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Hansen et al.

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[54] **METHOD AND APPARATUS FOR EXAMINING LIQUID FILLED CONTAINERS**

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[52] **U.S. Cl.**....................................**356/36,** 73/61.4, 233/26, 250/218, 356/102, 356/197, 356/208, 356/246

[51] **Int. Cl.**.................**G01n 1/00,** G01n 15/02, G01n 21/04

[58] **Field of Search**................356/36, 39, 40, 180, 182, 184, 356/186, 196, 197, 208, 246; 250/218; 73/61.4; 233/26

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[57] **ABSTRACT**

A container which is at least partially filled with a liquid is centrifuged while its longitudinal axis is maintained substantially perpendicular to its axis of rotation thereby causing impurities which may be present in the liquid to move to the end of the container farthest from the axis of rotation while the air bubbles in the liquid collect at the end of the container nearest to the axis of rotation. The container is then moved diametrically past the axis of rotation causing the air to move to the opposite end of the container. The centrifuging of the container continues causing any impurities which may be present to be transferred from the end of the container in which they have been collected to the opposite end. The presence or absence of these impurities is sensed by a photoelectric device during this transfer.

11 Claims, 11 Drawing Figures

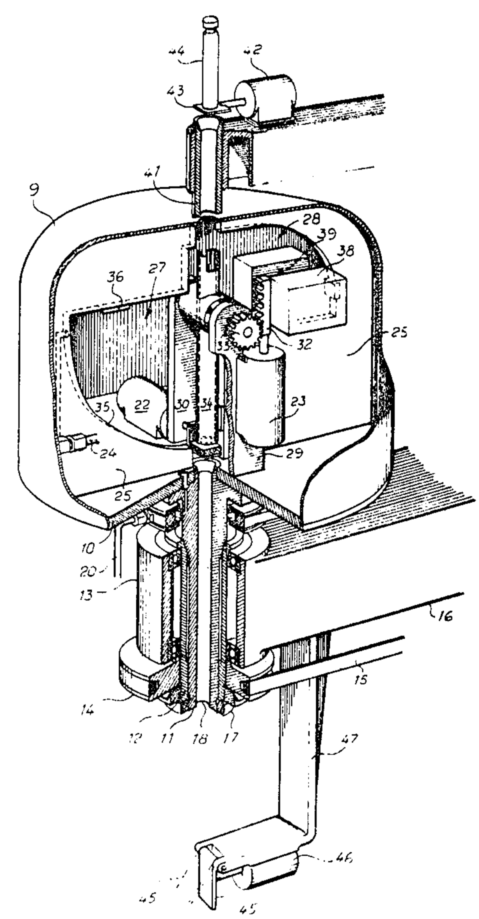

Fig. 1

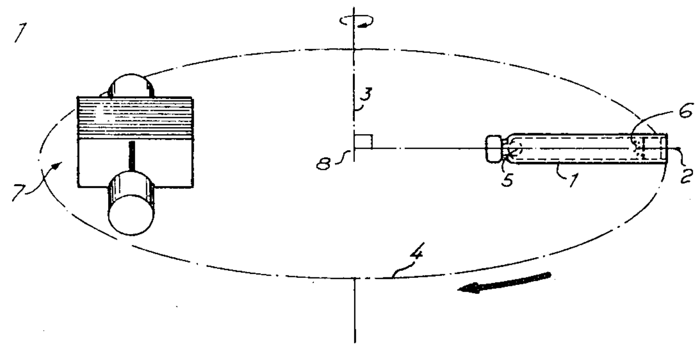

Fig. 2

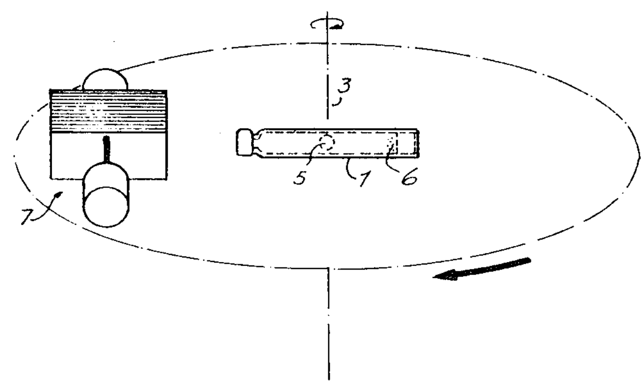

Fig 3

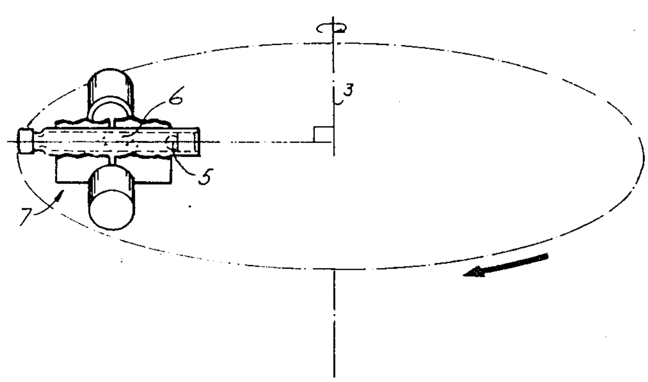

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Fig 4

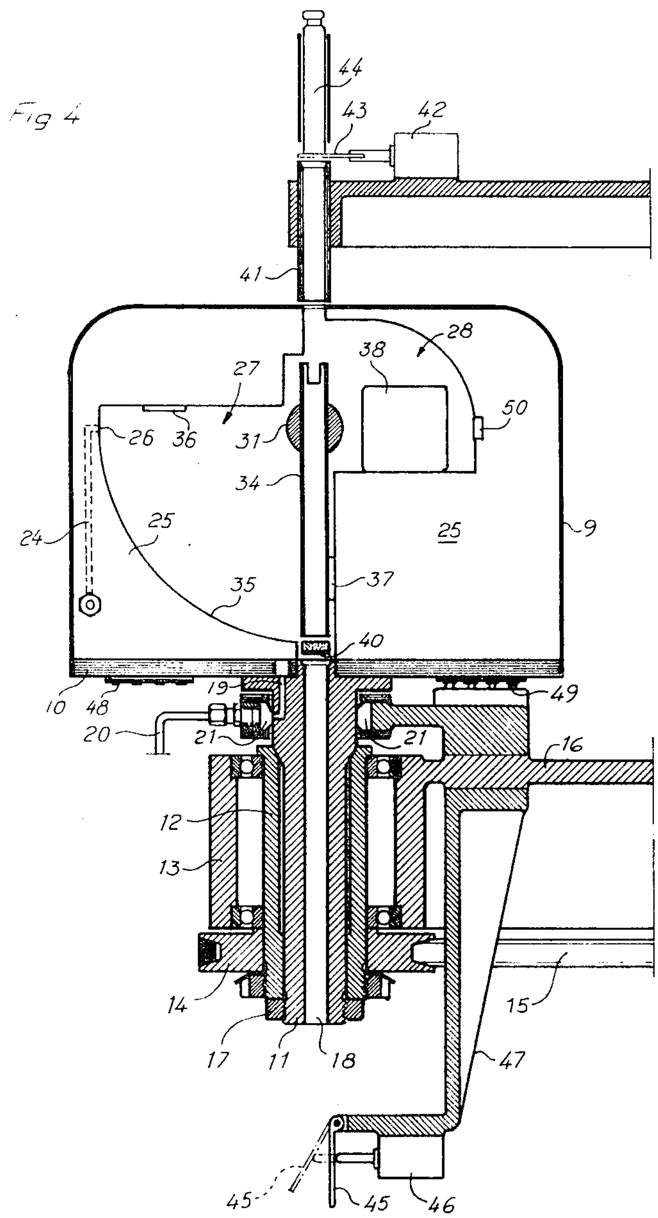

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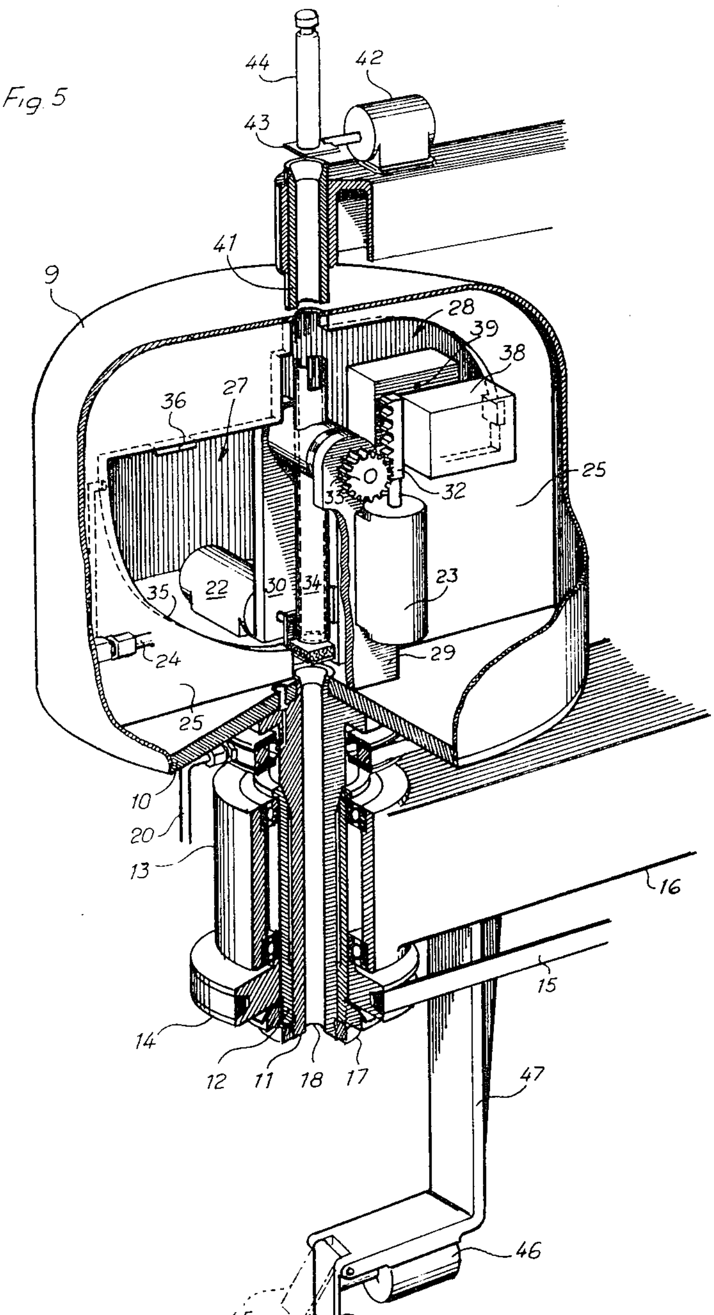
Fig. 5



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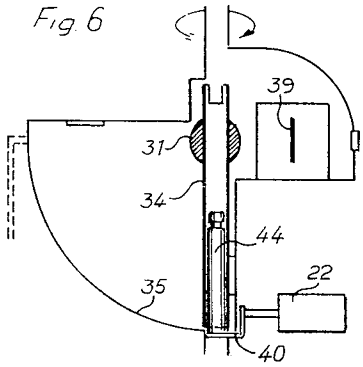

Fig. 6

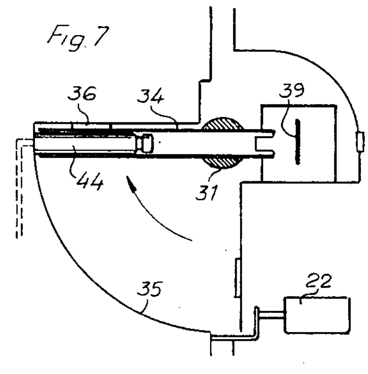

Fig. 7

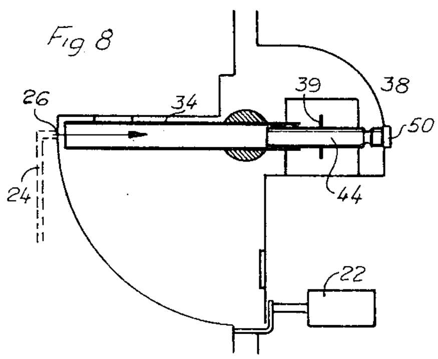

Fig. 8

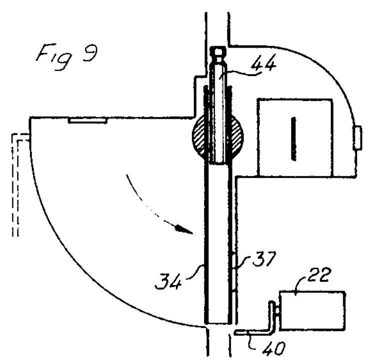

Fig. 9

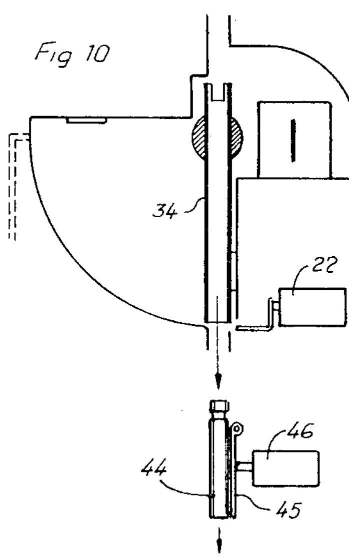

Fig. 10

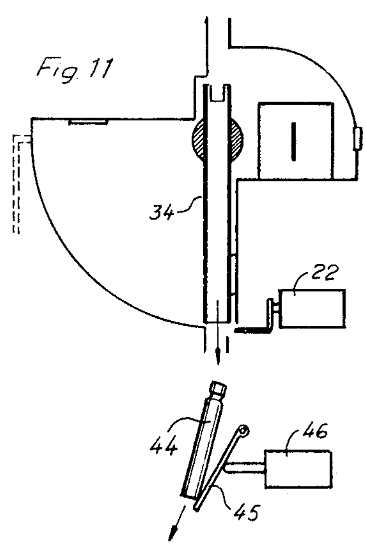

Fig. 11

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METHOD AND APPARATUS FOR EXAMINING LIQUID FILLED CONTAINERS

BACKGROUND OF THE INVENTION

The present invention relates to a method and apparatus for examining a container to determine the absence or presence of impurities, and more particularly to a novel and highly effective method and apparatus for determining the presence of these impurities by centrifuging the container while it is held in two successive positions.

A difficult problem is presented by the need to determine whether containers which have been filled with a liquid are contaminated by impurities which may have been introduced into the container when they were filled or closed. It has not been found possible to completely eliminate the occurrence of these impurities despite the maintenance of high standards of cleanliness when the containers are washed, filled, and closed. Moreover, impurities may be present in the liquid which are traceable to the manufacture and treatment of the liquid itself and, therefore, not easily excluded during the filling and closing of the containers.

The problem described is of particular importance when, for example, ampoules are filled with and injection solution. It has been found that fibers, glass fragments, and the like are occasionally present in the filled ampoules despite efforts to guard against this contamination.

Because containers do contain impurities, it is necessary to provide a method and apparatus for examining the containers and segregating those which are contaminated by impurities. One known procedure is to manually examine ampoules under a strong light. This, however, is expensive and time consuming.

It is also known to examine ampoules to determine whether impurities are present by utilizing photoelectric devices. One known device causes a light source to be projected onto a concaved mirror and through a condensing lens and diaphragm. The beam thus produced is used to light an electrical screen utilizing an optic edge and an achromatic lens. The ampoule to be examined is disposed in front of the concaved mirror and rotated. When the rotation is stopped abruptly any particles of impurities which are present in the liquid continue to move because of inertial force. Spots caused by the particles are registered on the screen. Ampoules containing particles of impurities can be identified and discarded in this way. It has been discovered however, by manual examination, that a large portion of the discarded ampoules are, in fact, free from contamination. This is because the ampoules contain small air bubbles which move through the liquid and are registered on the lighted electrical screen in the same manner as particles of impurities. It has not previously been possible, despite ingenious and sensitive examining devices, to distinguish between the air bubbles and the contaminating particles.

SUMMARY OF THE INVENTION

The invention provides a novel and highly effective solution to the problem described above. According to the invention, a container, which is at least partially filled with a liquid, is centrifuged by causing it to move along a circular path about an axis of rotation while maintaining the longitudinal axis of the container substantially perpendicular to the axis of rotation. After being centrifuged for an appropriate time and at a sufficient speed in this position, the container is caused to move diametrically toward the opposite periphery of the circular path, thereby causing the interior of the container to move past the axis of rotation. The centrifuging of the container then continues while the longitudinal axis is again maintained substantially perpendicular to the axis of rotation. While the container is being centrifuged, but before it has been moved diametrically, the impurities which may be present in the container will be collected at the end of the container which is farthest from the axis of rotation. During this continued centrifuging the container is examined to determine the absence or presence of impurities. Air which may be present in the container will move to the end of the container which is then closest to the axis of rotation. The air may collect in the form of one large bubble. After the container has been moved diametrically, and while the centrifuging is continued, the impurities which may be present in the liquid will be transferred to the end of the container which is then farthest from the axis of rotation. It is during this movement of the impurities that the presence or absence of impurities is photoelectrically detected.

The means for examining the container may be mounted so as to be diametrically displaceable. In this case the container may be examined after its interior has moved past the axis of rotation. Alternatively, the means for examining the container may be mounted so as to be stationary with respect to its diametrical position. In this case the container is examined as it moved diametrically past the means for examining it.

An apparatus for carrying out the method described above may comprise a rotatable platform which may be horizontally disposed so as to form the base plate of a rotatable housing. Holding means for maintaining the container in the desired orientation and a means for examining the container which may be mounted on the base plate may be fixedly connected to a vertical, rotatably mounted first shaft means which is provided with an opening passing longitudinally through its center. The holding means may comprise a holding tube which is mounted so as to be rotatable between a vertical and a horizontal orientation within the housing. The holding tube, when in its vertical position, may be in alignment with the opening in the first shaft means. The holding tube may be fixedly connected to a first shaft means at a distance from the base plate and may thereby be rotated between its vertical and horizontal orientation.

A means for feeding the containers to be examined is stationarily disposed above the center of the housing. It comprises a centering tube and a means for controlling the movement of the containers into the holding means.

The invention provides a method and apparatus for examining liquid filled containers in a highly reliable manner whereby those containers contaminated by impurities can be segregated. An essential factor is that air bubbles which may be present in the container are not registered during the examination of a container.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawings in which:

FIGS. 1 – 3 are diagrammatic representations showing a container during stages of an examination carried out in accordance with the method of the invention;

FIG. 4 is an orthographic projection in section of an apparatus constructed in accordance with the invention;

FIG. 5 is a sectional pictorial representation of the apparatus of FIG. 4; and

FIGS. 6 – 11 are modified diagrammatic representations showing a portion of the apparatus of FIGS. 4 and 5 during various phases of its operating cycle.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The principles of the method of the invention will be described first. FIGS. 1 – 3 show a container 1 which comprises a cylindrical ampoule and is at least partially filled with a liquid. The liquid may be an injection solution. The container 1 is disposed with its longitudinal axis 2 perpendicular to and at a suitable distance from and axis of rotation 3. The container 1 is subjected to centrifuging by causing it to move along a circular path 4 while maintaining the longitudinal axis 2 of the container 1 substantially perpendicular to the axis of rotation 3. Air may be present in the container 1 in the form of a bubble 5. Impurities 6 may also be present in the container 1. These impurities may, for example, be glass fragments, small pieces of dirt, or fibers.

The container 1 is centrifuged at a speed sufficient to cause the impurities 6 which may be present to be collected at the end of the container 1 which is farthest from the axis of rotation 3, this speed also being sufficient to cause the air 5 which may be present in the container 1 to move to the end of the container 1 nearest to the axis of rotation 3.

A means for examining the container to determine the absence or presence of impurities with which it is at least partially filled, shown here as examination station 7, is disposed in the plane of the circular path 4. After the air bubble 5 and the particles 6 have been caused, by the centrifuging of the container 1, to move to their respective positions described above, the container 1 is caused to move diametrically past the axis of rotation 3 toward the opposite periphery of the circular path 4. As shown in the drawings, the container 1 moves from the position shown in FIG. 1, through the position shown in FIG. 2, to the position shown in FIG. 3. This diametrical movement of the container 1 takes place during continuous centrifugation by rotation about the axis of rotation 3. As the container 1 passes the axis of rotation 3 the air bubble 5 remains over the axis at the point 8. Thus as the container 1 continues its diametrical movement, the air bubble 5 is transferred to the opposite end of the container 1 which is then nearest to the axis of rotation 3.

The container 1 continues to be centrifuged, after it has been moved diametrically at a speed sufficient to cause the impurities 6 which may be present to be transferred to the end of the container 1 which is then farthest from the axis of rotation 3. The container 1 is examined during this transfer of the impurities which move through one or more beams of light and their presence is detected by one or more photoelectric cells which generate electrical signals.

The longitudinal axis 2 of the container 1, referred to above, is considered to be an imaginary line which passes through the container 1 and the axis of rotation 3 while the container 1 is held in the position in which it is centrifuged. In the instance of a particular container this axis is preferably selected to provide the most effective collection of the impurities and to provide the most effective detection of the impurities after the container has begun to move diametrically.

The container 1 may be fed to the examining apparatus with its longitudinal axis 2 substantially coincident with the axis of rotation 3, in which case the container 1 is rotated into a position in which it is perpendicular to the axis of rotation 3 before it is centrifuged. Alternatively, the container 1 may be fed to the examining apparatus with its longitudinal axis 2 substantially perpendicular to the axis of rotation 3. In this case it may be fed at the periphery of the circular path 4.

An apparatus for carrying out the method described above is shown in FIGS. 4 and 5 and will now be described. A cylindrical housing 9 and a rotatably mounted platform 10 are provided. The rotatably mounted platform 10 comprises a horizontally disposed circular disc which forms the base plate of the housing 9. The platform 10 is attached to a vertically disposed rotatably and concentrically mounted first shaft means 11.

The first shaft means 11 is engaged by a cylindrical casing 12, which is rotatably mounted in a bearing housing 13. The bearing housing 13 is provided, on its lower extension, with a pully 14 driven by a flexible belt 15 which is partially conical in cross section. The bearing housing 13 is mounted on a supporting member 16.

The first shaft means 11 is fixidly attached to the cylindrical casing 12 by means of a locking nut 17 which is engaged by threads on a lower portion of the casing 12. The vertically mounted first shaft means 11 is provided with a cylindrical opening 18 which passes longitudinally through its center and has a diameter somewhat greater than the diameter of the containers which the apparatus is used to examine.

The first shaft means 11 is further provided with a channel 19 (see FIG. 4) which is connected to a compressed air tube 20 by a peripheral opening 21 which circumscribes the first shaft means 11. Thus, an open path is maintained between the compressed air tube 20 and the channel 19 during the rotation of the first shaft means 11. The compressed air from channel 19 passes through a hole in the platform 10 to a conduit (not shown) having three branches and located within the cylindrical housing 9. Each branch of the conduit is provided with a valve (not shown). Two of the branches of the conduit are connected to compressed air cylinders 22 and 23 respectively (note FIG. 5). A third branch 24 of the conduit is disposed within the partition 25 and ends in an opening 26 disposed at a distance from the platform 10. The opening 26 is directed toward the center of the housing 9. Partition 25 has a fixed orientation within the housing 9 and is provided with two apertures 27 and 28, each having a shape of a sector of a circle.

A holding means, comprising holding tube 34, for maintaining the longitudinal axis of the container substantially perpendicular to the axis of the platform 10 is provided. To support and actuate this holding means bearings 29 and 30 are vertically disposed on opposite sides of the partition 25 (see FIG. 5) to engage a second shaft means 31 which is connected to the holding means and is disposed at a distance from the base plate 10 and perpendicular to the partition 25. The second shaft means 31 has portions which project into the bearings 29 and 30. A rack 32 engages a gear wheel 33 which is attached to the portion of second shaft means 31 which projects into the bearing 29. The rack 32 is arranged to be actuated by the compressed air cylinder 23 and thereby cause rotation of the second shaft means 31.

The holding means, comprising the holding tube 34, is arranged to be rotatable between a vertical and a horizontal orientation by the second shaft means 31 which is provided with a hole concentric with one of its diameters and located at its intersection with the holding tube 34. The holding tube 34 has an inside diameter somewhat larger than the diameter of the containers which are to be examined. The second shaft means 31 is arranged to be rotated 90° by the rack 32 and the gear wheel 33 thereby rotating the holding tube 34 from its vertical to its horizontal orientation.

The holding tube 34 is of a length such that it lies in close proximity to a curved interior edge 35 of the partition 25 formed by the aperture 27. The corner of the aperture 27 opposite the curved edge 35 is coincident with the intersection of the second shaft means 31 and the holding tube 34. When the holding tube 34 is rotated into its horizontal orientation it will abut against or move close to an edge of the aperture 27 on which a resilient damping means, comprising a pad 36, is provided. A similar resilient damping means, comprising pad 37, is provided on another edge of aperture 27 so as to engage the holding tube 34 when it moves to its vertical orientation.

A means 38 for examining the container to determine the absence or presence of impurities in the liquid with which it is at least partially filled is fixedly attached to the partition 25 next to the aperture 27. The means 38 for examining containers comprises a low resistance photoelectric element of, for example, silicium or cadmium sulphide. The photoelectric element is illuminated through an optical lens (not shown) and a vertical slit 39, by a lamp (not shown). The components of the means 38 for examining containers are arranged so that the light beam is directed substantially perpendicular to an extension of the center line of the holding tube 34 when it is at its horizontal orientation, with its longitudinal axis substantially perpendicular to the axis of rotation of the platform 10.

The compressed air tube 22 has provided therewith a first blocking means 40 disposed between the upper part of first shaft means 11 and the lower part of the holding tube 34. The first blocking means 40 has a resilient upper surface which functions as a damping means. It is arranged to be actuated by the compressed air cylinder 22 whereby it can be withdrawn at the appropriate time during each operating cycle of the apparatus, thus providing an unobstructed path formed by the holding tube 34 and the opening 18 of the first shaft means 11. The first blocking means 40 is subsequently returned to its original position, obstructing this path, by means of a spring (not shown) located in the housing of the compressed air cylinder 22.

A means for feeding the containers to be examined is stationarily disposed above the center of housing 9. It comprises a centering tube 41 and an electromagnetic means 42 for controlling the movement of the containers into the holding means comprising holding tube 34. Electromagnetic means 42 is arranged to operate a second blocking means 43, which is withdrawn when it is desired to release an ampoule 44 into the centering tube 41. The centering tube 41 is arranged so that the longitudinal axis of the ampoule 44 will be aligned with the centers of the holding tube 34 and the first shaft means 11. In addition, the centering tube 41 may serve as a means for checking the diameters of containers whereby ampoules which are too large in diameter are prevented from passing through the centering tube 41 into the means for holding the containers, comprising holding tube 34.

Arranged beneath the first shaft means 11 is a rotatably mounted guide means 45 which is rotatably mounted at a point located outside and extension of the walls of the opening 18 provided in the first shaft means 11. Movement of the guide means 45 is controlled by an electromagnetic means 46 which is supported by a shank 47.

As can be seen in FIG. 4, the underside of the platform 10 is provided with circular contact paths 48. Sliding contacts 49 are arranged to lie adjacent these circular contact paths 48 during the rotation of the cylindrical housing 9. This provides the components mounted on and within the housing 9 with electrical power and provides a path for electrical signals which control electromagnetic means 42 and 46. The above described circuit means similarly controls the valves associated with the two branches of the conduits which supply compressed air cylinders 22 and 23. The circuit means also controls the valve associated with the branch 24 of the conduit which provides a stream of compressed air emitted from opening 26. A photoelectric cell (not shown) is provided as a means for sensing the completion of an operating cycle which is indicated by the fall of an examined ampoule from the lower end of opening 18.

The operation of the apparatus shown in FIGS. 4 and 5, which takes place in accordance with the method of the invention, will now be described. The belt 15 supplies power to a pully 14 thereby causing the first shaft means 11 and the cylindrical housing 9 to rotate at a speed of approximately 300 revolutions per minute, which is suitable for causing the desired movement of impurities and air, which may be present in the container. An operating cycle commences when an electrical impulse actuates the electromagnetic means 42 thereby causing it to withdraw the second blocking means 43 and allowing the ampoule 44 to move downward under the force of gravity into the centering tube 41. The blocking means 43 then returns to the position shown in the drawings. The ampoule 44 descends from the centering tube 41 into the holding tube 34 which is, at this time, vertically oriented. The descending ampoule 44 is intercepted by the resilient surface of the first blocking means 40. The sharp impact of the ampoule 44 is softened by its resilient surface.

FIGS. 6 through 11 illustrate positions of the ampoules and apparatus during various phases of the examining procedure. In these Figures the electrically controlled compressed air cylinder 22 has been displaced 90° so as to give a clear and unobstructed view of the operation.

After the ampoule 44 has attained the position illustrated in FIG. 6, the valve associated with the branch of the conduit connected to the compressed air cylinder 22 receives an electrical signal which results in the rack 32 being displaced by the force of the compressed air. The second shaft means 31 is thus rotated causing the holding tube 34 which holds the ampoule 44 to rotate approximately 90° to its horizontal orientation, as shown in FIG. 7. As the holding tube 34 moves from its vertical to its horizontal orientation the ampoule 44 is pressed, by centrifucal force, against the curved edge 35 of the partition 25. The ampoule 44 then continues to be centrifuged in the position illustrated in FIG. 7 in which the holding means comprising the holding tube 34 maintains the longitudinal axis of the container substantially perpendicular to the axis of rotation of the platform 10, i.e., the center of first shaft means 11. Thus, the rotation of the cylindrical housing 9 causes impurities such as glass fragments, fibers, and the like, which may be present in the ampoule 44, to be collected at the end of the ampoule 44 which is farthest from the axis of rotation of the platform 10 and closest to the periphery of the circular path about the axis along which the container is rotated. A second effect of the centrifugation is to cause the air which may be present in the ampoule 44 to from a single, large bubble at the end of the ampoule 44 which is closest to the axis of rotation of platform 10.

The movement of the impurities to the end of the ampoule 44 farthest from the axis of rotation of platform 10 is attributable largely to the centrifugation while the ampoule 44 is in its horizontal orientation illustrated in FIG. 7. However, this collection of impurities is also partially attributable to the tendency of these impurities to move to that end of the ampoule 44 when it comes to an abrupt stop against the resilient surface of the first blocking means 40.

After the ampoule 44 has been centrifuged in its horizontal position for a number of seconds, the valve associated with the branch 24 of the compressed air conduit is opened thereby causing a horizontally directed stream of compressed air to be emitted from the opening 26 into the holding tube 34. Thus, the ampoule 44 is caused to move from the position shown in FIG. 7 to the position shown in FIG. 8, in which it is in close proximity to the light emitting vertical slit 39. The ampoule 44 comes to a stop against a damping means 50. As can be seen in FIG. 8 a large portion of the ampoule 44 is then situated outside of the holding tube 34 between the light source and the photoelectric element of the means 38 for examining the container. Its longitudinal axis continues to be maintained substantially perpendicular to its axis of rotation. The center of the ampoule 44 is substantially situated adjacent the vertical light emitting slit 39.

As explained above, the air bubbles in the ampoule 44 will remain at the center of rotation over the center of the second shaft means 31 as the ampoule 44 moves diametrically past this point. After the interior of the ampoule 44 has moved passed the axis of rotation, the air bubble, thus has moved the entire length of the ampoule 44 and is situated at the opposite end which is now closest to the axis of rotation, this being the same end of the ampoule 44 at which the impurities are now gathered.

As the ampoule 44 moves to the position illustrated in FIG. 8 the beam of light emitted by the slit 39 is interrupted by a metal envelope provided on the end of the ampoule 44. This causes the photoelectric element of the means 38 for examining the containers to produce a sharp electrical impulse. In the event that the ampoule 44 is inserted in the apparatus in the reverse position, the function of the metal envelope is fulfilled by a rubber stopper which closes the opposite end of the ampoule 44. The impulse thus generated by the means 38 for examining the containers causes the photoelectric examination of the ampoule 44 to commence. Thus, as the ampoule 44 passes the light emitting slit 39 the beam of light passes through its liquid contents.

As the ampoule 44 continues its diametrical movement it moves past the light emitting vertical slit 39 enabling successive portions of the ampoule 44 to be examined. Accordingly, the impurities which are at this time transferred through the ampoule 44 toward the end which is now farthest from the axis of rotation, because of the centrifuging of the ampoule 44, will pass through the beam of light causing variations in the electrical signal generated. If impurities are present in the ampoule 44, the varying electrical signal causes the guide plate 45 to move from its vertical first position (shown in FIG. 10) to an angulated second position (shown in FIG. 11). The guide plate 45 thus diverts contaminated ampoules from the path they would otherwise take, causing them to fall into a segregated group.

After the examination of each ampoule is completed the guide plate 45 returns to its vertical position so that the next ampoule, if it does not contain impurities, will be permitted to fall without striking the guide plate 45. In the instance in which the ampoule does not contain impurities a variable electrical signal, which indicates the presence of impurities, is not generated and the guide plate 45 remains in its vertical position as shown in FIG. 10.

When an ampoule which has been examined passes through the first shaft means 11 it is sensed by photoelectric cell located between the lower end of the shaft and the guide plate 45. This photoelectric cell generates a signal which actuates electromagnetic means 42 thereby causing the next ampoule to be fed to the apparatus commencing the next operating cycle. If, at the conclusion of an operating cycle, an ampoule is not sensed by the photoelectric cell beneath first shaft means 11, this is an indication that the ampoule has become lodged in the apparatus, probably in the centering tube 41, and a signal is accordingly generated which stops the rotation of the cylindrical housing 9. Ampoules become stuck in the apparatus primarily because their diameters are too large. Accordingly, it is possible to prevent such stoppages of the apparatus by checking the diameters of the ampoules in a separate device before they are delivered to the centering tube 41.

It will be obvious to those skilled in the art that the above described embodiment is meant to be merely exemplary and that it is susceptible of modification and variation without departing from the spirit and scope of the invention. For example, one or more photoelectric elements may be disposed so that two light streams may be caused to pass through the containers, perpendicular to each other. The containers, which are at least partially filled with liquid, may be breakampoules, cylindrical ampoules, small injection flasks, (conveniently having a volume of up to approximately 20 milliliters) or other similar containers. Therefore, the invention is not deemed to be limited except as defined by the appended claims.

We claim:

1. An apparatus for examining a container which has a longitudinal axis and is at least partially filled with a liquid, comprising a rotatably mounted platform, a holding means for maintaining the longitudinal axis of the container substantially perpendicular to the axis of rotation of said rotatable platform, means for causing said container to move within said holding means past the axis of rotation of said platform toward the opposite side of said platform, and means for examining the container to determine the absence or presence of impurities in the liquid with which it is at least partially filled while the longitudinal axis of the container continues to be maintained by said holding means substantially perpendicular to the axis of rotation of said platform.

2. The apparatus of claim 1, wherein a means for feeding the containers to be examined is stationarily disposed above the center of said platform, said means for feeding the containers comprising a centering tube and a means for controlling the movement of the containers into the holding means.

3. The apparatus of claim 1 further comprising a vertically disposed rotatably mounted first shaft means which is provided with an opening that passes longitudinally through its center, wherein said rotatably mounted platform comprises a horizontally disposed circular disc, said platform being attached to said first shaft means, said holding means comprising a holding tube which is rotatable into a vertical position in which it is in alignment with the opening in said first shaft means.

4. The apparatus of claim 1 further comprising a second shaft means to which said holding means is connected whereby said first shaft means can be rotated, said holding means comprising a holding tube which is arranged to be rotatable between a vertical and a horizontal orientation.

5. The apparatus according to claim 1 wherein the means for examining the container includes a light source and a photocell.

6. The apparatus of claim 4, wherein said means for examining the container is disposed at a distance from said platform and is aligned with the position of said holding tube when said holding tube assumes its horizontal orientation.

7. A method of determining whether impurities are present in a container which is at least partially filled with a liquid comprising the steps of:

centrifuging the container by moving it along a circular path about an axis of rotation,

moving the container diametrically across its circular path, thereby causing the interior of the container to move past the axis of rotation and causing any impurities present in the container to change position within the container; and

examining the container while it is being centrifuged by directing radiant energy at the container and detecting the energy which passes therethrough, whereby the presence or the absence of impurities within the container is determined.

8. The method of claim 7 wherein the step of centrifuging the container is carried out at a speed of rotation sufficient to cause impurities which may be present in the container to be collected at the end of the container which is farthest from the axis of rotation, this speed also being sufficient to cause any air which may be present in the container to move to the end of the container nearest to the axis of rotation, and wherein the container continues to be centrifuged after it has been moved diametrically at a speed sufficient to cause the impurities which may be present to be transferred to the end of the container which is then farthest from the axis of rotation, and wherein the step of directing radiant energy at the container is carried out during this transfer of the impurities.

9. The method of claim 7 wherein the container is examined after the interior of the container has moved diametrically past the axis of rotation, wherein the radiant energy is directed at the container by means for examining the container, and wherein the means for examining the container is moved with respect to the axis of rotation while the container is examined.

10. The method of claim 7 wherein the container is examined by an apparatus that remains stationary with respect to the axis of rotation while the container is examined.

11. The method of claim 7 further comprising first feeding the container which has a longitudinal axis into an examining apparatus in a position in which its longitudinal axis is substantially coincident with the axis of rotation, and then rotating the container into a position in which its longitudinal axis is substantially perpendicular to the axis of rotation.

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