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PHOTOELECTRIC INSPECTION OF CONTAINERS FOR DIRTY FINISHES

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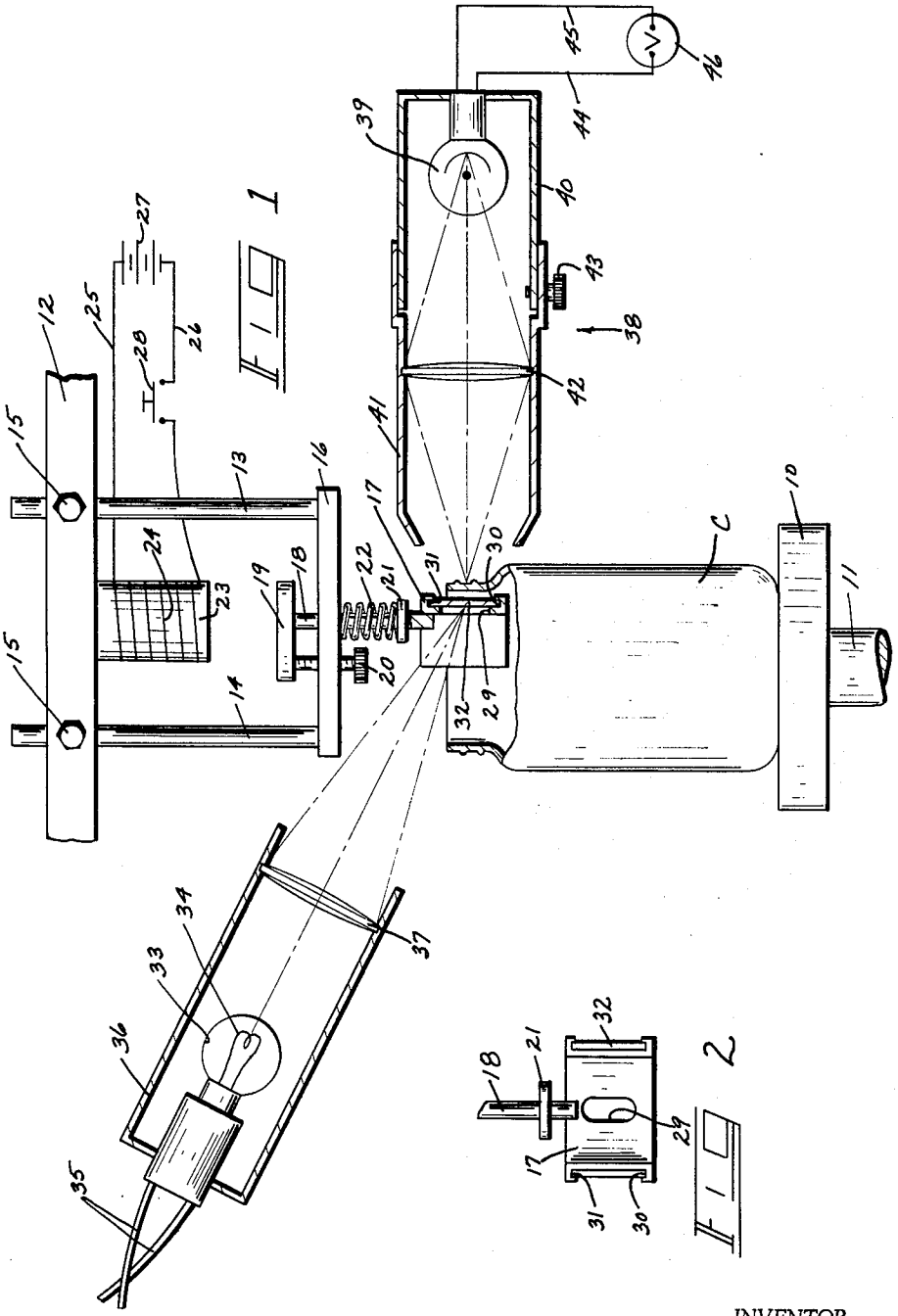

FIG 1

FIG 2

Hans R. Rottmann INVENTOR.

BY W. A. Schaich & D. T. Innis

ATTORNEYS

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PHOTOELECTRIC INSPECTION OF CONTAINERS FOR DIRTY FINISHES

Hans R. Rottmann, Toledo, Ohio, assignor to Owens-Illinois Glass Company, a corporation of Ohio

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This invention relates to a method and apparatus for inspecting the finish or closure attaching portion of a transparent glass container. More particularly this invention relates to a method and apparatus utilizing optical principles for inspecting container finishes for dirt or other contamination which may be present thereon as a result of the forming process of making the containers.

It is an object of this invention to provide a method of inspecting the finish of a glass container to determine the presence or absence of mold dope or other contaminating substances thereon.

It is an additional object of this invention to provide apparatus for inspecting finishes of glass containers for dirt or other foreign substances.

It is a further object of this invention to provide a method and apparatus for inspecting glass articles for the presence of dirt thereon which utilizes a diffuse source of illumination for an optical inspection.

Other and further objects and advantages will be apparent from a consideration of the following disclosure taken in connection with the drawings in which:

FIG. 1 is a side elevational view partly in section of the inspection device of the invention, and

FIG. 2 is a left side view of the mask of FIG. 1.

Referring to FIG. 1 a container C, to be inspected, is supported by a table **10**. The table **10** is supported by a rod **11** and is adapted to be rotated by the rod. In this manner the container C is rotated. Vertically spaced from and above the table **10** is a fixed support **12** to which are adjustably attached a pair of spaced rods **13** and **14**. The rods **13** and **14** are maintained in adjusted position by a pair of bolts **15** which are threaded through the support **12** and engage the rods **13** and **14** which extend through vertical openings provided in the support **12**.

The lower ends of the rods **13** and **14** are connected together by a horizontal bar **16** which serves as the support for a mask **17**. The mask **17** is carried at the lower end of a rod **18** which extends through an opening provided in the bar **16**. The rod **18** has, at its upper end, a crosshead member **19** which bears against the end of a thumb screw **20**. The thumb screw **20** is threaded in an opening provided in the bar **16** and by rotation thereof may be vertically adjusted. The rod **18** also has a shoulder portion **21** formed thereon adjacent its connection to the mask **17** and a biasing spring **22** surrounds the rod **18** and bears at its upper end against a bar **16** and at its lower end against the enlarged portion **21** of the rod **18**. In this manner the mask **17** is biased in a downward direction to a certain extent and its vertical position with respect to a container within which it is positioned, is adjustable by adjustment of the thumb screw **20**. Vertically above the crosshead **19** is positioned an electro-magnet having a soft iron core **23** and having wound therearound a suitable number of turns of wire **24**. The wire **24** is connected by leads **25** and **26** to a battery **27** or other suitable source of direct current. In the lead **26** there is provided a switch **28** which may be opened or closed depending upon whether it is desirable to energize the electro-magnet. Closing of the switch **28** will complete the circuit through the wire **24** and magnetize the soft iron core **23**. The crosshead **19**, formed of a magnetizable material, will be attracted by

the electro-magnet to cause the crosshead and mask **17** to be moved vertically a distance sufficient to withdraw the mask from the finish portion of the container C.

In this manner the container may be easily removed from the table **10** and another container to be inspected may be inserted in place thereof.

As best shown in FIG. 2, the mask **17** is semi-circular in configuration and has an aperture **29** formed therein at the center thereof. The aperture **29** should have a vertical length which is at least equal to the vertical height of the finish portion of the container to be inspected. The mask **17** is formed with a pair of channels **30** and **31** adjacent its top and bottom and which are in facing relationship. These channels serve as the supporting means for a translucent light diffusing material **32**. This material may be, for example, translucent plastic or any material which has the property of diffusing light passed therethrough. The translucent material **32** is exposed, through the aperture **29** formed in the mask **17**, to a source of light provided by a conventional light bulb **33**. The light bulb has a filament **34** which glows upon excitation by a suitable current fed thereto through the leads **35**. The bulb is supported in a housing **36** which also supports a condensing lens **37** which will focus an image of the filament **34** onto the aperture **29** formed in the mask **17**. It should be understood that the image of the filament will be slightly larger than the aperture **29** to provide uniform illumination of that portion of the translucent material overlying the aperture.

In this manner the translucent material **32** will illuminate a portion of the finish of the container with diffused light. The illuminated portion of the finish of the container is viewed by a photo-sensitive means, generally designated **38**. The photo-sensitive means takes the form of a photoelectric cell **39** mounted in the end wall of the cylindrical housing **40**. Cell **39** has an opaque coating with only a relatively small, uncoated area facing in the direction of the longitudinal axis of the inspection device. Whether the finish is focused on the clear area or on the cathode of the cell is not critical because the distance from the clear portion of the cell to the cathode is many times smaller than the distance from the lens to the photocell. The forward end of the housing **40** telescopically receives a cylindrical member **41** which serves as the support for a condensing lens **42**. The member **41** is axially shiftable with respect to the housing **40** and may be retained in adjustable position by a clamping screw **43**. The axial adjustment of the member **41** permits shifting of the lens **42** so as to focus an image of the illuminated finish portion of the container onto the photoelectric cell **39**. The photoelectric cell **39** is connected by leads **44** and **45** to a voltmeter **46**.

Thus it can be seen that illumination of the translucent material will provide a source of diffuse light in close proximity to the neck or finish portion of the container and inasmuch as the aperture **29** is relatively narrow, in the order of $\frac{1}{32}$ to $\frac{1}{16}$ of an inch, a narrow section of the total circumference of the container finish portion will be illuminated and upon rotation of the container, successive portions of the container finish will be illuminated. Complete rotation of the container through 360° will, of course, illuminate the entire circumference of the finish portion of the container. The photosensitive means **39** will have an output voltage depending upon the intensity of the light transmitted through the finish portion of the container. If the finish portion is clean and free of any specks caused by mold dope, the voltmeter **46** will provide a steady reading, however, if a speck of mold dope is present on the finish portion of the container, as this speck passes into the area of illumination it will mask a portion of the light being transmitted through the

container finish and the voltmeter **46** will immediately indicate a reduction in intensity of the light transmitted. The specks which may appear are primarily caused by combustion of mold dope which is sprayed within the neck molds of a container forming machine and may become stuck to the outer finish portion of the container. These specks usually consist of pieces of graphite which are opaque thus masking the transmission of light out of the finish portion.

By providing an apertured mask covered by a translucent material, a relatively small area of the finished portion of the container is illuminated thus the interpositioning of a speck between the source of diffused light and the photocell will decrease the intensity of light transmitted to the photocell, an amount sufficient to provide a distinct response in the voltmeter **46**.

From the standpoint of operability of the inspection device of the invention, it is necessary to use diffused light as the finish portion illuminating means. Diffused light when passing through the irregular outer surface of the finish portion of the container, will not be reflected from this irregular outer surface to the extent that incident light would be reflected, thus providing a substantially constant voltage indication for clean container finishes.

While applicant has described a convenient manner of providing a source of diffused light for illuminating the small radial portion of the container finish, it should be pointed out that the rod **18** could serve to support a bulb having a light diffusing surface in close proximity to the aperture **29** in which case the translucent material covering the aperture **29** would be unnecessary. Furthermore, other and different means could be provided for raising and lowering the mask **17**, for example, the rod **18** could be vertically shifted by means of a hydraulic motor fixed to the support **12**. A further alternative, a horizontally disposed electric motor having its output shaft connected to a crank arm with the end of the crank arm connected to the rod **18** would also provide means for raising and lowering the mask **17**.

Various modifications may be resorted to within the spirit and scope of the appended claims.

I claim:

1. Apparatus for inspecting the finish portion of a glass container for mold dope or specks of dirt comprising means for rotating a container about its vertical axis in an upright position, a curved mask having a narrow vertical aperture therein of a length corresponding to the height of the finish portion to be inspected, means for positioning said mask within the finish portion of the container in close proximity to the inner surface thereof, a light diffusing material carried by said mask in overlying relationship to said aperture, a light source positioned outside of said container, means for focusing said light source onto said aperture for illuminating a narrow, vertical portion of said light diffusing material on the side opposite that facing the container surface, a photosensitive detector positioned outside the finish portion of said container in horizontal alignment with said aperture in said mask, and indicating means connected to said detector for indicating the intensity of light passing through said container finish whereby mold dope or dirt specks will be detected by a variation in the transmission properties of said finish portion.

2. Apparatus for inspecting the finish portion of a glass container for mold dope or specks of dirt comprising means for rotating a container about its vertical axis in an upright position, a curved mask having a narrow vertical aperture therein, means for positioning said mask within the finish portion of the container in close proximity to the inner surface thereof, said means for positioning said mask comprising an electromagnet mounted above the mask, a cross-head connected to said mask, a spring normally urging said mask in a downward direction, means for selectively energizing said electromagnet to lift said mask out of said container after completion of the inspection thereof, a light diffusing material carried by said mask in overlying relationship to said aperture, a light source positioned outside of said container, means for focusing said light source onto said aperture for illuminating a narrow, vertical portion of said light diffusing material, and a photosensitive detector positioned outside the finish portion of said container in horizontal alignment with said aperture in said mask, whereby said detector will provide an indication of the intensity of light passing through said container finish and mold dope or dirt specks will be detected by a variation in the transmission properties of said finish portion.

3. The apparatus as defined in claim **2** further including means for adjusting the vertical position of said mask when positioned within the container finish.

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RALPH G. NILSON, *Primary Examiner.*