

[54] **BOTTLE INSPECTION APPARATUS**
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 250/223 B; 356/237

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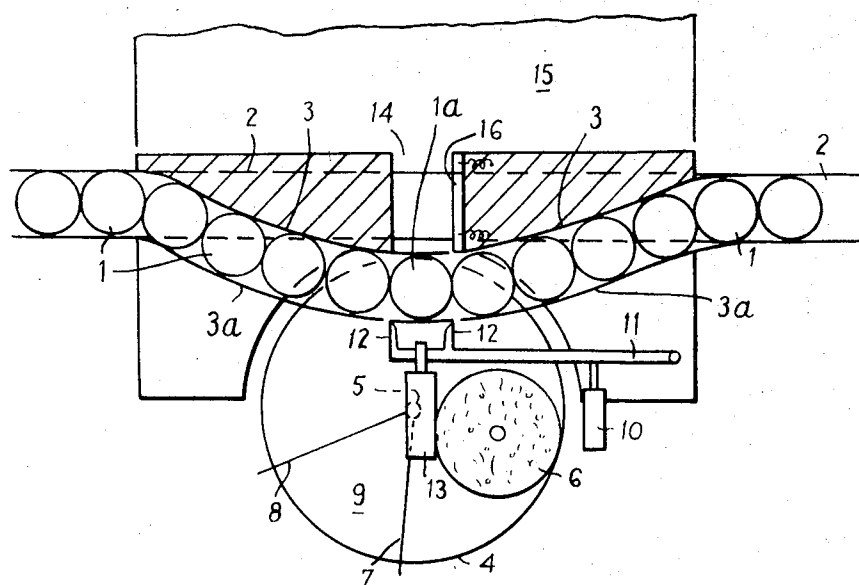
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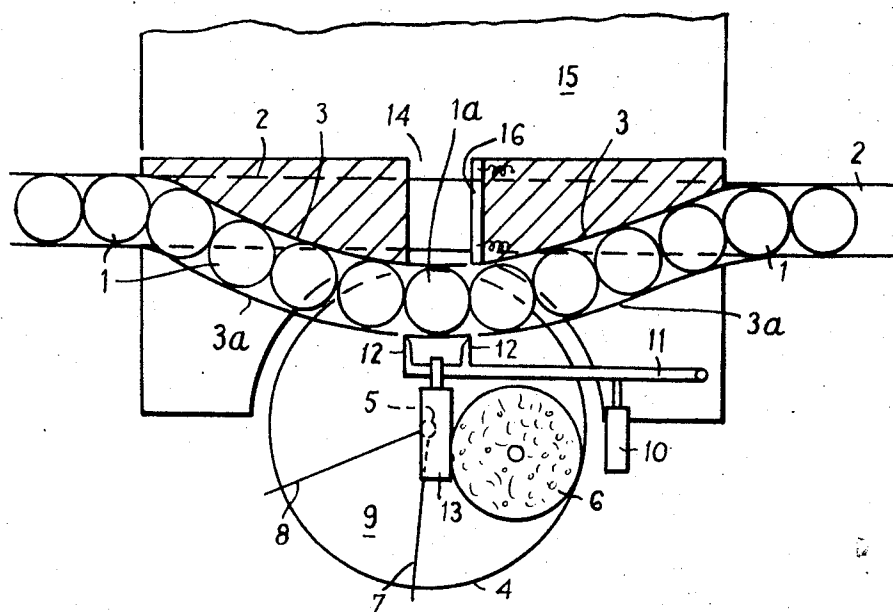
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[57] **ABSTRACT**

A bottle inspection apparatus for optically inspecting the bases of transparent bottles comprises a light source disposed below the inspection position through which a line of bottles is fed and a photocell device disposed above the position for scanning the base of each bottle whilst it is illuminated by the light source. As the bottles pass over the light source they are supported on a horizontal translucent plastics plate which is slowly rotatable about a substantially vertical axis. A rejection mechanism for rejecting dirty or faulty bottles from the bottle line in response to a signal from the photocell device is also disposed at the inspection position and is actuated immediately upon detection of a dirty or faulty bottle to remove the latter from the line, thereby making a pulse storage memory device unnecessary.

6 Claims, 1 Drawing Figure





BOTTLE INSPECTION APPARATUS

The present invention relates to apparatus for the detection of dirt or foreign bodies in transparent bottles or other containers before they are filled and offered for sale, particularly in bottles such as milk or beer bottles which are re-used after washing.

Machines are known which inspect the bottle by optically scanning the base by light projected therethrough. In machines as commercially used the bottles are advanced into or through the inspection zone with the bottle held so that its base is completely clear of obstruction while it is being illuminated and scanned. For this purpose known machines use a star wheel, either free-wheeling or driven, and running in mesh with a row of bottles on the conveyor, each aperture of the star wheel having a suction cup to engage its bottle, the cup being piped to a valve and source of vacuum. This suction cup serves to hold and support the bottle while it passes over a gap in the base plate of the machine beneath which is the illuminating light source and screen, and also to retain a rejected bottle in the star wheel to pass it out to a reject collecting table instead of allowing it to return to the conveyor.

The present invention has for its object to provide a simplified means for supporting the bottles as they are moved over the light source at the base inspection zone. To this end the bottles are caused to slide over the surface of a substantially horizontally disposed translucent plate, for example, a glass plate or an opal plastics plate, which is slowly rotatable about a vertical axis. Preferably, the plate is made from opal polycarbonate material which diffuses the light from the light source. Alternatively, it may be a glass plate which is ground on one or both surfaces, or may be otherwise constructed in order to diffuse the light from the light source therebeneath. The plate is conveniently subjected to a washing or cleaning process as it rotates in areas of its surface which are not occupied by bottles. By means of the arrangement according to the invention the problem of supporting the bottles over the light source is achieved in a simple manner, areas of the supporting plate being freshly cleaned between each cycle of movement through the inspection zone.

A feature of the invention consists in an arrangement for the rejection of bottles or containers which inspection has shown to be faulty. In prior inspection systems the reject output signal has been stored in a memory device which operates rejection mechanism at some point downstream of the inspection position. According to this feature of the invention, the rejection mechanism is disposed to reject a reject bottle at the inspection position so that, upon inspection of a bottle showing it to be dirty or faulty, that bottle is immediately removed by the reject mechanism from the conveyor line, making a pulse storage memory device unnecessary.

In order that the present invention may be more readily understood, reference will now be made to the accompanying drawing, which illustrates a plan view of one embodiment of the invention.

Referring to the drawing, a queue of bottles 1, moving along the conveyor 2, is deflected by guide walls 3, 3a so that the bottles slide over the peripheral zone of a circular translucent plastics plate or disc 4 which is made from opal polycarbonate sheet material, e.g., that marketed by Farbenfabriken Bayer AG under the trade

mark "Makrolon," and which is rotated slowly by an electric motor (not shown) about the vertical axis 5. Beneath the peripheral zone of the plastics disc across which the bottles move is disposed the inspection light source, the light from which is diffused by the opal plastics disc. The base of the bottle is scanned by scanning means, preferably an integrated photocell device as described in the copending application Ser. No. 210,351, now Pat. No. 3,727,068 granted Apr. 10, 1973, filed on an even date and assigned to the same assignees as the present application, which is disposed above the mouth of the bottle and produces a reject output signal if dirt, a foreign body or a fault is detected.

The upper surface of the plastics disc is cleaned as the disc rotates, for example, by a rotary brush 6 which may be supplied with a drip feed of detergent, after which the disc moves under and in contact with two squeegee wiper blades 7 and 8 between which clean rinse water is applied to the surface of the disc at 9. The first wiper blade 7 squeezes away the detergent liquid and the second wiper blade 8 squeezes away the rinse water.

Experiments have shown that despite the passage of the bottles thereover, the rotation of the disc enables its upper surface to be maintained in reasonable optical condition, whereas orientated scratch patterns arise if the disc is stationary which can cause difficulty with the inspection. Furthermore, dirt streaks which would accumulate over a period of time and also interfere with the inspection, are cleaned away by the washing or cleaning process.

After passing the inspection zone the bottles 1 are returned to the conveyor 2, those which have produced a signal indicating dirt being rejected from the line.

In the event of a reject output signal being produced, an electric or pneumatic actuator 10 is operated which moves a lever arm 11 towards the bottle 1a in the inspection position to cause fingers 12 on the arm to project into the path of movement of the bottles at opposite sides of the bottle 1a, thus arresting movement of bottle 1a and also of the queue of bottles upstream thereof. As soon as the bottle 1a is arrested, an ejector device 13 is actuated to push the reject bottle 1a through a gap 14 in the opposing guide wall 3 to a collecting area 15 for reject bottles. The gap 14 may have a spring-pressed side wall 16 for holding the rejected bottle, and the gap walls may be so arranged that a reject bottle is deflected thereby into the area 15 by the movement of the conveyor 2 therebeneath. As soon as the bottle is rejected, the ejector device 13 and the arm 11 move back to their original positions and inspection of the queue of bottles again commences.

Whilst a particular embodiment has been described it will be understood that various modifications may be made without departing from the spirit of the invention. For example, a separate diffuser plate may be positioned below a transparent rotating plate or disc. The disc may be made from a translucent material other than polycarbonate sheet material provided that such material is sufficiently scratch-resistant. Also other means than those shown may be provided for washing or cleaning the surface of the disc. The cleaning liquid or water may be removed or dried off by an air blast, which may be heated. Moreover, although it is preferred to drive the plate by a motor, the friction of the moving bottles on the surface thereof can be used to rotate the disc or plate.

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We claim:

1. In bottle inspection apparatus for optically inspecting the bases of transparent bottles and other containers, a light source disposed below an inspection position through which each container is fed, a photocell device disposed above said position for scanning the base of a container whilst it is illuminated by said light source, a substantially horizontal translucent plate disposed above said light source and on which the container bases are supported as said containers move over said base light source, said containers being supported upon a part only of the upper surface of said plate, means mounting said plate for rotation about a substantially vertical axis, and means for cleaning said upper surface, as said plate rotates, in areas of its surface which are not occupied by containers.

2. Apparatus as claimed in claim 1, wherein said plate is an opal plastics plate which is slowly rotatable about said vertical axis by the friction of the moving containers on said upper surface of said plate.

3. Apparatus as claimed in claim 1, wherein said cleaning means comprises a rotary brush engaging said upper surface, an arrangement for supplying a drip feed of detergent to said brush and two generally radially disposed squeegee wiper blades engaging said surface downstream from said brush and between which rinse water is applied to said surface of said plate.

4. Apparatus as claimed in claim 3, including a rejection mechanism disposed so as to reject a reject bottle at the inspection position whereby, upon inspection of a bottle showing it to be faulty, that bottle is immediately removed by the reject mechanism from the conveyor line.

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5. In inspection apparatus for inspecting bottles and other containers moving along a conveyor line, a mechanism for rejecting from said line a container which is shown, upon inspection, to be dirty, said rejection mechanism being disposed adjacent the inspection position and comprising a pivoted lever arm swingable towards and away from said inspection position and having spaced fingers adjacent said position which project into the path of movement of the containers on opposite sides of a container at said inspection position upon movement towards said position, actuator means responsive to a reject signal produced upon detection of a dirty container at said inspection position to move said lever arm towards said dirty container at said position and cause its fingers to project into the path of movement of said containers on opposite sides of said dirty container, and an ejector device operable to push said dirty container disposed between said fingers from said conveyor line.

6. Apparatus as claimed in claim 5, wherein said ejector device is mounted on said lever arm and includes a reciprocable plunger projecting between said fingers.

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