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[72] Inventor **John E. Scott**
Columbus, Ohio

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[73] Assignee **Owens-Illinois, Inc.**

[54] **METHOD OF POLISHING**
2 Claims, 3 Drawing Figs.

[52] U.S. Cl. **51/283**
[51] Int. Cl. **B24b 1/00**
[50] Field of Search 51/283, 76

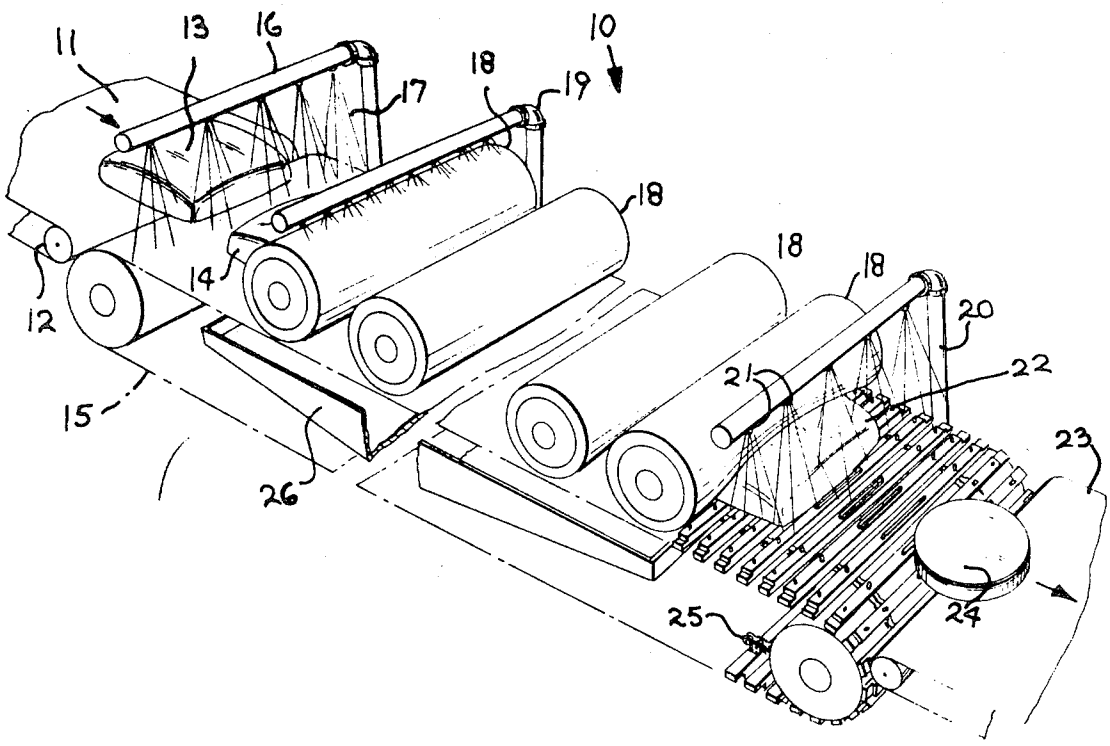
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Primary Examiner—Lester M. Swingle
Attorneys—D. R. Birchall and W. A. Schaich

ABSTRACT: A method of polishing a glass article such as a television picture faceplate that is held in position on an articulated belt. The belt is equipped with protruding lugs that aid in the grasping and positioning of the article while it is being transported and polished.



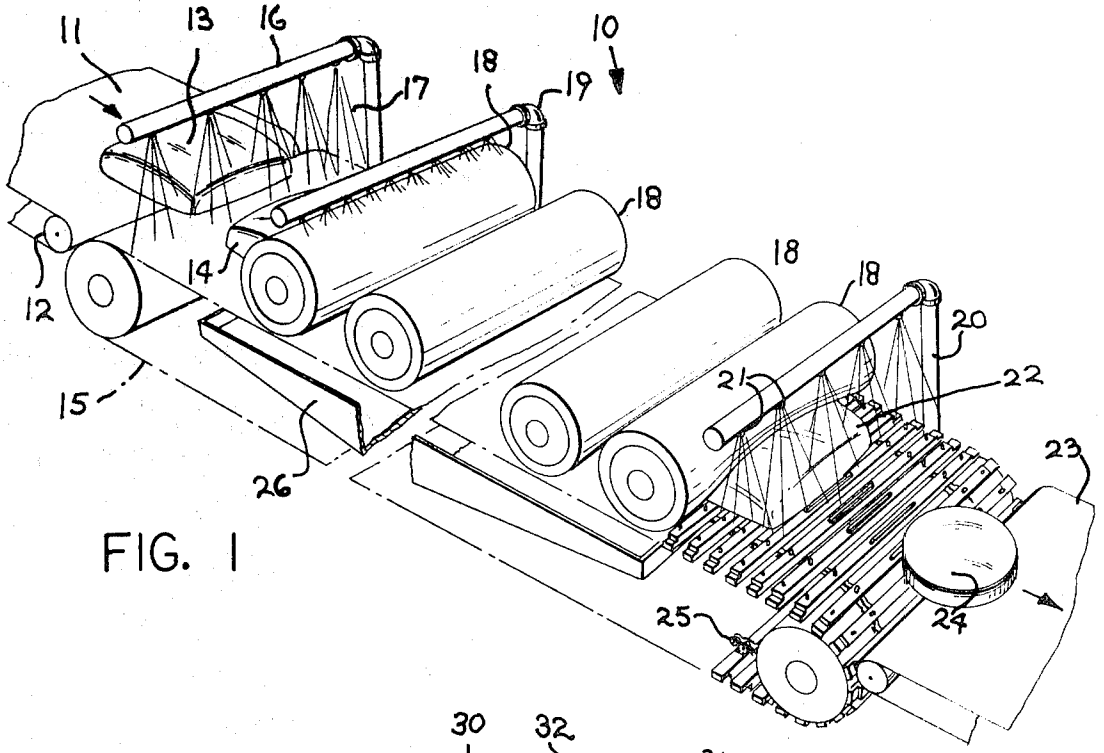


FIG. 1

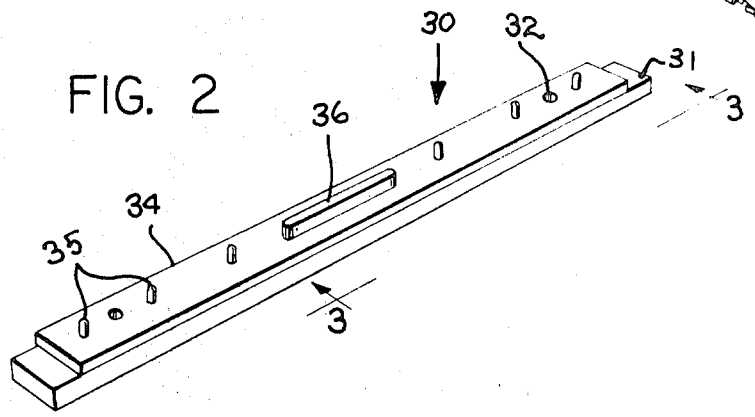


FIG. 2

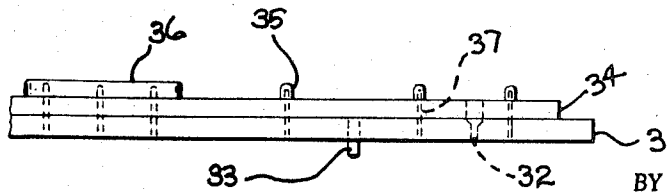


FIG. 3

INVENTOR
JOHN E. SCOTT
BY

ATTORNEYS

METHOD OF POLISHING

This application is a division of my application, Ser. No. 562,732, filed July 5, 1966, now U.S. Pat. No. 3,447,268, dated June 3, 1969.

This invention relates to glass polishing apparatus and more particularly it relates to the grinding and polishing of large curvoconvex articles such as television picture tubes and other similar glass components useful in the electronics industry. The invention also includes the method of grinding and polishing glass articles.

Even though the production of large glass surfaces is well established, there are many instances where manual labor is utilized to move, transfer, align and polish the curved surfaces of articles such as, for example, television picture tube faceplates. After the television tube faceplates have been pressed or otherwise formed to their final configuration from molten glass, they are processed through a slow moving annealing lehr so that a more equal distribution of the stresses within the glass will occur. Subsequent to the annealing operation, the television tube faceplates are transferred to a polishing machine where the exterior surface of the faceplate is ground and polished.

In the prior art devices for grinding and polishing of glass surfaces such as the curved exterior of cathode-ray tubes and more particularly television tube faceplates, each article had to be placed by hand on a special carrier that grasped the four corners of the faceplate. The carrier generally in the form of a conveyor mechanism was then passed beneath a series of grinding and polishing rolls in order to achieve the desired finish.

To accomplish the grinding in a minumum amount of time, the grinding and polishing rolls exert a substantial downward or normal force upon the exterior surface of the faceplate. In addition to the downward force, a rather substantial horizontal force must be reacted by the mounts that support the faceplate. Because of the loads encountered during the grinding and polishing operation, only a limited number of faceplates could be accommodated on a given line. The present invention is a distinct improvement over the prior art because a wide variety of sizes and shapes of faceplates can be processed on the same line. One of the features of the present invention that aids in its versatility is the vertically extending protuberances that can withstand the horizontal loads imposed during grinding and polishing. The protuberances are so spaced in order to receive and retain a wide variety of sizes of faceplates.

An additional improvement over the prior art devices is that the annular edge portion of the hollow glass article is fully protected for subsequent sealing operations. Since the annular edge of the faceplate is supported by an open elastomeric foundation in the form of an articulated conveyor belt, any foreign material on the surface of the belt can be readily removed by the unimpeded flow of the rinse fluids.

According to the invention, facilities are provided for receiving television tube faceplates from a conveyor and positioning them in the proper attitude on a moving conveyor belt so that they may be ground and polished. The conveyor belt is of articulated configuration so that it will provide a firm basis for receiving the downward thrust associated with the grinding operation. Each segment of the articulated belt is spaced one from the other so that there will be instantaneous drainage of the fluids associated with the grinding operation. The top surface of each segment of the conveyor belt employed in the present invention is made from a resilient elastomeric material such as, for example, rubber and is provided with a series of strategically positioned protuberances which facilitate in the orientation of the television tube faceplates on the conveyor. The horizontal thrust developed by the rotation of the grinders is counteracted by the protuberances on the belt segments.

An object of this invention is to provide a method of grinding and polishing the surface of an article without the necessity of precise positioning and alignment.

FIG. 1 is a perspective view of an article-polishing apparatus formed in accordance with the present invention;

FIG. 2 is a perspective view of one of the bars which form the articulated conveyor belt shown in FIG. 1; and

FIG. 3 is a fragmentary elevational view of an individual bar taken along the line 3–3 of FIG. 2.

Referring to the drawings in detail, the overall polishing apparatus is designated by the numeral **10** in FIG. 1. The drawing has been reduced in detail so that only the essential components are shown schematically. An incoming article conveyor **11** positioned at the left end of FIG. 1 carries the television tube faceplates or other similar articles from previous processing equipment to grinding and polishing apparatus **10**. The end support roller **12** of incoming article conveyor **11** is positioned essentially parallel to the receiving end of polishing apparatus **10**. As articles such as **13** and **14** arrive at the end of article conveyor **11**, the forward end of the article will be suspended in air so long as the center of gravity remains on the planar area of the conveyor. The leading edge of the article then approaches the receiving end of articulated conveyor belt **15**. Since the belt **15** is so designed to entrap the forward edge of the article, it is therefore readily transferred to the top surface of belt **15**.

The articles received by belt **15** are moved first under a rinse header **16** that is positioned across belt **15**. Jets of water **17** or other fluids can then be trained down upon and around the articles passing therebeneath. The rinse fluid is then collected in a drain pan and trough located beneath the top concourse of belt **15**. The drain pan has been shown very schematically since it is of conventional design. It will suffice to state that the rinse fluid can find ready access into the drain pan because of the unique properties of conveyor belt **15** which permits the fluid to pass readily therethrough.

The articles such as television tube faceplates **13** and **14** advance along with conveyor **15** until they pass under the first of a series of cylindrical grinders or buffers **18** which are mounted across and above belt **15**. Buffers **18** are of conventional design and are so suspended that a uniform downward thrust is placed upon the convex top surface of the television tube faceplates or other similar articles. The downward biasing force can be of conventional cantilevered suspension wherein the weight of the supporting frame, the drum, the motor which drives the buffer, and a spring supply the prescribed amount of force. (The details are not shown.) The downward force need only be great enough to insure that equal pressure is imparted to all areas of the tube surface for the purpose of creating a uniform polishing action thereon. The actual suspension system including the arrangement for mounting the buffers is not shown in the drawing since it is considered to be of conventional design.

The rotational action of the buffer drums **18** is aided by a conventional polishing composition such as an aqueous suspension of cerium oxide which is dispensed upon the surface of buffer **18** by dispensing header **19**. Cerium oxide is a well-known substance which finds use in the grinding and polishing of glass surfaces. Generally an aqueous suspension is used and is continuously applied to the rotating or revolving felt-covered buffer by means of a control pumping system. Cerium oxide has a fairly high density and unless there is a sufficient fluid to carry it away, it will have a tendency to form cakes which are difficult to remove from the vicinity of the article being polished. Therefore it is imperative that there be adequate movement and volume of the fluid or carrying agent to remove the cerium oxide once it has left the surface of the glass article or the buffer. The conveyor belt **15** of the present invention is particularly valuable since the passages provided therein are ideal in providing openings through which the spent cerium oxide fluid can pass. Once the cerium oxide forms a cake, it is difficult to redisperse the particles after it has been permitted to stand for some time. Under optimum conditions, the spent cerium oxide solution is collected and recirculated to an agitator where it is conditioned for recycling. The spent fluid from the series of buffers **18** is collected in a return trough **26** which underlies the top surface of

the conveyor belt 15. The fluid thus collected by trough 26 can flow immediately to a pumping center where it can again be fed into headers such as 19. Each of the buffers 18 may have a similar spray header as shown associated with the first buffer to the left in FIG. 1. Only one header 19 has been shown in the drawings.

The television tube faceplates or other similar articles pass progressively through the buffing action supplied by a plurality of buffers 18. The downward force, the rotational direction, the angular rotational velocity, and the amount of grinding compound associated with each can be varied in order to achieve the optimum results desired on the exterior surface of the article being polished.

After the polishing and grinding of the exterior convex surfaces of the glass articles has been completed, the articles than progress through a rinse stage. A header 20 supplies water under pressure to a series of spray nozzles 21 which direct the water onto the freshly polished convex surfaces of the glass articles. A rather large volume of water in the form of a spray is required to remove all traces of the grinding compound. As the rinse water drains from the glass articles, it passes quickly and readily through the openings provided in conveyor belt 15.

As shown in FIG. 1, a finished television tube faceplate 22 is exiting from the last of buffer drums 18. As the glass articles are moved to the exiting end of apparatus 10, they are deposited on a conveyor 23 which is similar to conveyor 11 which carries the glass articles to apparatus 10. A round faceplate 24 is shown as it transfers from conveyor 15 to conveyor 23.

FIG. 2 shows perspective one of the transverse segments 30 which comprise the articulated belt 15 which forms part of the apparatus shown in FIG. 1. Segment 30 is but one of many similar elements which make up conveyor 15. Each segment is comprised of a transverse support bar 31 that spans the entire width of conveyor 15. In order to anchor support bar 31 to a conveyor chain such as 25, openings 32 are placed through segment 30. Bolts (not shown) may then be used to secure segments 30 to the individual links of chain 25. Further stabilization is provided by pins 33 that are anchored in bar 31 and protrude downwardly from bar 31 into receptacles within chain 25.

The top portion or pad 34 of segment 30 is made from an elastomeric material such as rubber. Pad 34 is preferably made from an elastomeric material having a hardness in the range of 60 to 80 durometer. Extending upwardly from the top surface of pad 34 are protrusions 35 and elongated bar 36. Protrusions 35 and bars 36 aid in entrapping the glass articles as they are received from conveyor 11 to conveyor 15 so that they are in the optimum position to receive the polishing and grinding action of buffers 18.

FIG. 3 is a side view taken in the direction of line 3–3 of FIG. 2. In order to provide the necessary rigidity to protrusions 35 and bars 36, pins 37 have been incorporated therein. Pins 37 are firmly anchored into support bar 31 and extend upwardly through pad 34 and into the interior of protrusions 35 and bars 36. The assembly of support bar 31 and pins 37 may be placed in a mold along with sufficient unvulcanized rubber so that the finished vulcanized product will have the exterior configuration shown in the drawings.

The above set forth description provides for a simulated continuous belt which actually is a series of closely spaced bar assemblies. All of the desirable features of a continuous belt are present plus the added advantage of permitting the liquid polishing medium to pass therethrough in an efficient manner thus aiding in the recovery thereof. Also the overall assembly can be loaded and unloaded by means of continuous running conveyors thus eliminating the need for a manual or automatic operator at the receiving and exiting ends of the apparatus. The strategically located article holding attachments on the top of the articulated segments will accept a multitude of sizes of glass articles without the need for special holding devices.

While certain representative embodiments and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in this art that various changes and modifications may be made therein without departing from the spirit or scope of the invention.

I claim:

1. The method of grinding and polishing the surface of an article including the steps of:
   a. moving the article toward a means for removing a thin layer of a portion of the external surface thereof while said article remains essentially in a horizontal position,
   b. grasping said article by contact against a reentrant surface thereon to deposit said article on said layer-removing means,
   c. stabilizing said article so that it will not move in a horizontal direction under the influence of tangentially applied loads imposed against said article by said layer-removing means,
   d. grinding and polishing said article while it is being supported on said layer-removing means, and
   e. discharging said article from said layer-removing means after it has been ground and polished.

2. A method as claimed in claim 1 wherein said article is held in fixed position by at least one edge thereof.