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(54) **Tube rack and tubes therefor.**

(57) A rack for holding a plurality of tubes comprises a support member having a plurality of holes therein for receiving tubes. Each hole has a substantially flat wall portion surrounding same to prevent rotation of a tube placed therein.

A tube rack assembly comprises a rack substantially as described above, further including a tube in one of the holes. The tube has a closed end portion with at least one substantially flat wall surface in face-to-face alignment with the flat wall portion so that rotation of the tube in the hole is prevented.

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TUBE RACK AND TUBES THEREFOR

BACKGROUND OF THE INVENTION

1. Field of the Invention. The present invention relates to a rack for holding a plurality of tubes, and more particularly, concerns an improvement in a multiple tube rack for holding test tubes and the like during laboratory or clinical procedures.

2. Description of the Prior Art. In employing test tubes or vials during laboratory or clinical procedures, the user may require many test tubes at one time. For example, a plurality of test tubes are needed for various assay procedures. As the number of test tubes and implements which the user is relying on increases, it is sometimes awkward or difficult for the user to use two hands in handling different items. Such difficulty might arise when using standard metal test tube frames. These standard frames generally have two holes for each test tube, a hole through an upper framework and another hole through a lower framework aligned therewith. If the user needs to remove a plug or cap in the test tubes held in a standard metal frame, two hands are normally required, one to hold the test tube in place and the other to remove the cap. It is appreciated that when test tubes are closely arranged, using two hands for these procedures can be awkward while also increasing the risk that tubes or frames may be knocked over. In addition, anytime two hands are used, the possibility of cross contamination between tubes may be increased since more items may be touched with two hands.

It is therefore desirable for a user of test tubes or vials to be able to use one hand to work with test tubes which are closed and which require the removal of caps or plugs to gain access to the interior of the tubes. Furthermore, a compact work station would also assist the user of a plurality of test tubes during laboratory or clinical procedures. It is toward the satisfaction of these desires and aims which the present invention is directed.

SUMMARY OF THE INVENTION

The rack of the present invention holds a plurality of tubes. This rack comprises a support member having a plurality of holes therein for receiving tubes. Each hole has a substantially flat wall portion surrounding same to prevent rotation of a tube placed therein.

In a preferred embodiment of the present invention, the support member is substantially planar and has a raised upper surface and an annular flange therearound to facilitate fastening the rack to a work surface. The support member has a plurality of wells therein depending from the raised upper surface. These wells are preferably arranged in orthogonal rows and columns in the support member. Each well preferably has two substantially flat, planar sidewalls opposed from each other, two curved, concave sidewalls opposed from each other and a closed concavely curved bottom.

In another aspect of the present invention, a tube rack assembly includes a rack substantially as described above. In addition, a tube is in one of the holes in the support member of the rack. This tube has a closed end portion and at least one substantially flat wall surface in face-to-face alignment with the flat wall portion so that rotation of the tube in the hole is prevented.

In accordance with the principles of the present invention, a number of significant advantages and features are offered. For instance, the present invention allows the tubes to be placed in the tube rack assembly and a cap or plug therefor to be removed and replaced with only one hand. The fit between tubes and wells of the present tube rack assembly can be designed so that the tubes fit snuggly and will not drop out of the assembly even if the assembly is turned over. Further, the present tube rack may be affixed to a work surface so that the rack will not slide or be readily moved when the user is placing tubes in and out of the rack. It is also advantageous that the present invention may be made of plastic materials which can be made inexpensively so as to be disposable after use.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the preferred embodiment of a tube rack assembly of the present invention, illustrating, for exemplary purposes only, three different size tubes therein;

Fig. 2 is a cross-sectional view of one tube positioned in the rack taken along line 2-2 of Fig. 1;

Fig. 3 is a cross-sectional view of the rack taken along line 3-3 of Fig. 1;

Fig. 4 is a side elevational view of an alternate tube design having a flat bottom and two flat sides;

Fig. 5 is a side elevational view of another alternate tube design having a flat bottom and four flat sides; and

Fig. 6 is a side elevational view of a further alternate tube design illustrating a round bottom and four flat sides.

DETAILED DESCRIPTION

While this invention is satisfied by embodiments in many different forms, there is shown in the drawings and will herein be described in detail preferred embodiments of the invention, with the understanding that the present disclosure is to be considered as exemplary of the principles of the invention and is not intended to limit the invention to the embodiments illustrated. The scope of the invention will be measured by the appended claims and their equivalents.

Referring to the drawings, and Figs. 1 to 3 in particular, there is illustrated the preferred multiple tube rack assembly 10 of the present invention. Assembly 10 has a minimum number of general components a multiple tube rack 12 and at least one tube 14. Tubes 14a and 14b are illustrated in Fig. 1 to demonstrate that the size of the tubes may vary, if desired. Also, while not shown in Fig. 1, there may be as many tubes as there are wells in the rack, as part of the present invention.

Rack 12 consists of a generally planar support member 16 having a raised upper surface 18. Sidewalls 19 support raised upper surface 18. There is preferably an annular flange 20 surrounding sidewalls 19 around the entire periphery of rack 12. As seen in Fig. 1, rack 12 has a substantially square configuration; it is understood that various configurations of the rack fall within the purview of the present invention. Depending from upper surface 18 is a plurality of wells 21. These wells are preferably distributed throughout the support member and arranged in orthogonal rows and columns. In the embodiment being described, each well has a curved, concave closed bottom 22. In order to prevent rotation of tubes in the wells, the wells are preferably fabricated with at least one flat wall. As can be seen in Fig. 1, the wells of the embodiment being described has two flat, planar sidewalls 24a and 24b opposed from each other; in addition, each of these wells includes two curved, concave sidewalls 25a and 25b opposed from each other. The shapes and

orientation of these respective walls contribute to preventing the rotation of the tube in the well. It is understood that, instead of wells with closed bottoms, holes may be formed through upper surface 18 with the two flattened and two curved wall portions surrounding the hole to prevent rotation of a tube placed therein.

Tube 14 preferably includes a cylindrical body 30 with a closed end 31 and an open end 32. A threaded portion 34 surrounds open end 32. A cap 35, with internal threads, is preferably threaded onto the tube to cover open end 32. It can be seen in Figs. 2 and 3 that, in the embodiment being described, closed end 31 has a rounded configuration. Further, the closed end portion of the tube includes two substantially flat, planar wall surfaces 36a and 36b opposed from each other. In addition, the closed end portion of the tube has two curved, concave wall surfaces 38a and 38b. These respective flat and curved wall surfaces of the tube are in face-to-face alignment with the flat and curved wall portions, respectively, of the well into which the tube is positioned. With this type of structural arrangement, rotation of the tube in the well is prevented.

In order to assure that rack 12 stays in a fixed position on a work surface, the bottom side of flange 20 may be provided with a suitable adhesive. For example, a double-sided adhesive tape (not shown) around the bottom of the flange would allow the user to remove the cover strip and position rack 12 in a fixed position on a work surface. Use of the rack of

the present invention can then proceed with the assurance that movement of the rack will be prevented. It is appreciated that other fastening means may be employed to affix the rack to a work surface, particularly in conjunction with the peripheral flange.

While Fig. 1 illustrates all wells 21 being substantially uniform in size and shape, it is also within the purview of the present invention that the wells may have different sizes for different size tubes. However, it is preferable that the wells be uniform in size and shape so that one tube is interchangeably adaptable to any of the wells in the rack.

Alternate embodiments of tubes are illustrated in Figs. 4 to 6. In Fig. 4, tube 40 has a substantially cylindrical body 41 and an end cap 42 covering the open end thereof. In this alternate embodiment, the closed end of the tube is a flattened end 44. Two substantially flat, planar wall surfaces 45 are included in the tube, similar to the embodiment described above.

In Fig. 5, tube 50 has a substantially cylindrical body 51 and an endcap covering an open end thereof. The closed end of the tube is a flattened end 54. This embodiment has four substantially flat planar wall surfaces, all designated with numeral 55. Turning to Fig. 6, tube 60 has a substantially cylindrical body 61 and an end cap 62 covering an open end thereof. The closed end of this tube is a

rounded end 64. This embodiment also includes four substantially flat, planar wall surfaces, all designated as numeral 65. It is understood that when the tubes illustrated in Figs. 5 and 6 are employed in the rack of the present invention, the wells or holes preferably include four substantially flat, planar wall portions to mate in face-to-face alignment with the flat wall surfaces of the tube so as to prevent rotation of the tube when positioned in the rack.

While many materials may be chosen for the elements of the present invention, it is preferred that rack 12 be made out of plastic material. Further, it is preferred that rack 12 be formed in one piece in an economical molding or stamping process. The tubes of the present invention are preferably made of clear material, such as glass or plastic.

When fabricating rack 12, it is preferred that the fit between the tubes and the wells be tight so that a snug fit may be achieved. In this fashion, should the rack be upset or otherwise turned over, the tubes will remain in position.

Thus, the present invention provides a tube rack assembly in which the tubes and rack have mating, cooperating surfaces for holding the tubes in position in the rack. Rotation of the tubes is prevented so that the user of the present invention may remove and replace the cap with one hand. In addition, the rack assembly may be affixed to the work surface to prevent its movement during use.

WHAT IS CLAIMED IS:

1. A rack for holding a plurality of tubes comprising:

a substantially planar support member having a plurality of wells therein for receiving portions of tubes distributed throughout said support member, each of said wells having a closed bottom and at least two substantially flat, planar sidewalls opposed from each other.

2. The rack of Claim 1 wherein said support member has a raised upper surface from which said wells depend.

3. The rack of Claim 2 wherein said support member has an annular flange therearound to facilitate fastening the rack to a work surface.

4. The rack of Claim 1 wherein said wells are arranged in orthogonal rows and columns.

5. The rack of Claim 1 wherein said closed bottom is a curved, concave configuration.

6. The rack of Claim 1 wherein said wells have two substantially flat, planar sidewalls opposed from each other and two curved, concave sidewalls opposed from each other.

7. The rack of Claim 1 wherein said wells have four substantially flat, planar sidewalls.

8. A rack for holding a plurality of tubes comprising:

a support member having a plurality of holes therein for receiving tubes, each hole having a substantially flat wall portion surrounding same to prevent rotation of a tube placed therein.

9. A rack for holding a plurality of tubes comprising:

a planar support member having a raised upper surface and an annular flange therearound to facilitate fastening the rack to a work surface, said member having a plurality of wells therein for receiving portions of tubes, said wells depending from said raised upper surface and arranged in orthogonal rows and columns in said support member, each of said wells having two substantially flat, planar sidewalls opposed from each other, two curved, concave sidewalls opposed from each other and a closed, concavely curved bottom.

10. The rack of Claim 1 wherein said support member is made of plastic.

11. The rack of Claim 8 wherein said support member is made of plastic.

12. The rack of Claim 9 wherein said support member is made of plastic.

13. A tube rack assembly comprising:

a support member having a plurality of holes therein, each hole having at least one substantially flat wall portion surrounding same; and a tube in one of said holes having a closed end portion and having at least one substantially flat wall surface in face-to-face alignment with said flat wall portion so that rotation of said tube in said hole is prevented.

14. The assembly of Claim 13 wherein said tube is interchangeably adaptable to any of the remaining holes in said support member.

15. The assembly of Claim 13 wherein said tube has a rounded, closed end.

16. The assembly of Claim 13 wherein said tube has a flattened, closed end.

17. The assembly of Claim 13 wherein said holes have two substantially flat, planar wall portions opposed from each other and said tube has two substantially flat wall surfaces opposed from each other in alignment with said flat wall portions.

18. The assembly of Claim 13 wherein said holes have four substantially flat, planar wall portions and said tube has four substantially flat wall surfaces in alignment with said flat wall portions.

19. A tube rack assembly comprising:

a plastic planar support member having a raised upper surface and an annular flange therearound to facilitate fastening the rack to a work surface, said member having a plurality of wells therein depending from said raised upper surface and arranged in orthogonal rows and columns in said support member, each of said wells having two substantially flat, planar sidewalls opposed from each other, two curved, concave sidewalls opposed from each other and a closed, concavely curved bottom; and

a tube in one of said wells having a closed, rounded end portion and having two substantially flat, planar wall surfaces opposed from each other and two curved, concave wall surfaces opposed from each other, said flat and curved wall surfaces in face-to-face alignment with said flat and curved wall portions, respectively, so that rotation of said tube in said hole is prevented.

20. The rack assembly of Claim 19 wherein there is a plurality of tubes, each of said tubes being positioned in a well.

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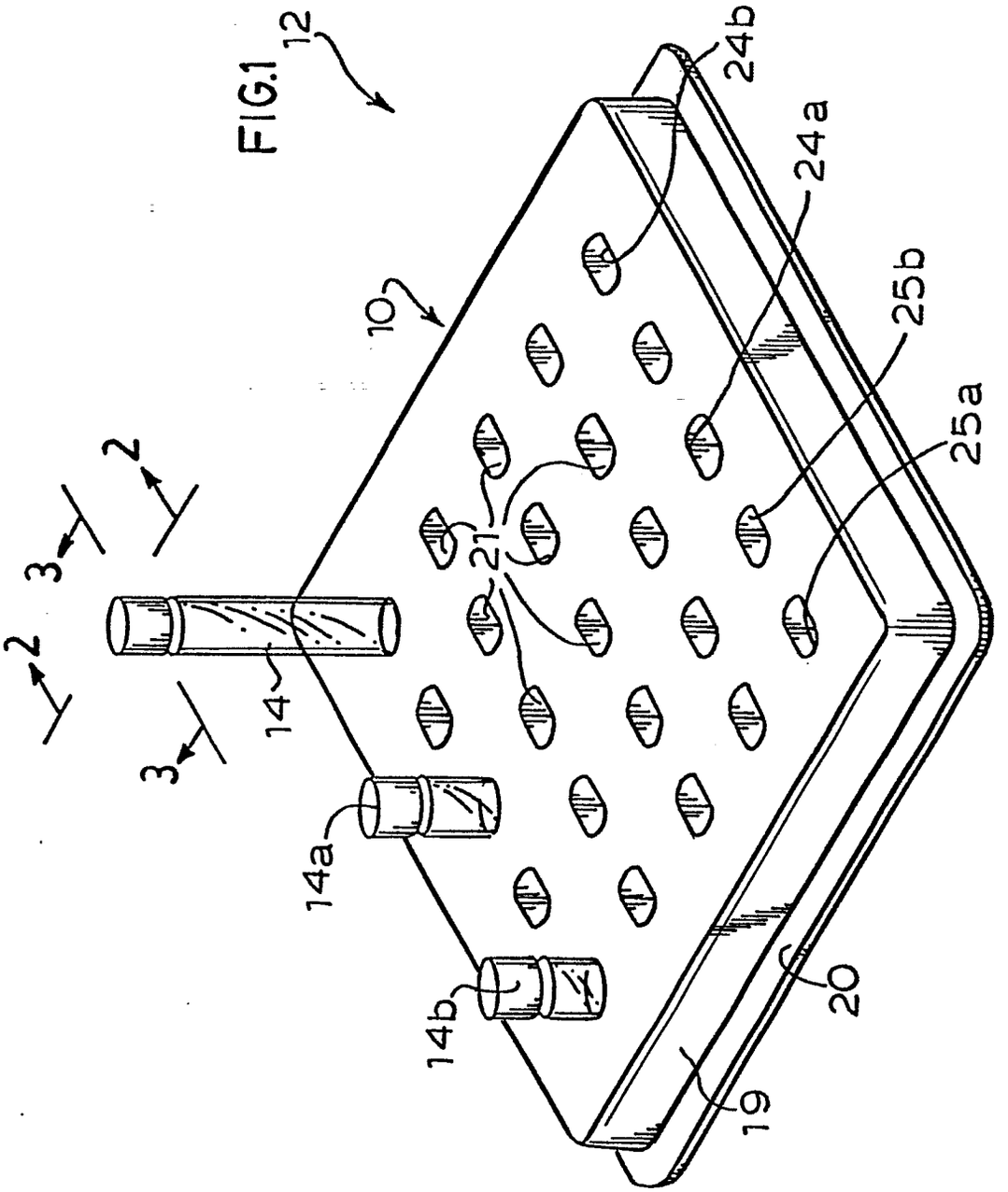
FIG.1



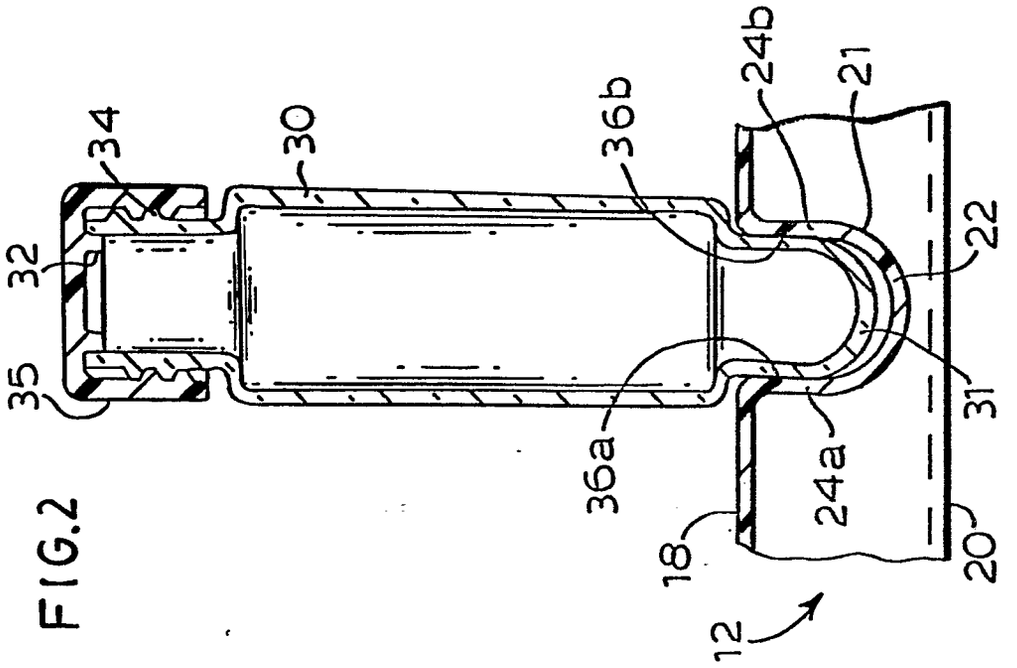

34
30
36b
24b
21
32
22
35
31
36a
24a
18
20
12

FIG.2

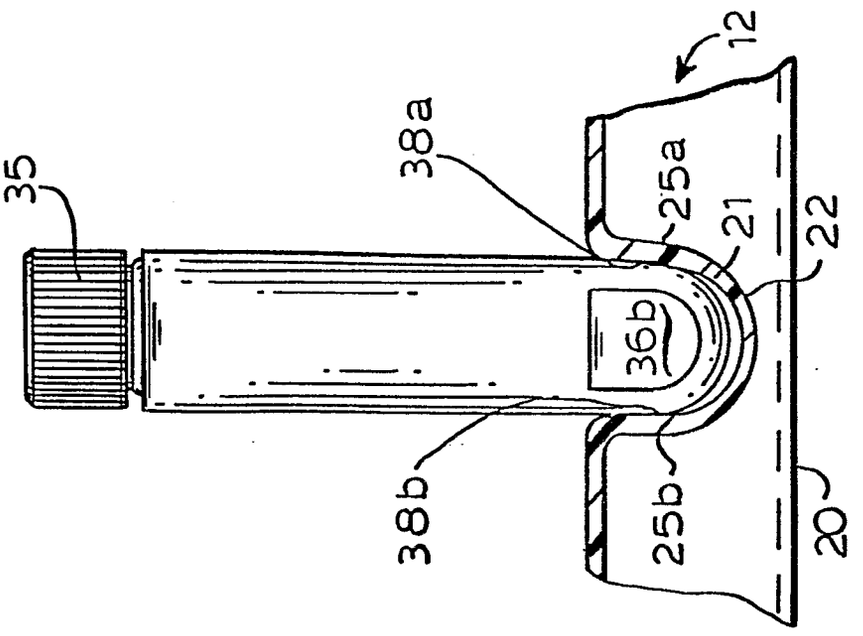

12
38a
25a
35
21
22
36b
38b
25b
20

FIG.3

FIG.4

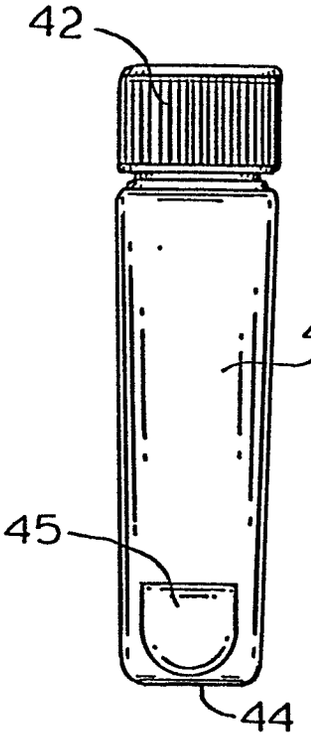


FIG.5

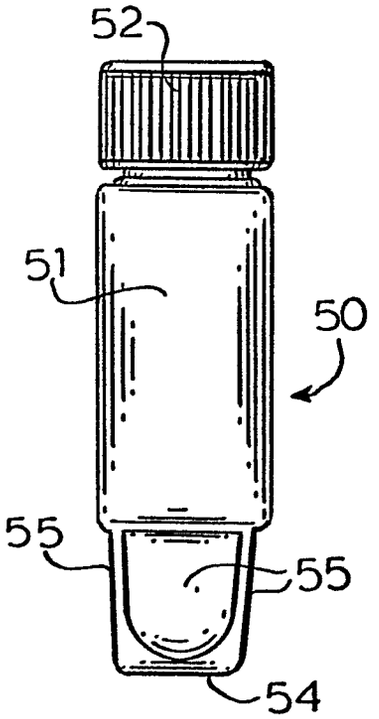


FIG.6