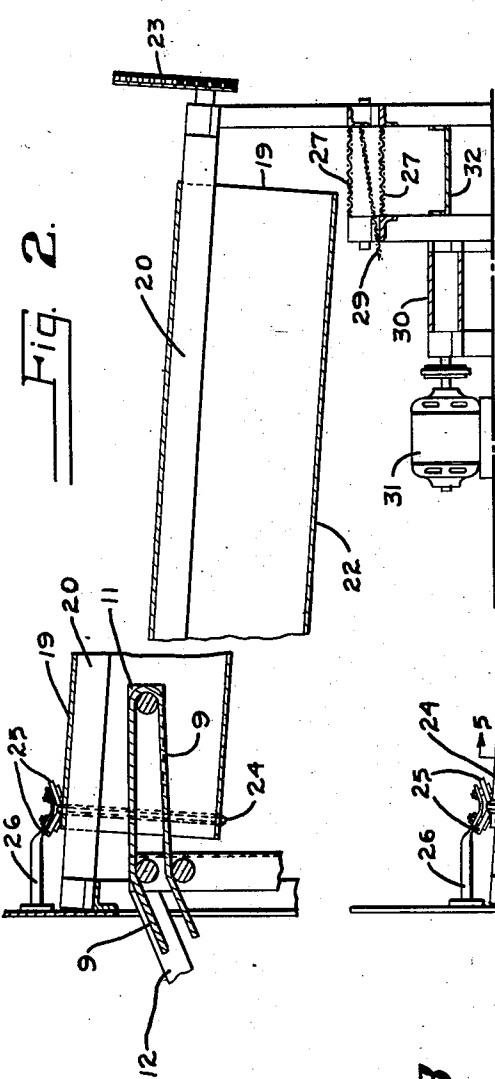


Fig. 4

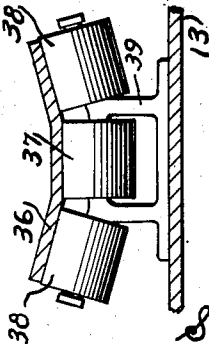
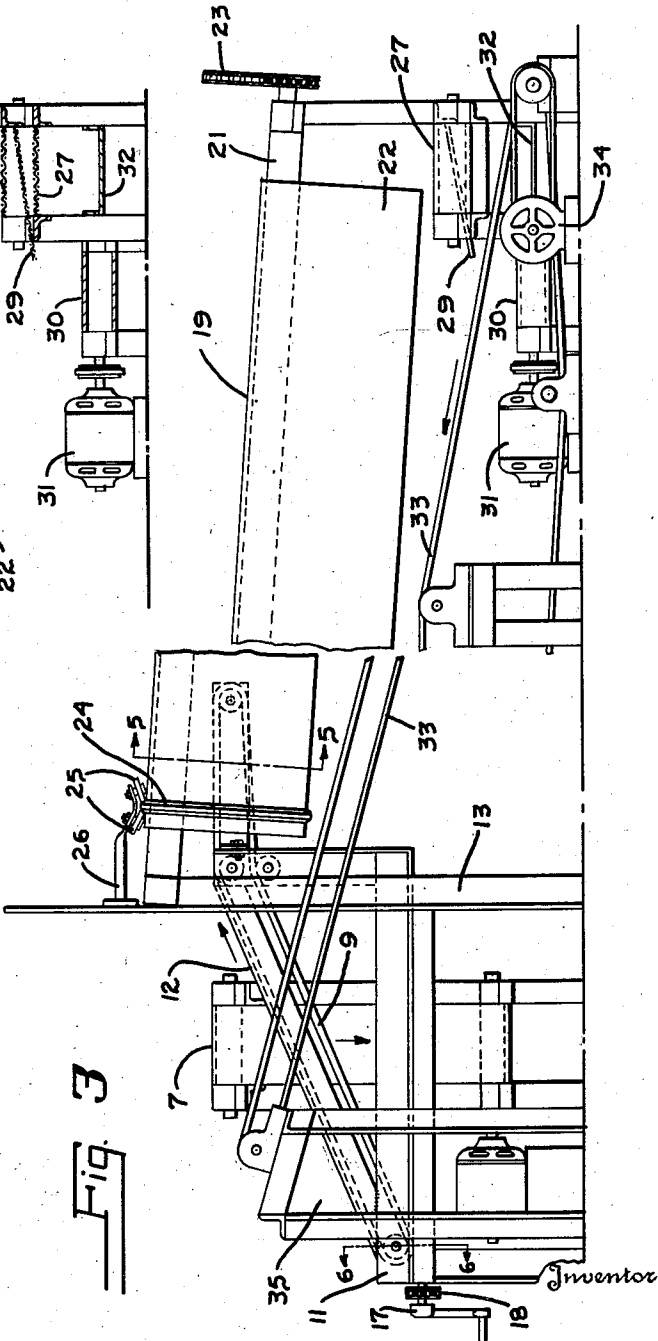


Fig. 3



ROBERT E. GOULD

Semmes, Keegin, Robinson & Semmes
Attorneys

May 22, 1951

R. E. GOULD

2,554,022

CONTINUOUS TUMBLING PROCESS

Filed June 5, 1947

3 Sheets-Sheet 3

Fig. 7.

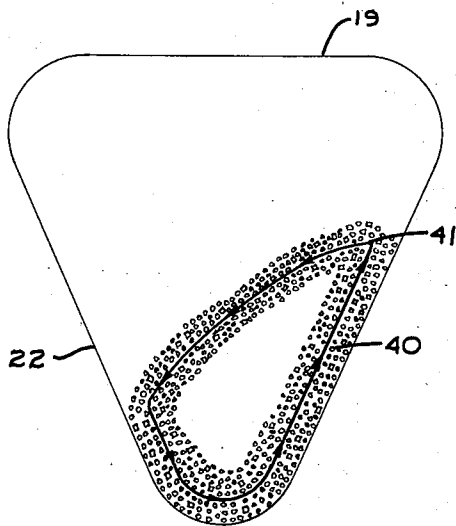


Fig. 8.

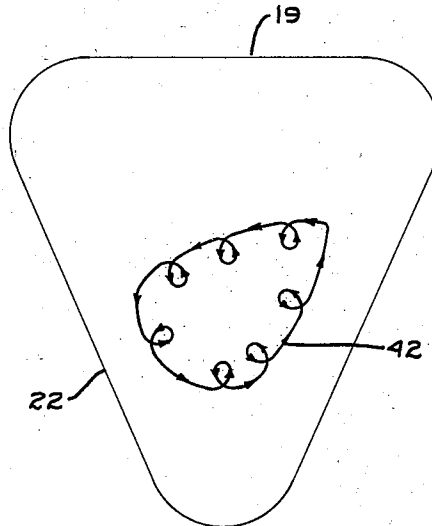


Fig. 9.

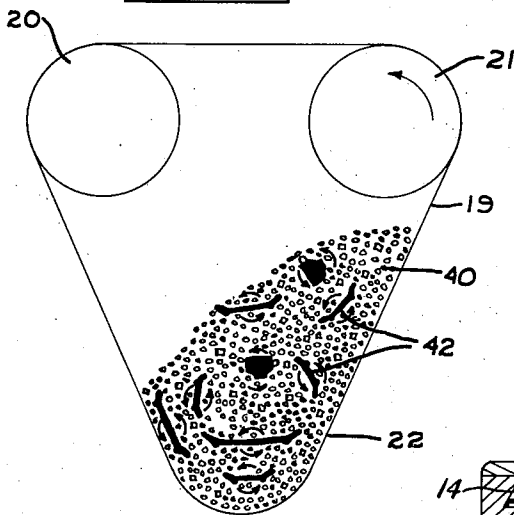


Fig. 5.

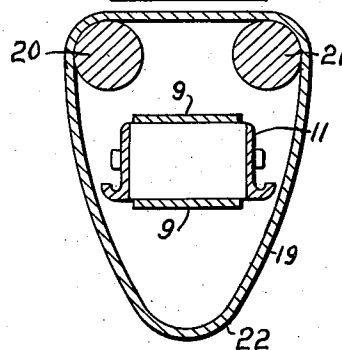
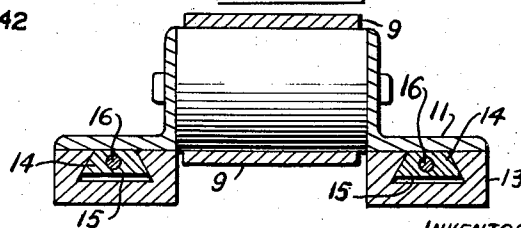


Fig. 6.



INVENTOR

ROBERT E. GOULD

³³⁴
Semmes, Keegin, Robinson & Semmes
Attorneys

UNITED STATES PATENT OFFICE

2,554,022

CONTINUOUS TUMBLING PROCESS

Robert E. Gould, Hamburg, N. Y., assignor to
Buffalo Pottery, Inc., Buffalo, N. Y., a corpo-
ration of New York

Application June 5, 1947, Serial No. 752,730

12 Claims. (Cl. 51—163)

1

This invention relates to a process and apparatus for abrasively cleaning articles of crockery or like materials.

In the manufacture of chinaware, the clay or other basic material is molded in the form of plates, cups, vases or the like and is packed in sand or other material. It is then fired in a bisque kiln to form the unglazed article, which is then removed from the sand. In the process of this first firing, small particles of sand, clay, dust or other material tend to adhere to the surface of the ware. These particles must be removed from the surfaces before the ware is given a vitreous coating in a glost oven. This is so because the glaze is usually not more than $\frac{1}{1000}$ to $\frac{1}{1000}$ inch thick and any particles adhering to the surface of the ware are apt to protrude or to cause unevenness of the surface of the glaze. Furthermore, ware with fine grains adhering to the surface is extremely difficult to decorate by the underglaze process.

In the past, such ware has been cleaned by various methods. One of these is to rub the surface by hand with an abrasive such as sandpaper or emery paper. In large scale manufacture, this method is obviously unsatisfactory because it is slow and entails high labor costs.

Another method is to subject the ware to a sand blast. This method is not satisfactory because the stream of abrasive material strikes each article only in a relatively small area and does not effect a thorough cleaning of the whole surface. Moreover, the surface is cleaned unevenly, as the amount of abrasion to which any part of the surface is subjected depends on its distance from the center of the abrasive stream. Furthermore, this method is usually employed with batches of the articles, which must be put in place for the blasting and removed therefrom by hand.

A still further method is to secure the ware in a frame which is rotated in a mass of abrasive material, such as broken pieces of china, known as grog, small stones or other loose material. By tumbling against the ware, the abrasive material grinds off the protruding particles, thus making the ware smooth. The principal objections to this method are that it is another batch method, in which the articles must be put in place for cleaning and later removed by hand. Also, the articles to be cleaned must be of the correct shape and size to fit the frame. Obviously, articles of different sizes and shapes, as they come from the bisque kiln, cannot be treated in the same frame. Moreover, where the articles

2

are held in a frame, all their surfaces are not cleaned uniformly.

The present invention overcomes the objections to the methods outlined above.

One object of this invention is to provide a process and apparatus for abrasively cleaning brittle articles which is continuous.

Another object is to provide an apparatus for continuously cleaning by abrasion brittle articles of various sizes and shapes at the same time.

A further object is to provide an apparatus for cleaning articles of crockery continuously by submerging them in a mass of grog or other suitable abrasive particles, which mass insulates the articles from each other to prevent breakage and is tumbled relative to the articles to effect the cleaning.

Other objects will be apparent from a reading of the following specification, in connection with the accompanying drawings in which:

Figure 1 is a plan view, broken away, of an apparatus constructed in accordance with this invention, showing the locations of various conveyor belts used in connection with the apparatus.

Figure 2 is a vertical section, broken away, of the apparatus, itself, showing the positions of the conveyor belts.

Figure 3 is a side elevation, broken away, of the apparatus, showing the conveyors for feeding ware and grog to the apparatus and for removing them therefrom.

Figure 4 is an enlarged cross-sectional view illustrating one form of troughing rollers which may be used to support the conveyors.

Figure 5 is an enlarged cross-sectional view of the tumbling belt and of the feeding conveyor therefor, on the line 5—5 of Figure 3.

Figure 6 is an enlarged cross-sectional view of the outer end of the feeding conveyor and of the frame therefor, on the line 6—6 of Figure 3.

Figure 7 is a schematic representation of the path traversed by the grog in the operation of the apparatus.

Figure 8 is a schematic representation of the orbit followed by the ware in the operation of the apparatus.

Figure 9 is a schematic representation of the positions assumed by the ware and the grog, combined, in the operation of the apparatus.

In the drawings, the numeral 1 designates a rack of spaced boards on which articles of crockery are placed on their sides as they are taken off cars carrying them in a bung from bisque kilns. Shaking or otherwise providing relative

motion between the plates or other articles loosens the sand, which falls between the boards onto a conveyor 2, driven in the direction of the arrow by a motor 3. The conveyor 2 carries the sand to a sand return conveyor 4, driven by a source of power not shown, which returns the sand to a bin for reuse in the bisque kilns.

The articles of crockery or pottery ware are pushed from the rack 1 onto a conveyor 5, which is driven by a motor 6. As will be described later, the conveyor 5 is carrying grog, which holds the articles and prevents them from damaging each other. The grog consists of broken pieces of china, small stones or other material having a fairly rough surface, the pieces being preferably about $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter.

The ware and grog are dumped from the conveyor 5 to a cross conveyor 7, driven by a motor 8. The cross conveyor 7 carries the ware and grog upwardly and dumps them onto a feeding conveyor 9, driven by a motor 10. The feeding conveyor 9 carries the ware and grog upwardly and may run in a frame 11 provided with raised sides 12 adjacent the conveyor belt 9 to prevent spilling of the material therefrom.

The frame 11 is preferably mounted adjustably in the supporting structure 13 of the apparatus. For example, as may be clearly seen in Figure 6, the frame 11 may be supported on the structure 13 by means of wedge-shaped ribs 14 attached to each side of the frame and sliding in grooves 15 in the structure 13. Threaded rods 16 engage threaded apertures in the ribs 14 so that when the rods are rotated by the handle 17 and cross-connecting chain 18, as may be seen in Figures 1 and 3, the ribs 14 and the frame 11 are moved longitudinally, carrying therewith the belt 9.

As may be more clearly seen in Figures 2 and 5, the frame 11 carrying the conveyor belt 9 extends within the open end of a tumbling belt or conveyor 19. The belt or band 19 is made of flexible material, such as canvas or rubber, and is suspended over rollers 20 and 21, rotatably supported in the structure 13. The belt 19 is sufficiently large in diameter to form with its slack portion beneath the rollers 20 and 21 a chamber, trough or bight 22, into which the grog and ware fall and in which the abrasive cleaning takes place. It will be understood, of course, that the apparatus can be constructed with more than two rollers to support the belt 19 or with a single roller of large diameter. The rollers 20 and 21 are supported in the structure 13 at a small, adjustable angle to the horizontal, so that, when the apparatus is operating, the mixture of grog and ware progresses slowly toward the open lower end of the belt.

In one apparatus which has been constructed, it has been found that with the belt 19 revolving at a linear speed of approximately 253 feet per minute, a proper cleaning of mixed articles of crockery is achieved with the rollers and belt inclined from the horizontal between two and five degrees. The time for treatment of such articles is about three or four minutes.

One of the rollers, for example, the roller 20 is rotated, as by a driving chain 23, connected to a source of power not shown. Rotation of the roller 20 causes the belt 19 to revolve about that roller and about the idler roller 21.

In order to prevent longitudinal movement of the belt 19 with respect to the rollers 20 and 21, the belt may be provided with a circumferential ridge 24, having inclined sides which are engaged

by pairs of idling rollers 25, supported from the structure 13 by brackets 26.

When the cleaning treatment is completed, the mixture of ware and grog drops from the open, lower end of the belt 19 onto a foraminous conveyor 27, driven by a motor 28. The conveyor 27, as illustrated in Figure 1, has openings large enough to permit the particles of grog to fall through and yet the openings are small enough that the smallest articles of crockery to be treated in the apparatus cannot pass through the openings. The conveyor may, for example, be formed of wire netting of very coarse mesh.

The grog which falls through the mesh of the conveyor 27 slides on a chute 29, which is a wire screen of relatively fine mesh, to a conveyor 30, driven by a motor 31, and is carried thereby to the conveyor 5. As has already been described, the grog on the conveyor 5 is the bed into which the articles to be cleaned fall when they are pushed from the board rack 1.

Minute particles of grog, dust and sand fall through the mesh of the chute 29 and through the lower, returning portion of the meshed conveyor 27 into a bin 32, from which they are periodically removed. In this manner, the grog is kept relatively free of dust so that its effectiveness as an abrasive material is maintained.

The cleaned ware falls from the mesh conveyor 27 onto a ware selecting conveyor 33, which is driven by a motor 34. At this point is preferably located an electric fan, or air supply blower, for blowing residual dust off the ware, and an exhaust blower for carrying the dust away. In order to avoid confusion, these blowers are not shown in the drawings. The cleaned ware, which is now ready for glazing, is removed from the conveyor 33.

A certain amount of grog will remain on or in the ware even after the ware passes over the mesh conveyor 27 and onto the ware selecting conveyor 33. When the ware is taken from the latter conveyor, this excess grog is dumped from the ware onto the conveyor 33 and is carried thereby upward to a chute 35, over which it slides onto the feeding conveyor 9.

All of the conveyors used with this apparatus are preferably troughing conveyors, although for convenience they have been illustrated as flat. In Figure 4 there is illustrated one form of roller which may be used. The conveyor belt 36 has a troughed cross-section and passes over a central roller 37, having a horizontal axle, and outer rollers 38, having inwardly inclined axles. The axles for the rollers are supported on a frame 39 resting on the supporting structure 13. It will be understood that other forms of troughing rollers may be used.

In Figures 7, 8 and 9 are illustrated schematically the paths or orbits followed by the grog and ware in the operation of the apparatus. The tumbling belt 19 is shown as revolving in a counter-clockwise direction. As the right side of the bight or loop 22 moves upwardly, it carries the grog 40 upwardly to an apex 41 from which the grog falls over to the left side of the bight which is moving downwardly. The bulk of the grog 40 thus travels in an orbit adjacent the belt 19 and then from the apex 41 over the top of the mass to the other side of the belt. The orbit of the grog is thus seen to be larger than the orbit of the ware 42 which, due to the larger size of its pieces and because of the continual flow of the grog beneath the pieces, travels in a path farther removed from the belt 19 than the path of the

5

grog. The articles of ware 42 rotate on their axes, as indicated by the arrows in Figure 9, as they travel about their orbit.

The grog 40, in traversing its path, has a greater speed than does the ware 42 in its smaller orbit. There is thus a differential flow of the grog with relation to the ware and this differential flow causes a working of the grog relative to the ware. It is this continual working of the grog against the surfaces of the ware which performs the abrasive cleaning of the ware.

It has been found in practice that the grog automatically works between the articles of ware and separates them. This action not only effects a thorough scouring of the ware but it also insulates the articles from each other so that there is no breakage. It is this characteristic of the apparatus which makes its operation practical. Because of it, articles of different sizes and shapes can be cleaned in the same apparatus at the same time. This feature is one of considerable convenience and economy, since it is not necessary to sort the articles as they come from the kiln cars. Moreover, the insulating action of the grog makes it possible to clean the articles of crockery or other brittle material in one mass of grog and ware at the same time.

A further important advantage is that the cleaning process is continuous, effecting a considerable saving in time, labor and convenience over prior batch processes.

In practice, the belt 19 will not remain in the shape illustrated in Figures 7, 8 and 9, but will instead bulge outwardly near the center of the mass, adjacent the side of the belt which is moving upwardly. The shape of the trough 22 helps to cause the differential flow of the grog 40 and the ware 42.

An important advantage of this apparatus is that the conveyors and the tumbling belt are so arranged as to make it impossible for mineral or other foreign bodies to contaminate the ware and cause spots on it during further processing.

The operation of the apparatus may, if desired, be modified to provide for rotation of the roller 20 and consequent revolution of the belt 19 in opposite directions for alternate and equal intervals.

Another possible modification of the apparatus would be to substitute for the rollers 20 and 21 two bars to which the sides of a rectangularly shaped belt would be attached. The bars would be caused to reciprocate alternately, one bar being raised at the same time the other bar is being lowered, and then at the ends of their travel the directions of movement of the bars being reversed.

Although the apparatus has been described in connection with the abrasive cleaning of chinaware or crockery, it will be understood that it is also suitable for the cleaning of other articles. Examples of these are small castings of aluminum and other materials to which the particles to be removed are not too firmly attached.

I claim:

1. Apparatus for polishing ceramic ware or other articles comprising a roller inclined at a slight angle to the horizontal, an endless belt loosely supported by the roller forming a trough thereunder, a conveyor belt extending into the trough to discharge therein, grog on the conveyor belt continuously discharging into the trough, and passing through the trough, and means turning the roller and conveyor belt, the ware to be polished being placed on the grog

6

on the conveyor belt and discharged from the lower end of the trough.

2. A continuous process for cleaning potteryware and the like or other articles which comprises, advancing streams of grog and ware to an upper level and forming therefrom a unitary, unidirectionally flowing stream, moving the unitary stream down an inclined plane towards a discharge position and revolving the same enroute to tumble the constituents and clean the ware whilst continuously feeding uncleaned ware and grog into the unitary stream from the upper level and separating cleaned ware and grog at the lower level.

3. A continuous process for cleaning potteryware and the like or other articles which comprises, moving independent streams of grog and ware to an upper level, combining the streams to form a unitary, unidirectionally flowing stream of grog and ware, moving the stream of grog and ware down an inclined plane towards a discharge position, tumbling the constituents of the stream enroute to clean the ware whilst continuously moving grog and uncleaned ware into the upper level end of the tumbling section of the unitary stream and separating grog and cleaned ware at the lower level.

4. A continuous process for cleaning potteryware and the like or other articles which comprises, moving independent streams of grog and ware to an upper level, mixing the streams at the top of an inclined plane to form a single, unidirectionally flowing stream traveling down an inclined plane, tumbling the stream constituents together enroute down the inclined plane to clean the ware whilst continuously adding uncleaned ware and grog to the upper level end of the single stream and separating grog and cleaned ware at the lower level.

5. A continuous process for cleaning potteryware and the like or other articles which comprises, circulating a stream of grog in a closed path and in one portion of the path adding thereto in a continuous stream a quantity of ware to be cleaned and in another portion of the path, tumbling the grog and ware together while enroute down an inclined plane to clean the ware, and thereafter separating the grog and cleaned ware and returning the grog for further tumbling operations with uncleaned ware.

6. In the manufacture of potteryware and the like or other articles, the method of cleaning bisque ware which comprises, sending a continuous stream of bisque and grog down an incline and tumbling the mixture enroute by turning the ware and grog over and over from side to side relative to the direction of travel.

7. In the manufacture of potteryware and the like or other articles, the method of cleaning bisque ware which comprises, feeding a continuous stream of grog supporting a quantity of uncleaned ware into an incline and tumbling the mixture enroute down the incline by turning the ware and grog over and over from side to side relative to the direction of travel.

8. Apparatus for cleaning potteryware and the like or other articles comprising an elongated flexible tube having an inlet at one end and an outlet at the other, an inclined support for said tube and from which said tube is suspended in inclined position with the discharge end at the lower level, means for precluding endwise displacement of the tube, a drive for revolving said tube about its long axis, continuously moving ware and grog carrying means arranged to con-

tinuously discharge ware and grog directly into the inlet end of the flexible tube whilst the tube is revolving and conveying means for transporting grog and ware away upon discharge from the outlet end of the tube.

9. Apparatus for cleaning potteryware and the like or other articles comprising an open ended, elongated flexible tube having a non-metallic surface such as rubber for receiving the articles to be cleaned, an inclined support for said tube and from which said tube is suspended in loose fashion to form a bight in which the tumbling action takes place, means for supporting the tube against endwise displacement on the first support, a drive for revolving said tube, ware and grog conveying means for carrying grog and ware to be cleaned to the inlet end of the tube, ware and grog carrying means for conveying the ware and grog away from the discharge end of the tube and a grog cleaner for cleaning the grog before reuse.

10. In apparatus for cleaning potteryware and the like or other articles, an open ended, elongated, flexible tube, a support for said tube having a roller telescoped through the tube and from which the tube is loosely supported in inclined position, means for precluding endwise displacement of the tube comprising a pair of co-operating, relative movable members one of which is secured to the tube and the other which is supported adjacent thereto against movement in the direction of the long axis of the tube, a ware carrier for co-operation with the inlet end of the tube for continuously discharging ware thereto, a grog carrier for continuously discharging grog thereinto, and ware and grog conveying means for carrying the same away from the discharge end of the tube.

11. Apparatus for cleaning ceramic ware or other articles comprising a plurality of rollers inclined at an angle to the horizontal, an open ended endless tube suspended from the rollers in inclined position and forming an inclined trough thereunder, ware and grog conveying means arranged to discharge into the upper end of the tube, a drive for rotating at least one of the rollers to turn the tube around its long axis and means for supporting the tube against longitudinal displacement on the rollers.

12. In the manufacture of potteryware or other articles the method which comprises, transporting ware in mixed lots from station to station and at one station, combining the ware with grog, at another station tumbling the ware with the grog whilst the ware and grog are moving down an inclined plane and at another station separating the ware and grog, the process being carried on continuously with ware and grog being continuously fed in at one station and ware and grog being continuously separated at another station.

ROBERT E. GOULD.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
899,893	Pass	Sept. 29, 1908
1,224,191	Medgyes	May 1, 1917
1,702,759	Barber	Feb. 19, 1929
2,131,772	Turnbull	Oct. 4, 1938