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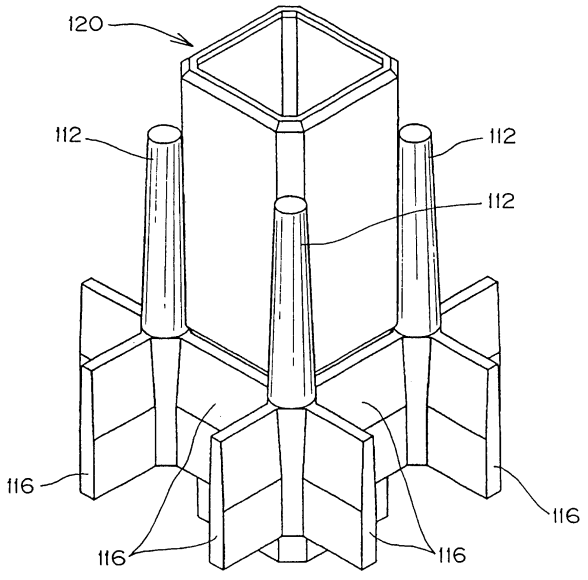
(54) Samples storage system for pharmaceutical development

(57) A samples storage system (100) for pharmaceutical development in which the usable volumes of ultramicrotubes (120) (384 tubes) are increased and smooth insertion and extraction of ultramicrotubes (120) is possible irrespective of the positions of the ultramicrotubes (120). The samples storage system (100) includes tubes (120) in which samples are sealed and a storage rack (110) for vertically accommodating a plurality of the tubes (120) in a grid pattern. Each tube (120) is of a rectangular hollow tubular cross-section and the intersect is tapered toward the bottom portion of the tube (120). Corner portions (122) of the outer four side surfaces of the tubes (120) are chamfered. The storage rack (110) has engagement partition walls (116) forming open-ended sections in a grid pattern inside the rack frame (114). The height of the walls (116) is smaller than the length of the tube (120), and tube-supporting pins (112) project vertically from the intersections of the grid. The outermost walls (116) of the grid are spaced inwardly from the frame (114) so that all of the tubes (120) in the grid are supported for ready insertion and removal.

Fig. 5



EP 1 852 187 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a samples storage system for pharmaceutical development used for identifying and storing a number of samples in a field of a pharmaceutical development research or the like, and more specifically it relates to a samples storage system for pharmaceutical development including tubes for sealing samples for pharmaceutical development and a storage rack for vertically accommodating 384 tubes in a grid pattern.

BACKGROUND OF THE INVENTION

[0002] In a field of wound medicine research or the like, the storage and transportation of samples has been carried out by sealing or encapsulating a sample-dissolved solution into a tube case so called as a microtube and accommodating a plurality of microtubes in a vertically provided manner in a storage rack which is partitioned in a grid patten, for example partitioned into 96 receptacles in a matrix with 8 rows and 12 columns. Further, to accommodate smaller microtubes that is ultramicrotubes (hereinafter sometimes referred to as "384 tube") in the same size storage rack as a storage rack partitioned into 96 sections in accordance with a standard of SBS (Society for Biomolecular Screening) a storage rack with the total of 384 partitioned sections in a matrix with 16 rows and 24 columns has been also known [(see for example, European Patent Application Publication No.0904841 (FIG. 1, paragraphs 7 to 9) and European Patent Application Publication No.1477226 (FIG. 5, paragraphs 3 to 5) and related US Patent No. 6,827,907].

[0003] FIG. 8 shows a samples storage system 800 for pharmaceutical development for accommodating ultramicrotubes (or 384 tubes) described in European Patent Application Publication No. 0904841. In this samples storage system 800 for pharmaceutical development, in a storage rack 810 with the same size as the storage rack in accordance with an SBS standard, in which 96 tubes are accommodated, it is four times number of tubes, that is 384, tubular ultramicrotubes 820 with bottoms are accommodated. Thus since the above-mentioned ultramicrotubes 820 take a shape in which a bottom surface size of a the ultramicrotubes (384 tubes) was reduced to substantially 1/4 of the surface size of the microtubes (96 tubes), the capacity of samples to be accommodated must be decreased. Further, since engagement partition walls 816 for forming accommodation sections 813 partitioned in a matrix with 16 rows and 24 columns are formed at substantially the same height as a rack frame 814 of the storage rack 810, an accommodation region in the ultramicrotubes 820 is decreased by the thickness of these engagement partition walls 816 and the capacity of samples to be accommodated was even more restricted as compared with the mcirotubes (96 tubes).

[0004] FIG. 9 shows a partial cross-sectional view of a samples storage system 900 for pharmaceutical development accommodating ultramicrotubes described in European Patent Application Publication No.1477226. In this samples storage system 900 for pharmaceutical development, a storage rack 910 accommodates four times number of tubes, that is ultramicrotubes 920, is the same size storage rack 910 as a storage rack in accordance with the SBS standard, accommodating microtubes (96 tubes) like the conventional case shown in FIG. 8. Since the ultramicrotubes 920 in this storage rack 910 have a rectangular hollow tubluar cross-section, the storage rack 910 has a greater accommodation volume than the tubular ultramicrotubes shown in FIG. 8.

[0005] However, since in this storage rack 910, engagement partition walls 916 extend to shoulder portions 922 of ultramicrotubes 920 and corner portions of the outer surfaces of the ultramicrotubes have chamfered portions (not shown), slight gaps are formed at corner portions of an accommodation portion 913 whose top are a square, resulting in a reduced increase in the accommodation volume by reason of the gaps. Further, since one surface or two surfaces of the respective tubes 920 accommodated adjacent the frame are supported against frame side walls 918, which are unlikely to elastically deform, the tubes 920 are difficult to insert and extract. Further, since there are differences in forces required for insertion and extraction between a case of tubes at the center portion of the storage rack and a case of tubes near the rack side wall 918, a complex control is required when picking with an automatic picking device.

SUMMARY OF THE INVENTION

[0006] Accordingly, the object of the present invention is to provide a samples storage system for pharmaceutical development in which the accommodation volumes of ultramicrotubes are increased and smooth insertion and extraction of ultramicrotubes become possible irrespective of the accommodation positions of the ultramicrotubes relative to the side walls.

MEANS FOR SOLVING THE PROBLEMS

[0007] The invention attains the above-mentioned object by a samples storage system for pharmaceutical development including tubes in which samples for pharmaceutical development are sealed and a storage rack with receptacles for vertically accommodating a plurality of the tubes in a grid pattern, characterized in that the tube is of a rectangular hollow tubluar cross-section and is tapered toward the bottom portion of the tube and at the same time corner portions of the outer four side surfaces of the tubes are o chamfered, the storage rack has engagement partition walls forming grid pattern receptacles inside the rack frame. The height of the walls is smaller

than the length of the tube. The grid partition walls have tube-supporting pins vertically extending from their respective intersections of the grid. The tubes accommodated adjacent the outermost sides are held vertical by the partition walls which are spaced from the frame and the tube-supporting pins projecting upwardly from the intersections of the grid in the same manner as the tubes in the middle of the rack.

[0008] The material of the tube and the rack used in the present invention is not limited particularly, but polypropylene (PP) or polycarbonate (PC) is preferably used as the material.

EFFECTS OF THE INVENTION

[0009] According to the invention, since in a samples storage system for pharmaceutical development including tubes in which samples for pharmaceutical development are sealed and a storage rack for accommodating a plurality of the vertical tubes in a grid pattern, the tube is of a rectangular hollow tubluar cross-section and is tapered toward the bottom portion of the tube and at the same time corner portions of the outer four side surfaces of the tubes are chamfered. The storage rack has engagement partition walls forming grid pattern receptacles inside the rack frame. The height of the walls is smaller than the length of the tube, and the grid partition walls have tube-supporting pins extending vertically from the respective intersections of the grid. The tubes accommodated on the sides adjacent the frame are held by the partition walls and tube-supporting pins vertically provided on the intersections of the grid as in other tubes, the accommodation volume of tubes can be increased and smooth insertion and extraction of tubes become possible irrespective of the accommodation positions of the tubes. Thus the effects are very large.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a perspective view of a samples storage system for pharmaceutical development according to the present invention;

[0011] FIG. 2 is top view of a storage rack shown in FIG. 1;

[0012] FIG. 3 is a cross-sectional view taken along the line III-III of the storage rack shown in FIG. 2;

[0013] FIG. 4 is an enlarged view of the portion encircled at IV in FIG. 3;

[0014] FIG. 5 is an enlarged perspective view of the portion encircled at V in FIG. 2; .

[0015] FIG. 6 is a top view of an ultramicrotube and a storage rack of the present invention shown in FIG. 5;

[0016] FIG. 7 is a cross-sectional view taken along the line VII-VII in FIG. 6;

[0017] FIG. 8 is a perspective view of conventional ultramicrotubes and a conventional storage rack; and

[0018] FIG. 9 is a part of a cross-sectional view of other conventional ultramicrotubes and a storage rack.

PREFERRED EMBODIMENT OF THE INVENTION

[0019] Next, a preferable example of a samples storage system for pharmaceutical development according to the present invention will be described with reference to drawings.

[0020] In the drawings, four ultramicrotubes 120 are accommodated in a storage rack 110. The storage rack 110, which is one of components of a samples storage system for pharmaceutical development of the present invention, has a rack frame 114 and lower engagement partition walls 116 forming grid pattern of open-ended receptacles inside the rack frame. It is noted that the outermost walls 116, which are adjacent the rack frame, are spaced inwardly of the inside of the inner walls 118 of the rack 114, and the height of all of the partition walls 116 is less than the length of the associated ultramicrotubes. Tube-supporting pins 112 extend vertically upwardly from the respective intersections of the grid.

[0021] As shown in Figs. 5 and 7, the pins 112 taper upwardly from the intersections to guide the ultramicrotubes into the receptacles when loading the rack., and the ultramicrotubes do not come into contact with the rack wall 118, and as shown in FIGS. 4 and 5, the outermost side ultramicrotube 120 is held, like other ultramicrotubes, by lower engagement partition walls 116 forming grid pattern sections inside than the length of the respective ultramicrotubes and four tube supporting pins 112 vertically upwardly provided from the respective intersections of the grid of the engagement partition walls 116. Therefore, the outermost side ultramicrotube 120 does not come into contact with a rack side wall 118.

[0022] As apparent from FIGS. 6 and 7, the ultramicrotube 120 has a rectangular hollow tubluar cross-section and is tapered toward a bottom surface 121 and corner portions 122 on the outer four side surfaces of the ultramicrotube 120 are chamfered. The ultramicrotube 120 has step portions 124 forming a shoulder at positions where the ultramicrotube 120 abuts on upper surfaces of the engagement partition walls 116, and this shoulder prevents the ultramicrotube 120 from slipping down past the upper surfaces of the engagement partition walls 116. Although the outer bottom surface of the ultramicrotube 120 is flat, the inner bottom surface 123 of the ultramicrotube 120 has inclined surfaces toward the center of the inner bottom, like a square pyramid. This shape makes the residues of solution extremely small when the solution in the ultramicrotube 120 is extracted by a pipet or the like.

[0023] Further, as shown in FIG. 7, tube locking convex projections 125 are provided on the respective outer four side surfaces at a lower portion of the ultramicrotube 120. When the ultramicrotube 120 is being inserted into an accommodation portion 113, which is one of sections of a grid pattern surrounded by four engagement partition walls 116, the tube locking convex projection 125 comes into contact with the upper surfaces of the engagement partition walls 116. One or both of the engagement par-

tition walls 116 and the tube locking convex projections 125 are elastically deformed so that the tube locking convex projections 125 are slipped down below the engagement partition walls 116. It is noted that since the outermost partition wall 116 is spaced from the frame side wall 118, the wall 116 is free to deflect, which enables the projection 125 to pass through the receptacle.

[0024] At this time since the engagement partition walls 116 and the tube locking convex projections 125 come into point contact with each other and the height of the engagement partition wall 116 is smaller than the length of the ultramicrotube 120, the ultramicrotube 120 can be inserted into the storage rack 110 by smaller force as compared with the conventional storage rack 910 for tubes shown in FIG. 9 for example. Further, once the tube locking convex projections 125 are slipped down below the engagement walls 116, even if vibration is applied to the storage rack 110, the ultramicrotube 120 does not come out of the storage rack 110. When a specified ultramicrotube 120 accommodated in the storage rack 110 is pulled out through the top of the rack, it can be easily pulled out by sticking a probe against the bottom of the tube through the lower side of the storage rack 110. In the event it is desired to extract the microtube through the bottom of the rack, the step portions 124 on the microtube may be replaced by convex projections similar to the projections 125.

[0025] In the above-mentioned example, an embodiment has been disclosed in which the tube locking convex projections are provided on four side surfaces of the lower portion of the ultramicrotubes 120 at the same distance from the bottom surface of the ultramicrotube 120. However, various examples of numbers, sizes and distances from the bottom and the like of the tube locking convex projections are considered.

Claims

1. A samples storage system (100) for pharmaceutical development including tubes (120) in which samples for pharmaceutical development are sealed and a storage rack (110) for vertically accommodating a plurality of said tubes (120) in a grid pattern, **characterized in that**
   said tubes (120) are of a rectangular hollow tubular cross-section which is tapered toward the bottom portion of the tube (120) and four sides with chamfered corner portions (122) on the outer surfaces, and
   said storage rack (110) has a frame (114) and engagement partition walls (116) intersecting one another and forming grid pattern sections inside said rack frame (114), said walls (116) having a height smaller than the length of said tubes (120),
   said grid partition walls (116) have tube supporting pins (112) extending vertically from respective intersections of the grid partition walls (116), whereby
   all of said tubes (120), including the tubes (120) accommodated adjacent said frame (114) are held by said grid partition walls (116) and said tube supporting pins (112).

2. A system (110) according to claim 1 wherein said partition walls (116) cooperate to form open-ended receptacles (113) for association with said tubes (120),
   each said tube (120) having a shoulder (124) on its periphery in said side surfaces and a convex portion (125) spaced a selected distance below said shoulder (124), said selected distance being not less than the height of said partition walls (116), and wherein further
   at least one of said side surface and the associated partition wall (116) is elastically deformable to enable said shoulder (124) and said convex portion (125) to engage the top and bottom of said partition wall (116) to effect releasable interlocking engagement of said tube (120) in said open-ended receptacle (113).

3. A system (100) according to claim 2 wherein said grid of partition walls (116) have outermost walls (116) adjacent said frame (114), said outermost walls (116) being spaced from said frame (114) and capable of being deflected to facilitate insertion and removal of said tubes (120) into and from the open-ended receptacles (113) formed by said outermost walls (116).

4. A storage rack (110) adapted for use in a system (100) for pharmaceutical development having tubes (120) in which samples for pharmaceutical development are sealed, said tubes (120) having a rectangular hollow tubular cross-section which is tapered toward the bottom portion of the tube (120) and four sides with chamfered corner portions (122) on the outer surfaces,
   a storage rack (110) having a frame (114) and engagement partition walls (116) intersecting one another and forming grid pattern of open-ended receptacles (113) inside said rack frame (114), said walls (116) having a height smaller than the length of said tubes (120),
   said engagement partition walls (116) have tube supporting pins (112) extending vertically from respective intersections of the grid partition walls (116), whereby
   all of said tubes (120), including the tubes (120) accommodated adjacent said frame (114) are held by said grid pattern engagement partition walls (116) and said tube supporting pins (112).

5. A storage rack (110) according to claim 4 adapted for use in a system (100) for pharmaceutical development having tubes (120) with shoulders (124) on

their outer surfaces and convex portions (125) spaced a given distance below said shoulders (124), wherein

said partition walls (116) have a height less than said given distance and are formed of an elastically deformable material to permit passage of at least one of said shoulders (124) and said convex portions (125) through said receptacles (113) during insertion and removal of said tubes (120) into and from said receptacles (113), said shoulders (124) and convex portions (125) providing a releasable interlocking of said tubes (120) with said partition walls (116) of said receptacles (113).

6. A storage rack (110) according to claim 4 wherein said pins (112) are tapered upwardly to guide the tubes (120) into said receptacles (113) during insertion of the tubes (120) into said receptacles (113).

7. A storage rack (110) according to claim 4 wherein said grid of partition walls (116) have outermost walls (116) adjacent said frame (114), said outermost walls (116) being spaced from said frame (114) and capable of being deflected to facilitate insertion and removal of the tubes (120) into and from the open-ended receptacles (113) formed by said walls (116).

Fig. 1

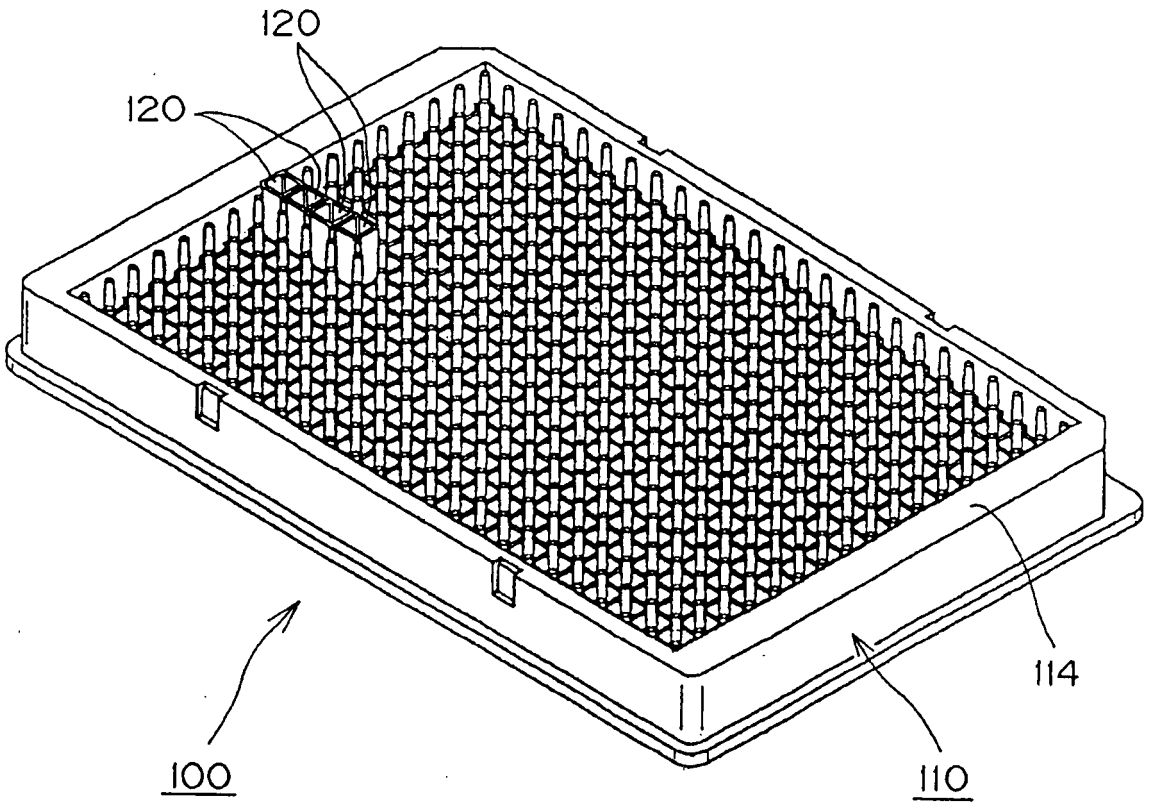


Fig. 2

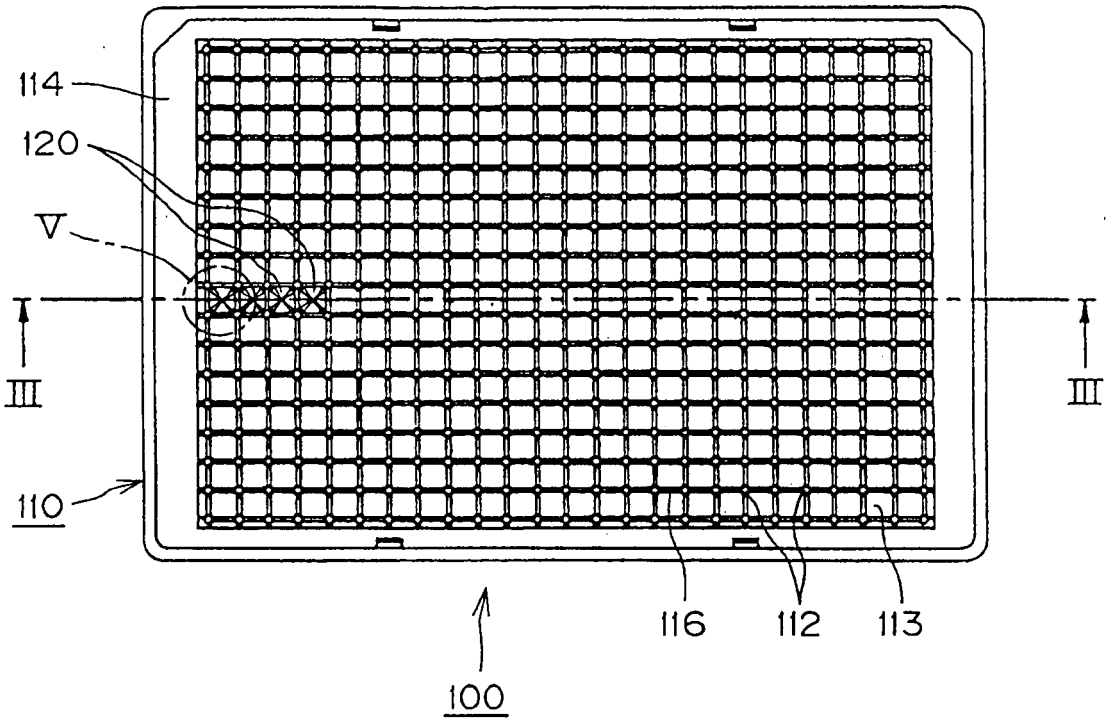


Fig. 3

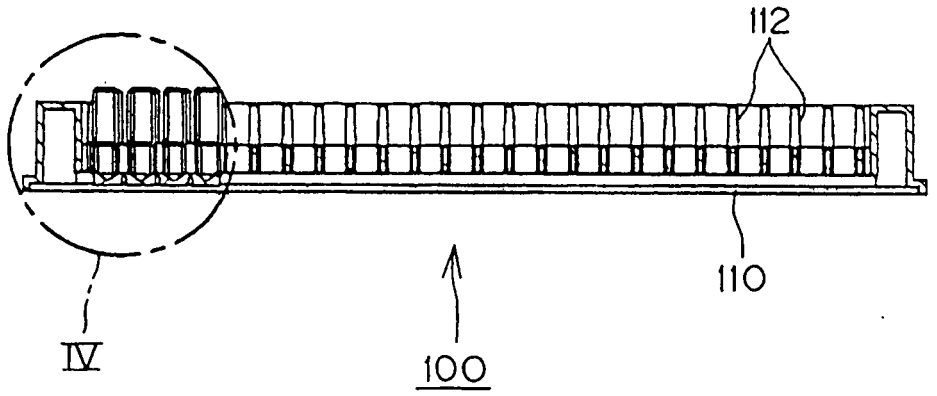


Fig. 4

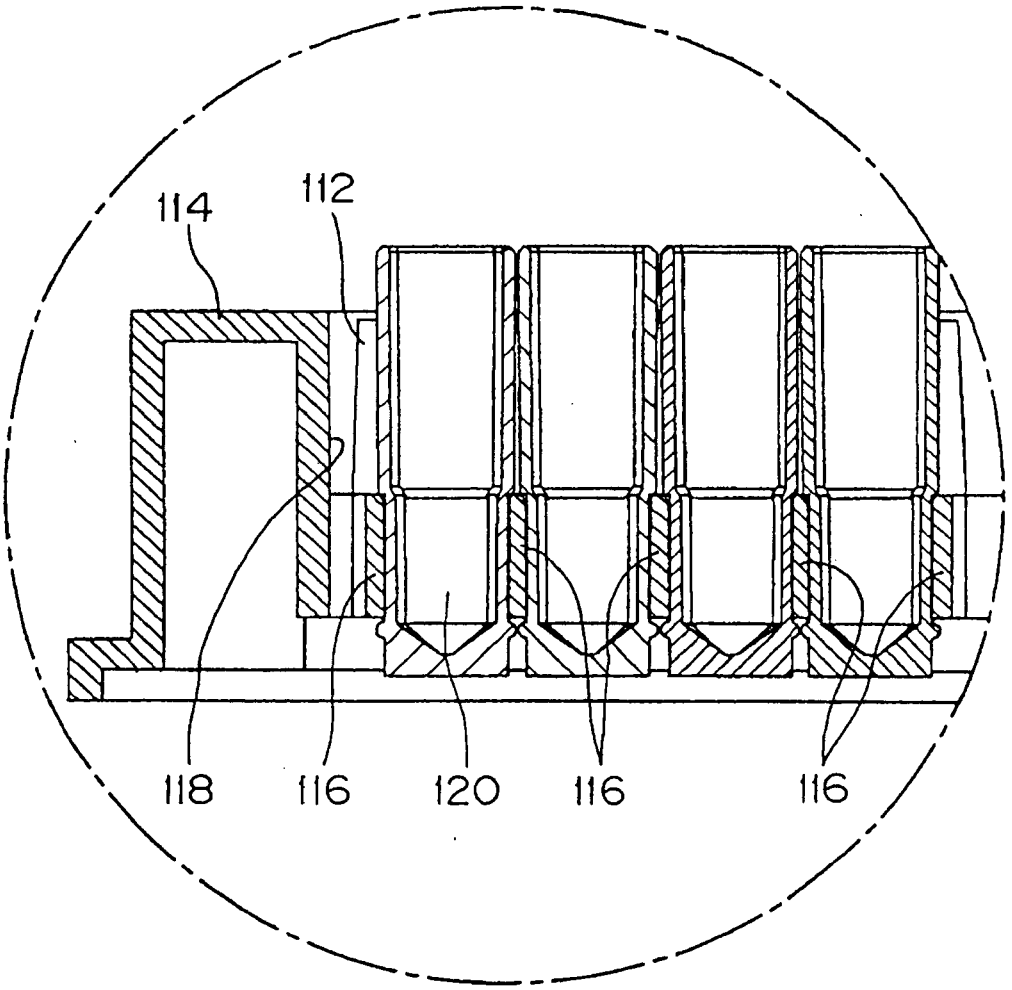


Fig. 5

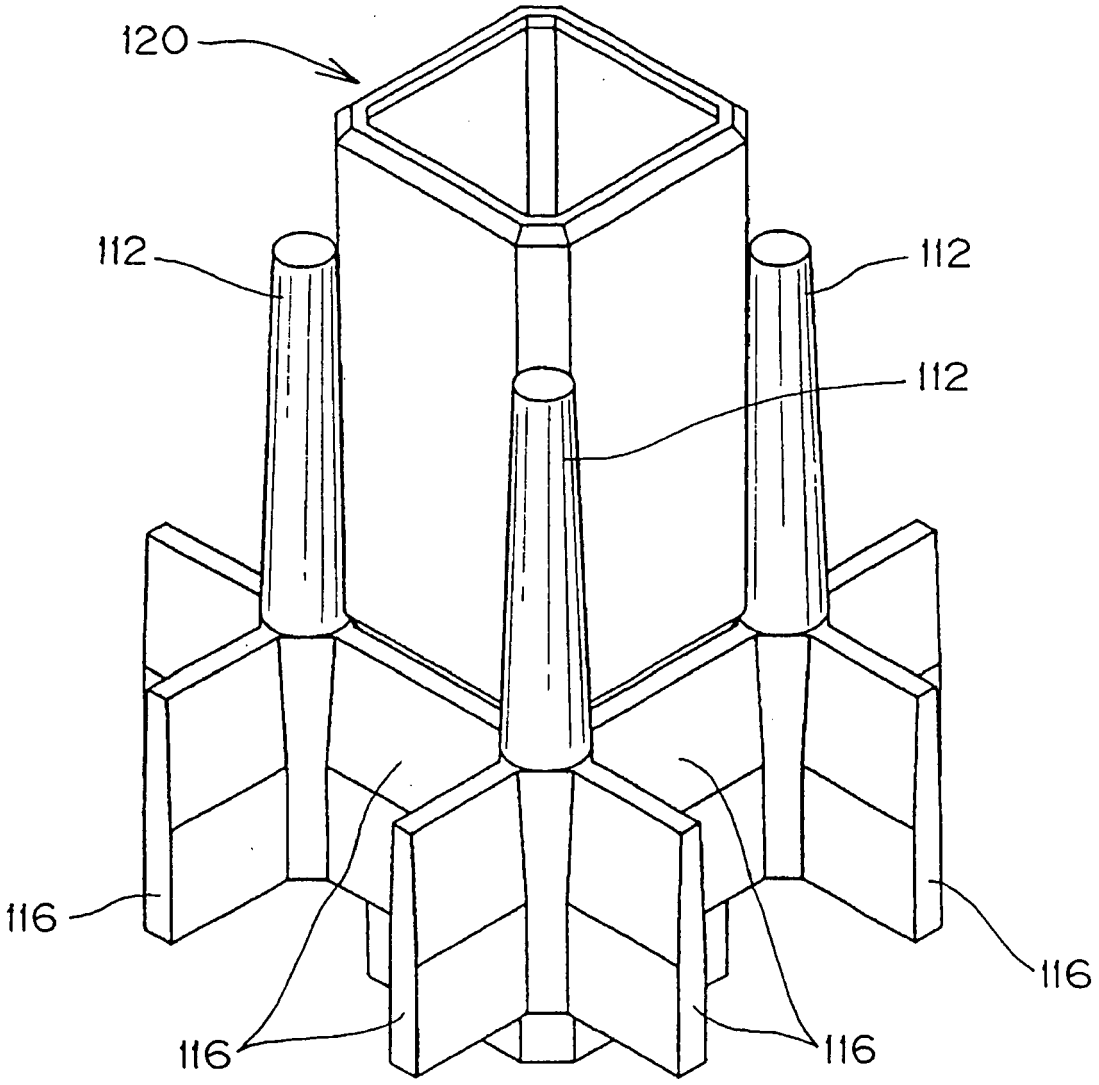


Fig. 6

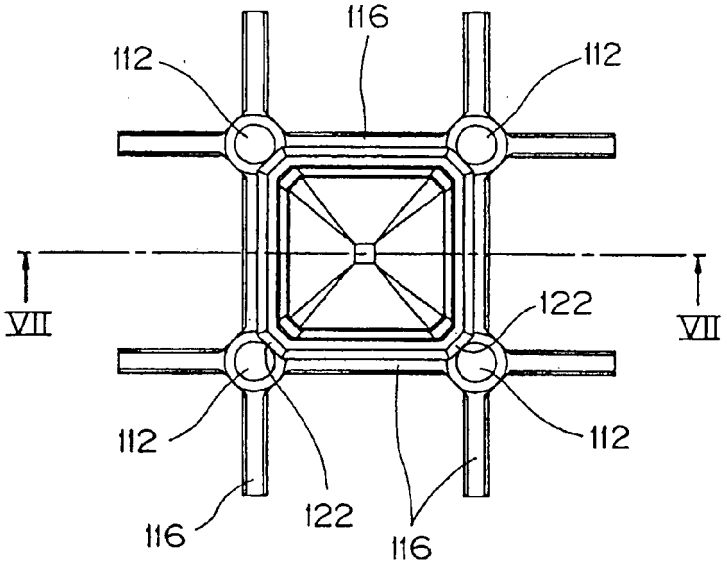

116
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Fig. 7

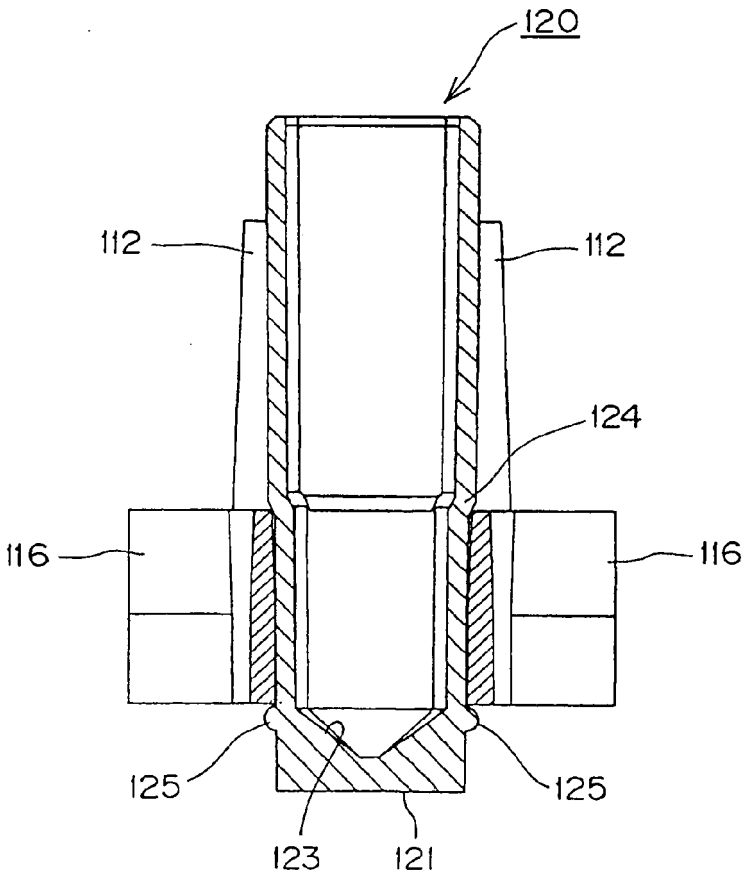
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Fig. 8
Prior Art

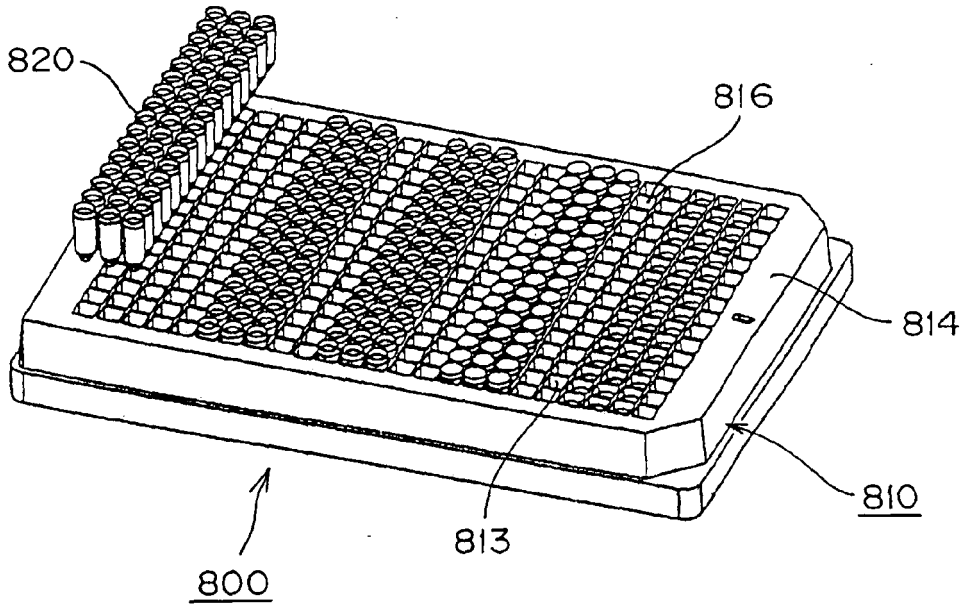
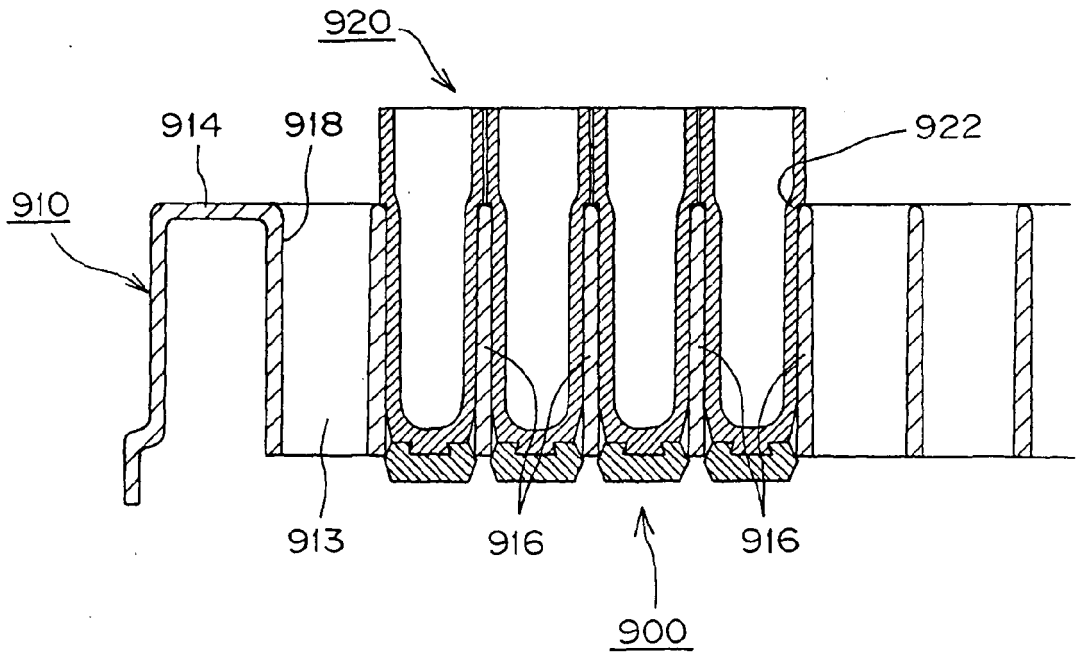


Fig. 9
Prior Art



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EUROPEAN SEARCH REPORT

Application Number
EP 07 00 3806

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	31 July 2007	Hoyal, Barnaby

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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