United States Patent

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[54] **REACTION VESSEL FOR USE IN PHOTOMETRIC MEASUREMENTS**
12 Claims, 4 Drawing Figs.

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[51] Int. Cl. G01n 1/10
[50] Field of Search 356/244, 246; 250/218; 23/292

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ABSTRACT: A small vessel having generally cylindrical form is described. This vessel has a flange at the upper rim and the lower portion is provided with parallel planar surfaces particularly suitable for photometric measurement of the contents of the vessel.

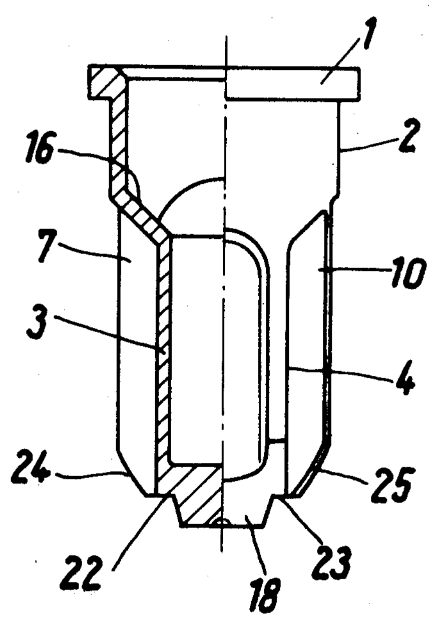


Fig.1

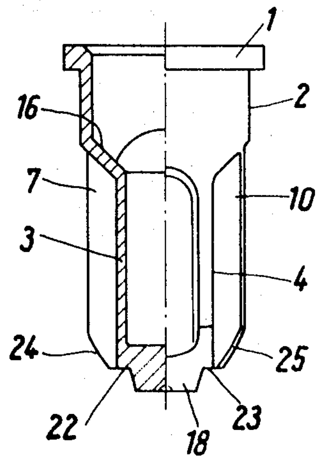


Fig.2

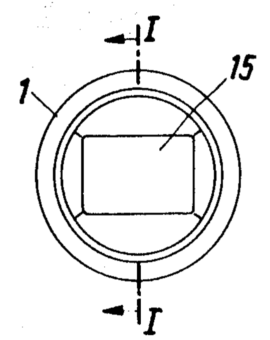


Fig.3

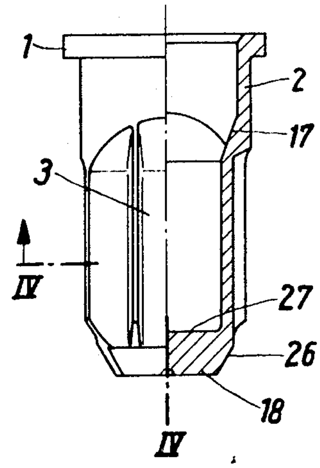
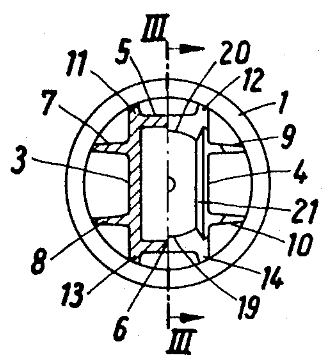


Fig.4



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REACTION VESSEL FOR USE IN PHOTOMETRIC MEASUREMENTS

BACKGROUND OF THE INVENTION

This invention relates to reaction vessels, and more particularly to reaction vessels adaptable for use in the photometric measurement of small quantities of liquids.

Small quantities of liquid are often handled in reaction vessels having a height of approximately 30 mm. and a diameter of approximately 15 mm. Such vessels are generally of cylindrical form and have an upper flange rim providing a shoulder which facilitates handling. Such vessels are of particular usefulness in connection with automatic processing systems wherein the transfer of the vessel and the agitation and treatment of the contents are simplified by the cylindrical form. These vessels are frequently made of plastic and are dispensable so that they need be used only once. In general the vessels have heretofore been used for mechanical treatment of the contents only. When it is necessary or desirable to execute photometric measurements of the contents, in particular, comparison measurements, special measuring cuvettes must be employed. The contents of the original vessel are transferred into these measuring cuvettes in order to assure that the optical properties of the vessel exhibit desired characteristics.

SUMMARY OF THE INVENTION

The present invention provides a reaction vessel which is not only particularly well suited for the mechanical treatment of the contents thereof, but at the same time may be employed as a cuvette suitable for making photometric measurements.

The vessel of the present invention exhibits in cross section a pair of parallel planar walls on opposing sides. These walls are disposed along chords of the circle defined by the upper cylindrical portion of the vessel. Outwardly directed ribs are arranged on the planar surfaces with a space therebetween. These ribs project no further than the periphery of said cylindrical portions.

By retaining the basic cylindrical form of conventional reaction vessels, the vessels of the present invention are suitable for handling in automatic systems in the same manner as existing vessels. On the other hand, as a result of the planar surfaces they contain, these vessels permit measurements to be made photometrically.

An object of the present invention is to provide an improved reaction vessel for both mechanical preparation of the contents and photometric measurement thereof.

Another object of the invention is to provide an improved reaction vessel having parallel planar walls.

Another object of the invention is to provide an improved reaction vessel having parallel planar walls and yet retaining a basically cylindrical configuration relative to the longitudinal axis thereof.

It has been found that the provision of reinforcing ribs of the nature described hereinafter, makes it possible to provide a thin construction of the planar surface of the vessel without danger of having the planar surfaces arch following production. It is possible to use ribs which extend around the circumference of the vessel perpendicular to the longitudinal axis thereof, however, a particularly preferred form of construction provides ribs which extend in a direction parallel to the vessel axis and are arranged on either side of the planar surface. By longitudinally the ribs in this fashion, the vessel is better adapted for insertion into openings or holes and in addition, the ribs provide some shielding of the planar surface on which measurements will take place.

Another object of the invention is to provide an improved reaction vessel having thin parallel planar walls and reinforcing ribs.

Another object of the present invention is to provide an improved reaction vessel particularly adapted for insertion into openings or holes without damaging the planar surfaces.

It has also been found desirable that the wall sections between the previously mentioned planar surfaces be also drawn in and arranged as parallel planar surfaces that are orthogonally disposed relative to the first mentioned planar surfaces and which also lie along chords of the circle defined by the cylindrical portion of the vessel. Thus, the same vessel provides two different optical measurement paths. Still further, it is contemplated that the invention provide an inner core section of the vessel which is rectangular at least in the region of the aforementioned planar surfaces. This rectangular section and the plane surface section being advantageously adjacent to an upper cylindrical wall section which is directly under a rim flange. Finally, a nose, or bottom portion, of substantially rectangular section is provided at the bottom of the vessel.

Another object of the invention is to provide an improved reaction vessel having two photometric measuring paths.

Another object of the present invention is to provide an improved reaction vessel having an at least partially rectangular interior portion in order to provide better mixing in the event of agitation.

Still another object of the present invention is to provide an improved reaction vessel having good form stability and heat transfer characteristics.

Yet another object of the present invention is to provide an improved reaction vessel including means for facilitating alignment of the vessel.

With respect to the last mentioned object, it will be noted that the ribs protect the planar surfaces against mechanical contact, scratching, and the like, and thereby provide an important function considering the fact that the vessel may be used for photometric measurements. These ribs may also be utilized in order to align the vessel for measurement. On the other hand, there may be provided a rectangular nose portion, or base portion, at the bottom of the vessel. According to a preferred form of construction, stepped surfaces extend at right angles to the longitudinal axis of the vessel and are arranged on at least two sides of the rectangular base. These surfaces make it possible to hold the vessel by the base and support it upon the stepped surfaces so that it is not inserted too deeply into any openings.

Advantageously, the vessel tapers at the bottom, the taper being produced essentially by chamfering of the ribs, while the interior of the vessel has a constant rectangular cross section extending through to the bottom. This tapering facilitates the easy introduction of the vessel into openings. It is to be noted however that the planar surfaces do not participate in this tapering effect and that they are always parallel with one another.

The above objects and features of the invention will be more clearly understood and appreciated from the following description which is made in connection with the drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a vessel embodying the present invention, half of this elevation being in section along the line I—I shown in FIG. 2;

FIG. 2 is a top view of a vessel embodying the present invention;

FIG. 3 is a side elevation of the vessel shown in FIG. 1, rotated through 90°, and having a portion in cross section taken along the line III—III shown in FIG. 4; and

FIG. 4 is a bottom view of the vessel embodying the invention, half of said view being in section taken along the line IV—IV in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The figures disclose a vessel which is open at the top and which may be provided with a variety of closure means. In usual embodiments, the vessel may have a height of approximately 30 mm. and the outside diameter of the upper flange rim may be approximately 18 mm. The upper portion of the vessel includes an outwardly extending flange 1 below and adjacent to which is a recessed cylindrical wall section 2. Below the cylindrical wall section **2**, the vessel walls are disposed inwardly and establish parallel planar surfaces. Two opposing surfaces **3** and **4** are created having somewhat greater width than the lateral interconnecting surfaces **5** and **6** which extend therebetween at right angles. The plane surfaces **3** and **4** have disposed thereon pairs of perpendicularly extending ribs **7, 8** and **9, 10**, which are spaced from the center of the surfaces and extend orthogonally therefrom to terminate in the outer contour defined by the upper cylindrical portion **2** of the vessel. These ribs may also form a smooth transition into the cylindrical section **2**. The outer edges of the ribs are accordingly designed obliquely to their major axes.

The surfaces **5** and **6** are also flanked by pairs of ribs **11, 12** and **13, 14**. In this case, the ribs **11–14** lie in prolongation of the wall portions forming the plane surfaces **3** and **4**. In accordance with this design, the inner cross section of the vessel at the level of the plane surfaces **3** and **4** is rectangular as illustrated at **15** in FIG. **2**. It will also be noticed from FIGS. **1** and **2** that the transitions **16** and **17** from the cylindrical vessel wall section **2** to the section with the inner cross section are formed by oblique transition surfaces; the inclination of the surfaces **16, 17** being different due to the different retraction of the plane surfaces **3** and **4** on the one hand and of the lateral surfaces **5** and **6** on the other. As a result of this, the ribs **11–14** are somewhat flatter than the ribs **7–10**.

At the bottom of the vessel, there is a projecting nose or base portion **18** which has a substantially rectangular cross section. FIG. **4** illustrates that the lower limiting edges **19** and **20** under the lateral surfaces **5** and **6** may be slightly rounded. This results from the amount of taper of the vessel downwardly. In any event, the longer edge **21** shown in FIG. **4**, and the corresponding edge on the opposite side (not shown), under the plane surfaces **3** and **4** are straight and parallel to the plane surfaces so that they may be used for alignment of the vessel.

FIGS. **1** and **3** also illustrate that the nose **18** tapers downwardly so that its introduction into a correspondingly profiled opening may be facilitated. In particular, as shown in FIG. **1**, stepped surfaces **22** and **23** are provided parallel to the longitudinal edges of the nose **18**. These surfaces provide for aligned vertical placement and make it possible to place a vessel with the nose **18** only in a prepared opening. These stepped surfaces may continue into the lower region of the ribs **7–10** so that a relatively large support surface is provided.

The taper of the lower vessel edge is produced in particular at the circumferential sections at which the plane surfaces **3** and **4** are located, by chamfers **24** and **25** of the ribs. The vessel body may also be bevelled, as for example at **26** in FIG. **3**, this chamfer will lie below the bottom surface **27** of the vessel.

A particular embodiment of the invention has been shown and described. Clearly, the dimensions recited herein, and even the relative dimensions of the various sides of the vessel, are not necessarily germane to the invention. It is contemplated that those skilled in the art may make many modifications within the spirit and teachings of this disclosure. Accordingly, the invention is intended to be only limited by the scope of the appended claims.

What is claimed is:

1. A reaction vessel suitable for the photometric measurement of small quantities of liquid, comprising an upper cylindrical portion having a longitudinal axis, a lower portion having opposed parallel planar walls, a connecting portion providing a transition between said upper and lower portions, and outwardly projecting ribs extending longitudinally on each side of said opposed parallel planar walls disposed to leave a flat central portion therebetween, the outer edges of said ribs establishing points on the circumference of a circle, said circle being disposed within a transverse plane through said vessel and orthogonal to said axis, whereby the outer edges of said ribs form the outline of a substantially cylindrical configuration.

2. A reaction vessel according to claim **1**, wherein the center of said circle lies on said longitudinal axis.

3. A reaction vessel according to claim **1**, wherein said circle has the same radius as said upper cylindrical portion.

4. A reaction vessel according to claim **1**, wherein each of said opposed parallel planar walls comprise planar portions that define chords on a circle disposed within a transverse plane through said vessel and orthogonal to said axis.

5. A reaction vessel according to claim **1**, wherein the wall sections of said vessel between said parallel planar walls are opposed parallel planar lateral surfaces.

6. A reaction vessel according to claim **5**, wherein end ribs project from said lateral surfaces as prolongations of said first mentioned parallel planar walls.

7. A reaction vessel according to claim **1**, wherein said vessel tapers at the bottom, said taper being affected essentially by a chamfer of said projecting ribs, and wherein the interior of said vessel has a constant rectangular cross section extending to the bottom thereof.

8. A reaction vessel according to claim **1**, having substantially equal wall thickness throughout.

9. A reaction vessel according to claim **1**, wherein the inner cross section of the vessel is rectangular at least in the region of said planar walls.

10. A reaction vessel according to claim **9**, wherein a projecting portion extends from the bottom of the vessel and exhibits a substantially rectangular transverse cross section.

11. A reaction vessel according to claim **10**, wherein the longer axis of said rectangular cross section extends parallel to said first mentioned parallel planar walls and at least the edges of said projection are straight in this direction.

12. A reaction vessel according to claim **11**, wherein at least on two sides of said projecting portion, stepped surfaces extend at right angles to said longitudinal axis.

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