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(54) **Title:** VIAL, TRAY, AND VIAL PROCESSING ASSEMBLY

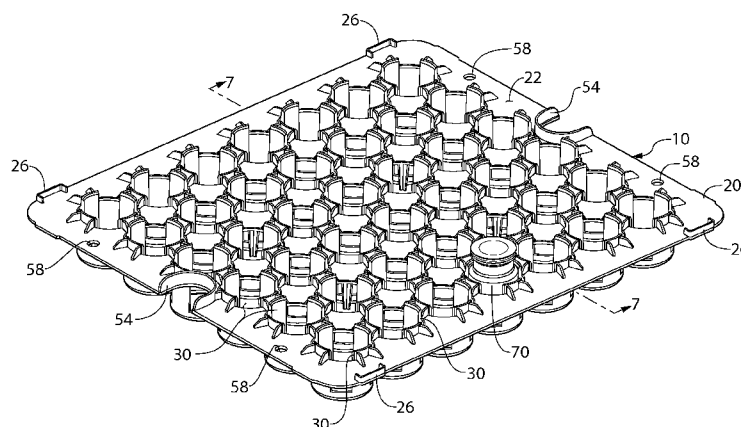


FIG. 6

(57) **Abstract:** A tray for seating a plurality of parenteral vials includes a substantially planar tray base and a plurality of vial seating receptacles defined in the base. Each of the receptacles is configured to seat a single parenteral vial during a processing operation of the vials. A parenteral vial transport assembly includes such a tray, and a tub configured for seating the tray in a suspended condition. A vial for use with the tray includes a bottom wall, a side wall extending upward from the bottom wall, a curved lower edge joining the bottom wall and the side wall, a radially inwardly extending shoulder formed at the top of the side wall, and a neck extending upwardly from the shoulder, the neck defining an opening at the top thereof, the opening leading to the vial interior.



VIAL, TRAY, AND VIAL PROCESSING ASSEMBLY

BACKGROUND

[0001] Injectable medications have traditionally been packaged in parenteral vials, by way of a number of processing steps that are specific to such parenteral vials and the drugs packaged therein. With the increasing popularity of prefilled syringes, more and more injectable medications are now being packaged in such prefilled syringes, which require a different series of steps from packaging of injectable medications in parenteral vials.

[0002] Prefilled syringes are typically processed by producing a plurality of syringe bodies, loading the syringe bodies into a tray, seating the tray within a tub, and covering the tub with a sealed semi-permeable membrane, such as a layer of TYVEK® material. The tub, tray, and vial assembly is then sterilized by subjecting the assembly to a sterilization gas that permeates the membrane to contact, and in turn sterilize the surfaces of the syringe bodies. The assembly is then transported to a filling facility where the membrane is removed and the vials are filled while seated in the tray, which is seated in the tub. The syringes may then undergo lyophilization, in which the filled syringe bodies are subjected to heating and cooling cycles to freeze-dry the medication contained therein.

[0003] It is desirable to produce an apparatus, and in particular a tray and tub assembly, that can accommodate parenteral vials during the processing stages described above, allowing such processing to take place on the same equipment as that used for prefilled syringes. It is further desirable to produce such an apparatus to permit elevation of the vials during filling, for example to allow application of a stopper and crimp used to close the vials. It is further desirable for such an apparatus to allow for contact between the bottom of the vial and dry freezer plate during lyophilization.

SUMMARY

[0004] The present invention is directed to a tray for seating a plurality of parenteral vials. The tray includes a substantially planar tray base and a plurality of vial seating receptacles defined in the base. Each of the receptacles is configured to seat a single parenteral vial during a processing operation of the vials.

[0005] The present invention is further directed to a parenteral vial transport and storage assembly including the tray described above, and a tub for seating the tray in a suspended condition therein.

[0006] The present invention is further directed to a vial for use with the tray and/or assembly described above, wherein the vial includes a bottom wall, a side wall extending upward from the bottom wall, a curved lower edge joining the bottom wall and the side wall, a radially inwardly extending shoulder formed at the top of the side wall, and a neck extending upwardly from the shoulder, the neck defining an opening at the top thereof, the opening leading to the vial interior.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a top perspective view of a first embodiment of a vial tray according to the invention;

[0008] FIG. 2 is a bottom perspective view of the vial tray of FIG. 1;

[0009] FIG. 3 is a top plan view of the vial tray of FIG. 1;

[0010] FIG. 4 is an enlarged detail showing top surface features of the vial tray of FIG. 1;

[0011] FIG. 5 is a front elevational view of the vial tray of FIG. 1;

[0012] FIG. 6 is a top perspective view of the vial tray as shown in FIG. 1, with a vial seated therein;

[0013] FIG. 7 is a cross section taken along line 7-7 of FIG. 6;

[0014] FIG. 8 is a cross section similar to that of FIG. 7, showing the vial and tray seated on a surface;

[0015] FIG. 9 is a cross section similar to that of FIG. 7, showing the vial partially elevated with respect to the tray;

[0016] FIG. 10 perspective view of a first embodiment of a vial for use with vial tray of the invention;

[0017] FIG. 11 is a perspective view of a second embodiment of a vial for use with the vial tray of the invention;

[0018] FIG. 12 is a perspective view of a third embodiment of a vial for use with the vial tray of the invention;

[0019] FIG. 13 is a top perspective view of a vial tub for use with a vial tray according to the invention; and

[0020] FIG. 14 is a top perspective view of the vial tray of FIG. 1, seated in the tub of FIG. 13.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Certain terminology is used in the foregoing description for convenience and is not intended to be limiting. Words such as “front,” “back,” “top,” and “bottom” designate directions in the drawings to which reference is made. This terminology includes the words specifically noted above, derivatives thereof, and words of similar import. Additionally, the words “a” and “one” are defined as including one or more of the referenced item unless specifically noted. The phrase “at least one of” followed by a list of two or more items, such as “A, B or C,” means any individual one of A, B or C, as well as any combination thereof.

[0022] A first embodiment of a vial tray 10 according to the invention is shown in FIGS. 1-9. As shown, the tray 10 includes substantially planar base 20 having a rectangular shape and defining a plurality of receptacles 30, each receptacle 30 configured to seat a single vial 70. The vial tray 10 of the embodiment shown defines forty-two (42) receptacles 30, which are arranged in rows of seven (7) and columns of six (6) receptacles. It should be understood that a tray 10 according to the invention could include other numbers and arrangements of receptacles 30 while remaining within the scope of the invention.

[0023] The tray base 20 is dimensioned to fit within a tub 90, as shown in FIG. 14. FIG. 13 shows the tub 90 in detail. As shown, the tub 90 includes a base wall 92, with a lower side wall 94 extending upward therefrom to define a seating region 96. A shoulder 98 is formed at a top edge of the lower side wall 94 and joins the lower side wall 94 with an upper side wall 100, which is substantially parallel to, and outwardly displaced from, the lower side wall 94. A flange 102 extends outwardly from a top edge of upper side wall 100. As shown in FIG. 14, when in use, the outer edges of tray base 20 rest on shoulder 98. In this position, receptacles 30 and the vials 70 seated therein extend partially downward from base 30 into the seating region 96 of tub 90. The upper side wall 100 is dimensioned to have a height H1 great enough so that the tops of vials 70 are positioned lower than flange 102. This permits an upper sealing material, for

example a semi-permeable TYVEK® material, such as that which may be used during sterilization processing, to be placed over the tub 90 and adhered to upper surface of flange 102 to cover the entire tray 10 and all vials 70 seated therein. The height H2 of lower side wall 94 is sufficient to allow receptacles 30 and vials 70 seated therein to be suspended within the seating region 96 without contacting base wall 92 of tub 90. In one embodiment, height H2 of lower side wall is sufficient to allow vials 70 of various sizes, for example all vial sizes used for storage of parenteral drugs, and receptacles sized to house such vials, to be suspended in the seating region 96 without contacting base wall 92 of tub 90. In one embodiment, the height H1 of upper side wall 100 is 25.5mm. In one embodiment, in which the tray 10 is configured to seat vials 70 sized up to 10R (according to standard DIN/ISO 8362-1), the height H2 of lower side wall 94 is 34.5mm, and the total tub height is 60mm. In another embodiment in which the tray 10 is configured to set vials 70 sized up to 20R, the height H2 of lower side wall 94 is 44.5mm, and the total tub height is 70mm. In another embodiment in which the tray 10 is configured to seat vials sized up to 30R, the height H2 of lower side wall 94 is 59.5mm, and the total tub height is 85mm.

[0024] FIGS. 10-12 show exemplary vials 70 according to the invention. As shown, each embodiment of the vial 70 includes a bottom wall 72 and cylindrical side wall 74 extending upwardly therefrom. A curved lower edge 76 is formed at the bottom of cylindrical side wall 74 and curves radially inward to connect bottom wall 72 with side wall 74. A shoulder 78 is formed at the top of the side wall 72 and extends radially inward, terminating at an upwardly extending neck 80. An opening 82 leading to the vial interior is formed at the top of neck 80 and is surrounded by an outwardly protruding rim 84.

[0025] The vials 70A and 70B of FIGS. 11 and 12 include additional features to complement the tray 10 of the invention. Vial 70A of FIG. 11 includes a radially outwardly protruding annular ridge 86A located between shoulder 78A and side wall 74A. Ridge 86A is located and dimensioned to rest upon top edge 44 of the receptacle 30 while the vial 70A is seated therein, to facilitate suspension of the vial 70A within the receptacle 30 when the tray 10 is suspended. Knobs 88A are formed at circumferential intervals along ridge 86A. Knobs 88A are spaced apart such that if vial 70A falls over, two adjacent knobs 88A will contact the surface on which vial 70A sits, to prevent rolling of vial 70A.

[0026] The vial 70B of FIG. 12 includes a step 86B that extends inward radially inward from the vial shoulder 78B to side wall 74B. Step 86B is located and dimensioned to rest upon the top edge 44 of receptacle 30 while the vial 70B is seated therein, to facilitate suspension of the vial 70B within the receptacle 30 when the tray 10 is suspended. Planar contact surfaces 88B interrupt the curved shape of shoulder 78B and extend upward from step 86B into shoulder 78B. Contact surfaces 88B are located and dimensioned such that if vial 70B falls over, one of the contact surfaces 88B rests flat against the surface on which vial 70B sits, to prevent rolling of vial 70B.

[0027] The tray 10 is shown in detail in FIGS. 1-9 and 14. The tray base 20 has a substantially rectangular shape and may have a length L and width W equal to the length and width dimensions of a standard syringe filling tray. In one example the tray base has a length L of 198.5mm and a width W of 230mm, to match the length and width dimensions of typical syringe filling trays. Likewise, the distance D_c between the center point of each receptacle 30 could be equal to the distance between central points in analogous receptacles of a syringe filling tray, and the placement and spacing of the receptacles 30 could be configured to match the placement and spacing of analogous receptacles in a syringe filling tray. In one example, the distance D_c between the center points of the receptacles is 28.6mm, to match such a distance in a typical syringe filling tray.

[0028] The tray base 20 includes an upper surface 22 and a lower surface 24. Each receptacle 30 has a substantially cylindrical wall 36 including an upper portion 32 that protrudes upward from the upper surface 22 of the base 20 and a lower portion 34 that protrudes downward from the lower surface 24 of the base 20. In one embodiment, the receptacles 30 are dimensioned such that the distance D between the upper surface 22 of the tray base 20 and the top of a vial 70 seated therein is equal to the typical distance between an upper surface of a syringe processing tray and the top of a syringe seated therein (FIG. 7). In one embodiment, the distance D is approximately 18mm. This facilitates processing, for example filling, of vials 70 seated in the tray 10 using the same equipment as that used for similar processing operations on prefilled syringes, for example, by ensuring that adequate clearance between the top of the vial and the filling equipment is available.

[0029] FIGS. 7-9 show how the receptacles 30 are configured to support vials 70 in different manners during different stages of processing. As shown, each receptacle 30 has a bottom opening 38 defined at a bottom edge of lower portion 34 of cylindrical wall 36, and an inwardly extending lip 40 surrounding each opening 38. FIG. 7 shows the tray 10 with a vial 70 seated therein, in a suspended condition, such as that which would occur while the tray 10 is housed within the tub 90, as shown in FIG 14. As shown, opening 38 is has an inner diameter slightly smaller than the outer diameter of the vial 70 side wall 74, but slightly larger than the bottom wall 72, such that the inner edges of lip 40 contact a portion of curved lower edge 76 joining side wall 74 and bottom wall 72. This configuration permits the vial 70 to be supported by the tray 10 while suspended, while with a lower portion of the vial protruding downward from the bottom edge of the tray.

[0030] FIG. 8 shows the tray 10 seated on a surface 60. As shown, in this configuration the bottom edges of receptacles 30 and the bottom wall 72 of the vial 10 both contact the surface 60. These conditions are ideal during operations such as lyophilization, where contact between the tray 10 and the surface 60, in this case a lyophilization freezer plate 60, is desirable to provide maximum support to the assembly, and contact between the vial 70 and the lyophilization freezer plate 60 is desirable for optimum heat exchange.

[0031] FIG. 9 shows a vial 70 elevated within a receptacle 30, as may occur, for example, when the vial 70 is suspended by automation during weighing, inspection, capping or crimping of the vial. As shown, the inner diameter of the receptacle 30 cylindrical wall 36 is slightly larger than the outer diameter of the vial side wall 74. This permits the vial 70 to be easily slid up and down within the receptacle 30 during elevation, while restricting movement of the vial 70 in nonaxial directions within the receptacle 30.

[0032] As shown in each of FIGS. 7-9, the upper edge 44 of cylindrical wall 36 is tapered in an upward and radially outward direction. This facilitates insertion of the vials 70 within the receptacles 30 by minimizing interference that could occur between curved lower edge 76 and upper edge 44 as the vial 70 is moved axially downwards into the receptacle 30 by filling line automation.

[0033] Receptacle cylindrical walls 36 further include windows 42. As shown, windows 42 begin at the top edge 44 of upper portion 32 of cylindrical wall 36, and in the illustrated

embodiment create interruptions 46 in the top edge 44. Windows 42 extend in the axial direction of receptacles, down the length of cylindrical wall 36, past tray base 20 and into the lower portion 34 of cylindrical wall 36, terminating just before reaching the bottom of lower portion 34, such that an annular portion 48 remains continuous just above lip 40. Between windows 42, the cylindrical wall 36 is formed as strips 50. In the illustrated embodiment, each receptacle includes four windows 42, defined between four strips 50, with the windows 42 and strips 50 being approximately equally circumferentially spaced around the receptacle 30, and being approximately equal in circumferential length. It should be understood, however, that fewer or more windows 42 and strips 50 could be provided, or the spacing and/or dimensioning of such windows 42 and strips 50 could be varied while remaining within the scope of the invention. Windows 42 impart the tray 10 with the advantages of, for example, aiding in heat exchange during lyophilization, and gas mobility during sterilization. Strips 50 impart the tray 10 with the advantages of increased stiffness and reduced deflection of receptacles 30.

[0034] The tray 10 further includes ribs 52 protruding upwards from the top surface thereof, and extending outwardly from receptacles 30. Each receptacle 30 of the tray 10 shown has eight (8) ribs 52 extending outwardly therefrom. In the embodiment shown, the ribs 52 are positioned substantially at circumferential edges of the portions of strips 50 forming the upper portion 32 of each receptacle. It should be understood, however, that fewer or more ribs 52 could be provided as well, and their positioning could be varied while remaining within the scope of the invention. As shown, ribs 52' extending from the sides of receptacles 30 that are adjacent to other receptacles 30, extend all the way to the adjacent receptacles 30, so that each of these ribs 52' is shared with an adjacent receptacle. Ribs 52'' located adjacent to an outer edge of the tray 10 extend radially outward from their associated receptacles 30 and terminate by tapering towards the base 20. Ribs 52 impart the tray base 20 as well as the receptacles 30 with the advantages of further increased stiffness and reduced deflection.

[0035] With reference to FIGS. 1-4, 6, and 14, the tray 10 includes dents 54 along the edges thereof. Dents 54 are preferably sized to accommodate a user's fingers, to facilitate removal of the tray 10 from the tub 90. In the illustrated embodiment, two dents 54 are provided along opposite edges of the tray base 20. To remove the tray from the tub 90, a user inserts one finger into the opening 56 defined between each dent 54 and adjacent portion of tray upper side

wall 100, hooks fingers beneath the tray base 20, and pulls tray 10 in an upward direction, out from the tub 90. Two dents 54 are provided in the illustrated embodiment, but it should be understood that the number and positioning of dents 54 could be varied while remaining within the scope of the inventions.

[0036] Bumpers 26 may be provided at the outer edges of tray base 20, to prevent overlapping of multiple trays 10 when moving in an automation line. In the illustrated embodiment, the bumpers have substantial “U” Shapes, including a front contact surface 28 joined at longitudinal ends thereof to tray base 20 by two legs 29. In use, two trays 10 approaching each other would contact each other at their bumper contact surfaces 28 before tray edges could contact each other and/or tray bases 20 could come into an overlapping or partially overlapping condition. Four bumpers 26 are provided in the embodiment shown, with two bumpers being formed on a selected edge, and two being formed on an opposite edge. Other numbers and locations of bumpers 26 could be employed as well, depending on the predicted conditions during processing.

[0037] The tray base 20 further defines locating holes 58 to serve as locating points for locating the tray 10 on the filling plate and facilitate moving the tray 10 into and out from the dry freezer during lyophilization.

[0038] While the preferred embodiments of the invention have been described in detail above, the invention is not limited to the specific embodiments described, which should be considered as merely exemplary.

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CLAIMS

What is claimed is:

1. A tray for seating a plurality of parenteral vials, comprising:
a substantially planar tray base; and
a plurality of vial seating receptacles defined in the base, each of the receptacles configured to seat a single parenteral vial during a processing operation of the vials;
wherein, the tray is configured to permit processing of the vials using equipment designed for processing of prefilled syringes.
2. The tray of claim 1, wherein each one of the receptacles includes a substantially cylindrical wall.
3. The tray of claim 2, wherein the substantially cylindrical wall includes an upper portion that extends above the tray base and a lower portion that extends below the tray base.
4. The tray of claim 3, wherein each one of the receptacles is dimensioned such that a distance between an upper surface of the tray base and the top of a vial seated in the receptacle is about 18mm.
5. The tray of any previous claim, wherein an opening is formed the bottom of each one of the receptacles.
6. The tray of claim 5, wherein each one of the receptacles includes a substantially cylindrical wall, and an inwardly extending lip is formed at the bottom of each substantially cylindrical wall, surrounding the opening.
7. The tray of claim 6, wherein the lip supports a curved bottom edge of a vial seated therein, such that the bottom of the vial protrudes downward from the opening when the tray is suspended.

8. The tray of claim 6 or 7, wherein the opening has an inner diameter that is smaller than an outer diameter of a side wall of a vial seated therein, and larger than a diameter of a bottom wall of the vial seated therein.

9. The tray of any previous claim, wherein when seated on a surface, a bottom edge of each receptacle and a bottom wall of a vial seated therein both contact the surface.

10. The tray of any one of claims 2-9, wherein the inner diameter of each substantially cylindrical wall is larger than the outer diameter of a side wall of a vial seated therein.

11. The tray of claim 10, wherein the vial is capable of sliding in an axial direction when seated in the receptacle.

12. The tray of any one of claims 2-11, wherein an upper edge of the substantially cylindrical wall is tapered in an upward and radially outward direction.

13. The tray of any one of claims 2-12, wherein windows are defined in the substantially cylindrical walls.

14. The tray of claim 13, wherein the windows begin at a top edge of each substantially cylindrical wall, forming interruptions in the top edge.

15. The tray of claim 13 or 14, wherein each one of the windows extends downward in the axial direction of the receptacle.

16. The tray of claim 15, wherein each one of the windows terminates prior to reaching the bottom of substantially cylindrical wall.

17. The tray of any one of claims 13-16, wherein each receptacle includes four windows that are substantially equally circumferentially distanced around the receptacle.

18. The tray of any one of claims 13-17, wherein axially extending strips are defined between the windows.

19. The tray of any previous claim, further comprising ribs that protrude upwards from a top surface of the base and extend outwardly from the receptacles.

20. The tray of claim 18, further comprising ribs that protrude upwards from a top surface of the base and extend outwardly from the receptacles at circumferential edges of the strips.

21. The tray of claim 19 or 20, wherein eight of the ribs extend outward from each receptacle.

22. The tray of any one of claims 19-21, wherein some of the ribs extend between two adjacent ones of the receptacles.

23. The tray of any previous claim, further comprising dents that are sufficiently sized to accommodate a portion of a user's finger and defined along the edges of the base.

24. The tray of claim 23, comprising two dents positioned on opposite edges of the base.

25. The tray of any previous claim, further comprising bumpers positioned along the outer edges of the tray base.

26. The tray of claim 25, wherein the bumpers each include a front contact surface that is configured to contact a contact surface of an adjacent bumper of an adjacent tray, and legs positioned at opposite ends of the contact surface to join the contact surface with an outer edge of the base.

27. The tray of any previous claim, further comprising locating holes defined in the tray base.

28. A parenteral vial transport and processing assembly, comprising the tray of any previous claim, and a tub configured for seating the tray in a suspended condition.

29. The assembly of claim 28, wherein the tub comprises:
a base wall;
a lower side wall extending upward from the base wall to define a seating region;
an upper side wall located above, parallel to, and outwardly displaced from the lower side wall; and
a shoulder that extends outwardly from the lower side wall, to join the lower side wall with the upper side wall;
wherein the shoulder is configured to support an outer edge of the base of the tray, to house the tray in the suspended condition.

30. The assembly of claim 29, wherein the tray further comprises a flange that extends outwardly from an upper edge of the upper side wall.

31. The assembly of claim 30, wherein the upper side wall has a height sufficient such that the tops of vials seated in the receptacles are positioned below the height of the flange.

32. The assembly of claim 30 or 31, wherein the flange is configured for adherence of an upper sealing material to cover the tub and the tray seated therein.

33. The assembly of any one of claims 29-32, wherein the height of the lower side wall is sufficient to permit receptacles and vials seated therein to be suspended above the base wall of the tub without contacting the base wall of the tub.

34. The assembly of claim 33, wherein the height of the lower side wall is sufficient to permit parenteral vials and receptacles of various sizes to be stored therein without contacting the base wall of the tub.

35. A vial for use with the tray of any one of claims 1-28 or the assembly of any one of claims 29-34, comprising:
a bottom wall;
a side wall extending upward from the bottom wall;
a curved lower edge joining the bottom wall and the side wall;

a radially inwardly extending shoulder formed at the top of the side wall; and
a neck extending upwardly from the shoulder, the neck defining an opening at the top thereof, the opening leading to the vial interior.

36. The vial of claim 35, further comprising a rim that protrudes outwardly from the opening at the top of the neck.

37. The vial of claim 35 of 36, further comprising a radially outwardly protruding annular ridge located between the shoulder and the side wall, the ridge configured to sit on a top edge of a receptacle when the vial is seated therein.

38. The vial of claim 37, further comprising a plurality of knobs formed at circumferential intervals along the ridge, the knobs spaced and configured to prevent rolling of the vial when sitting in a non upright condition on a surface, with two adjacent ones of the knobs resting on the surface.

39. The vial of claim 35 or 36, further comprising a step that extends radially inward from the shoulder to the side wall, the step configured to sit on a top edge of a receptacle when the vial is seated therein.

40. The vial of claim 39, further comprising a plurality of planar contact surfaces that extend upward from the step and into the shoulder, the contact surfaces spaced and configured to prevent rolling of the vial when sitting in a non upright condition on a surface, with a selected one of the contact surfaces resting on the surface.

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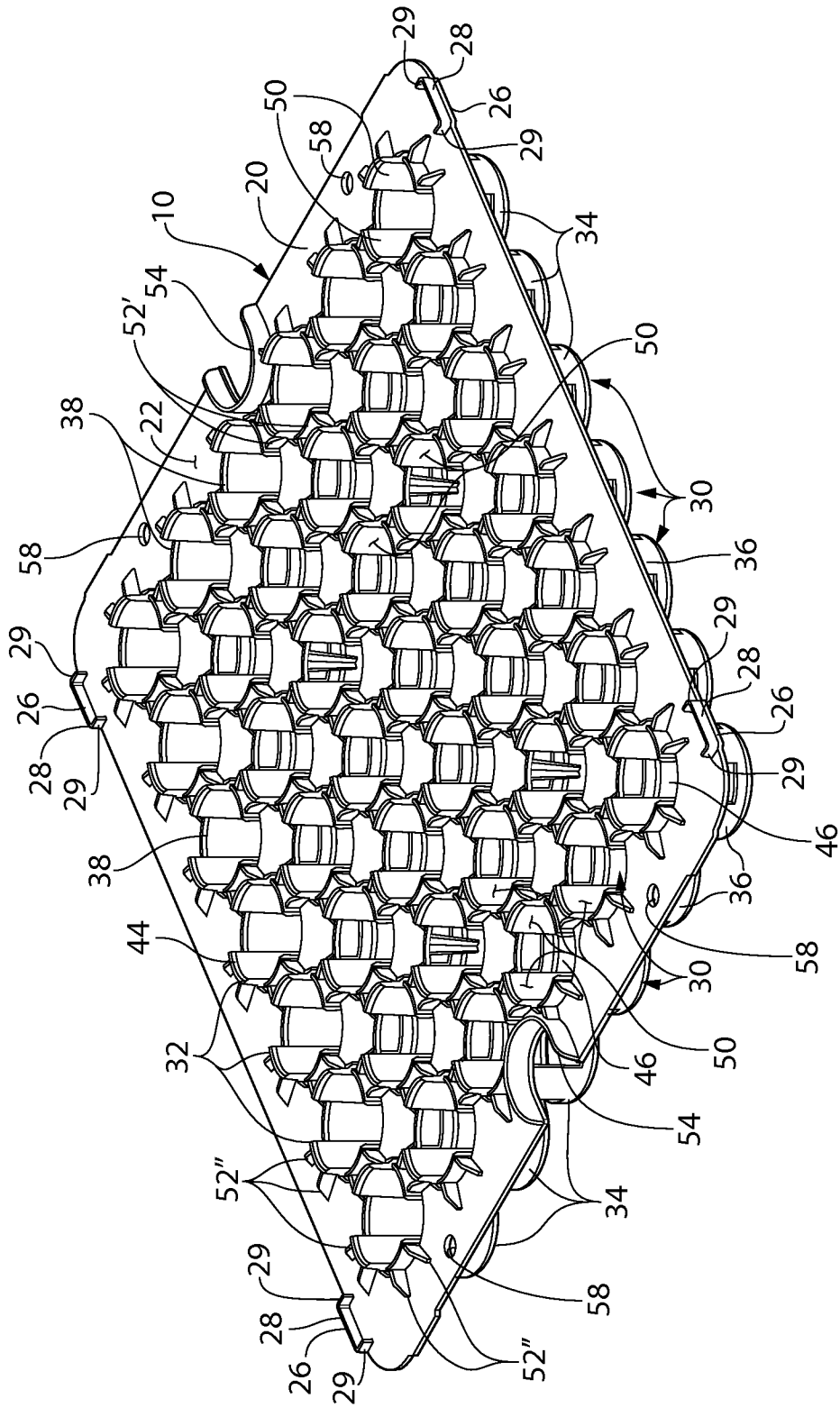


FIG. 1

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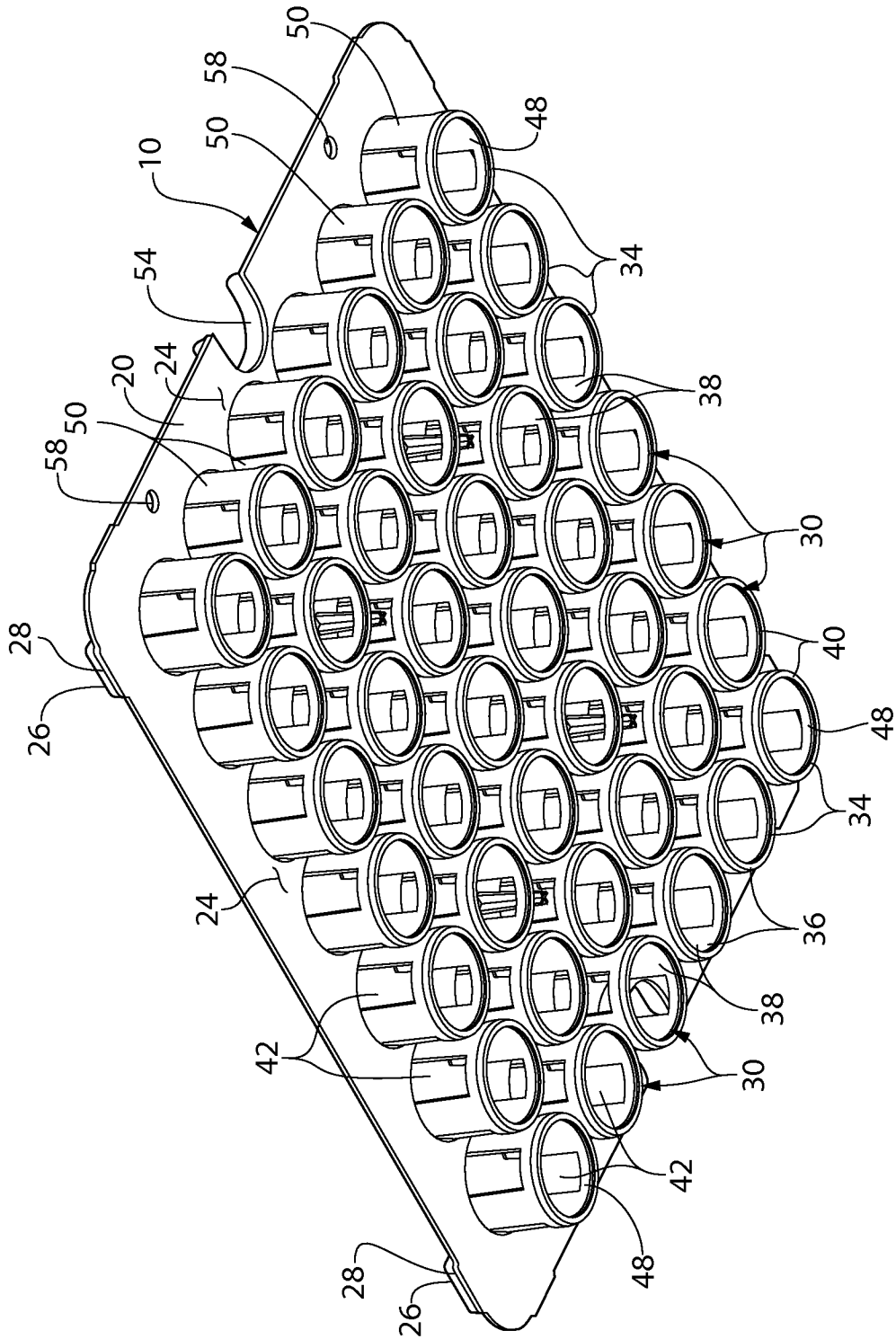


FIG. 2

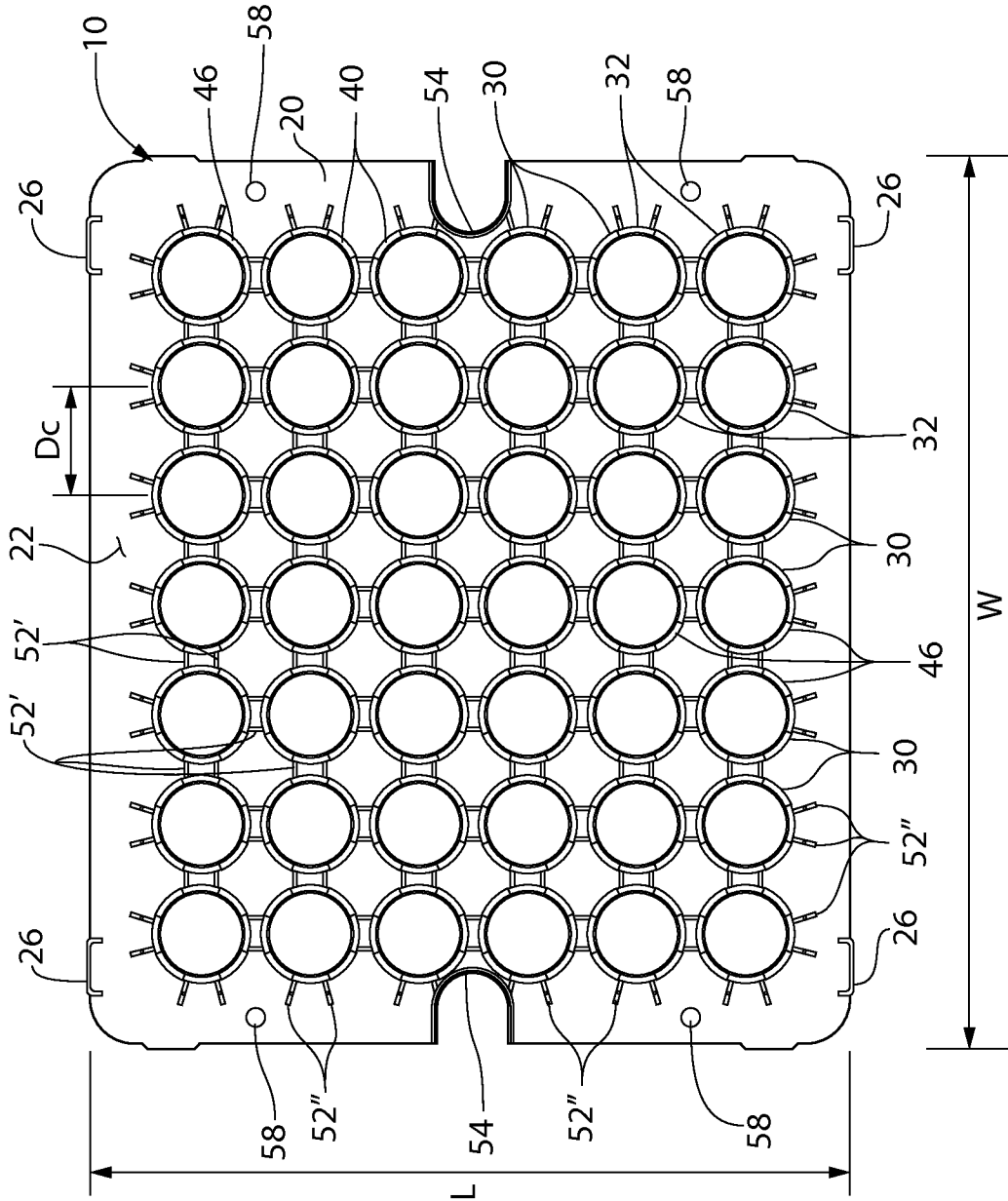


FIG. 3

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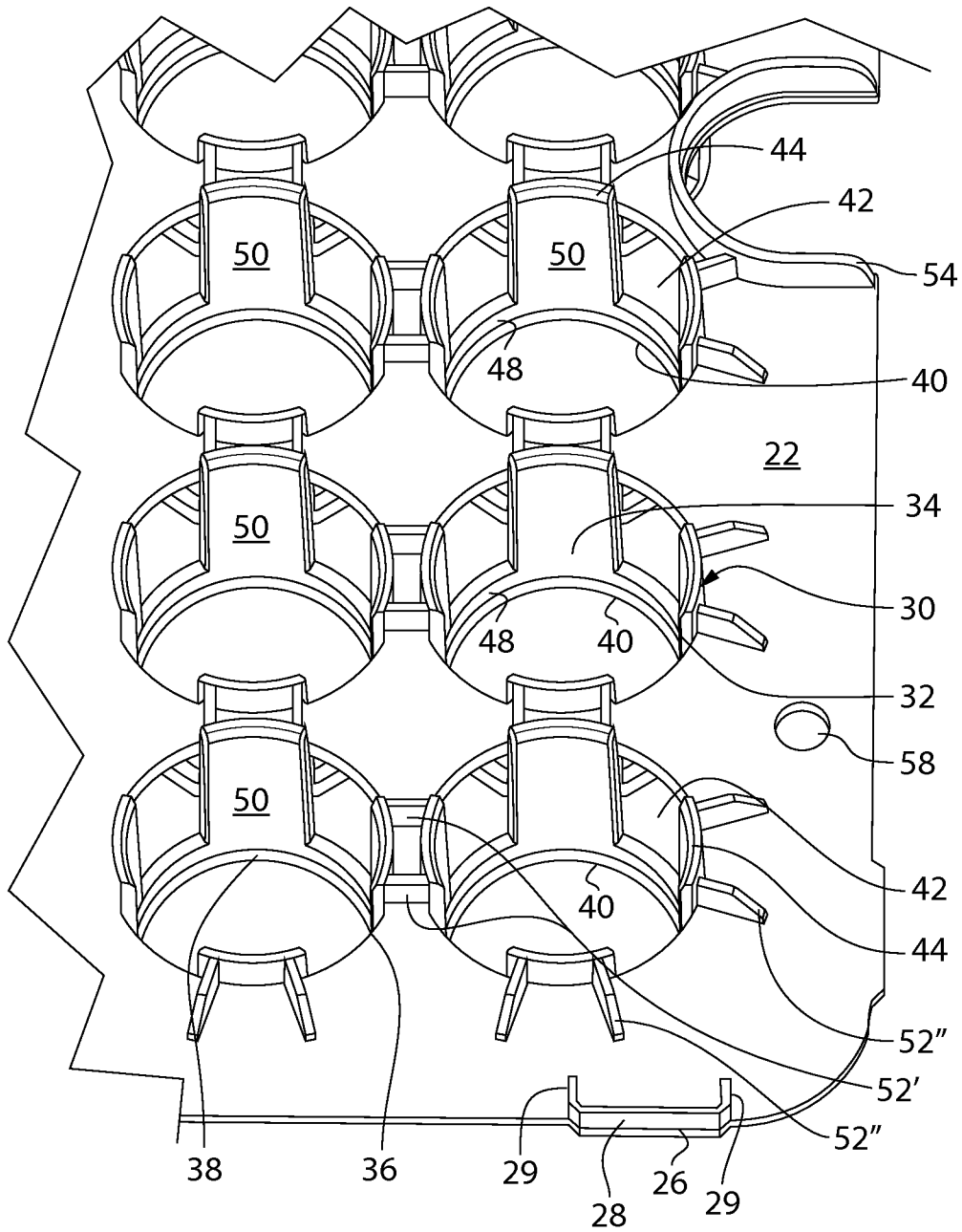


FIG. 4

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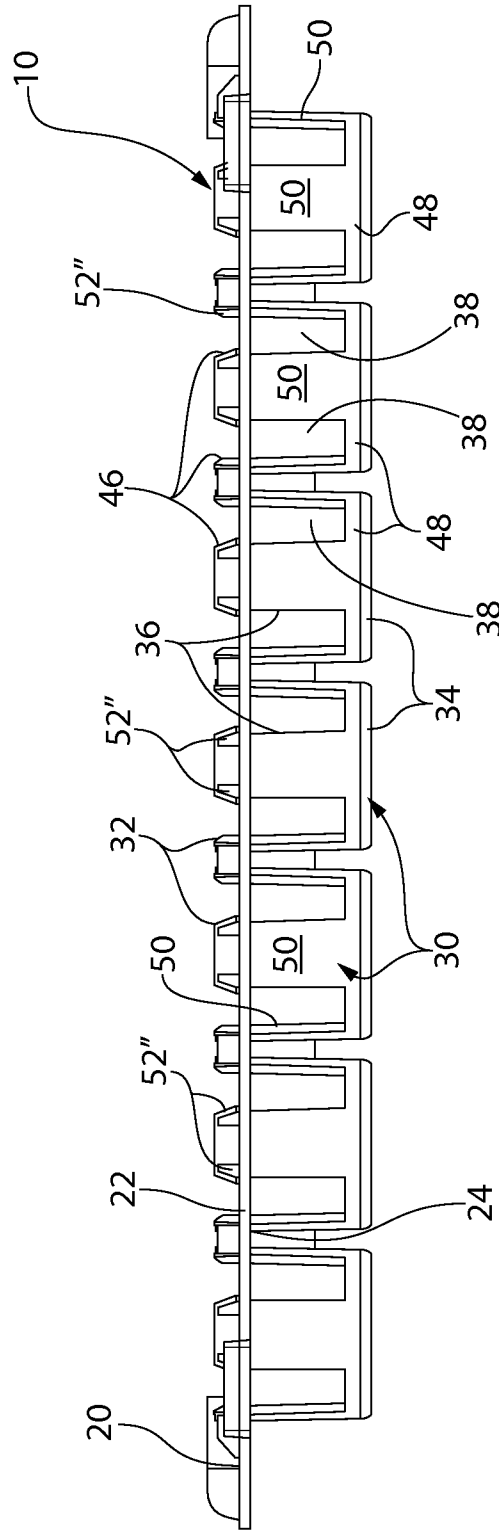


FIG. 5

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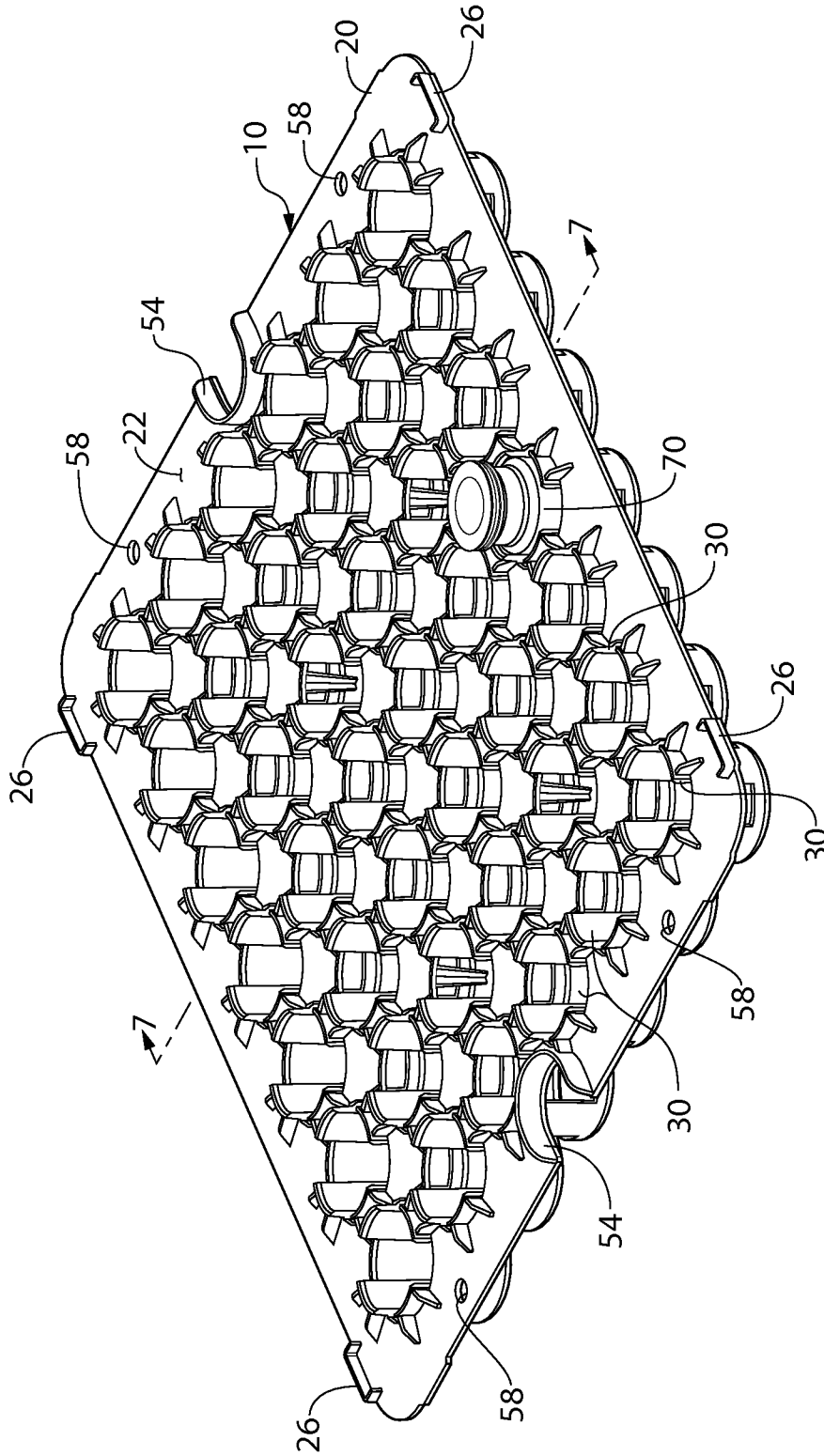


FIG. 6

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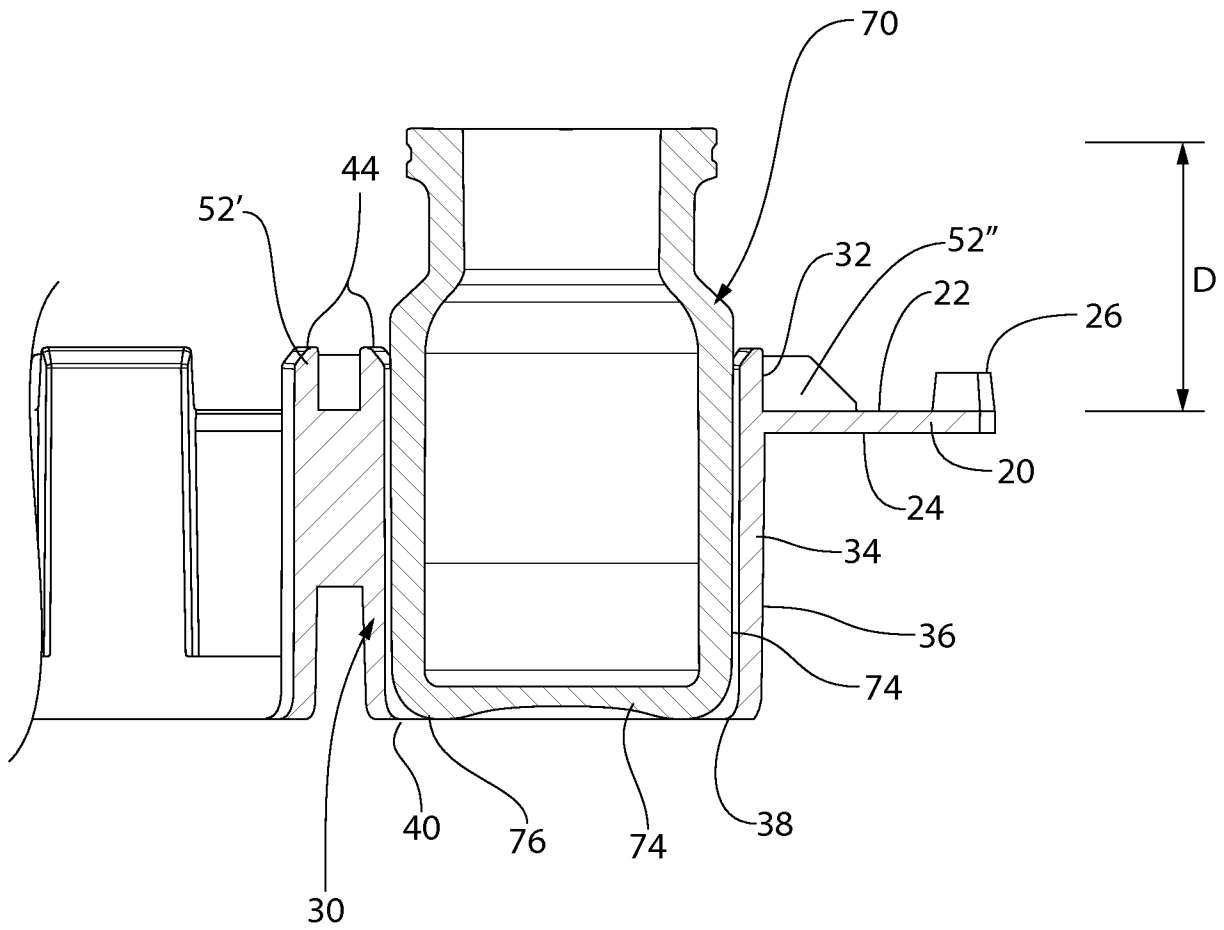


FIG. 7

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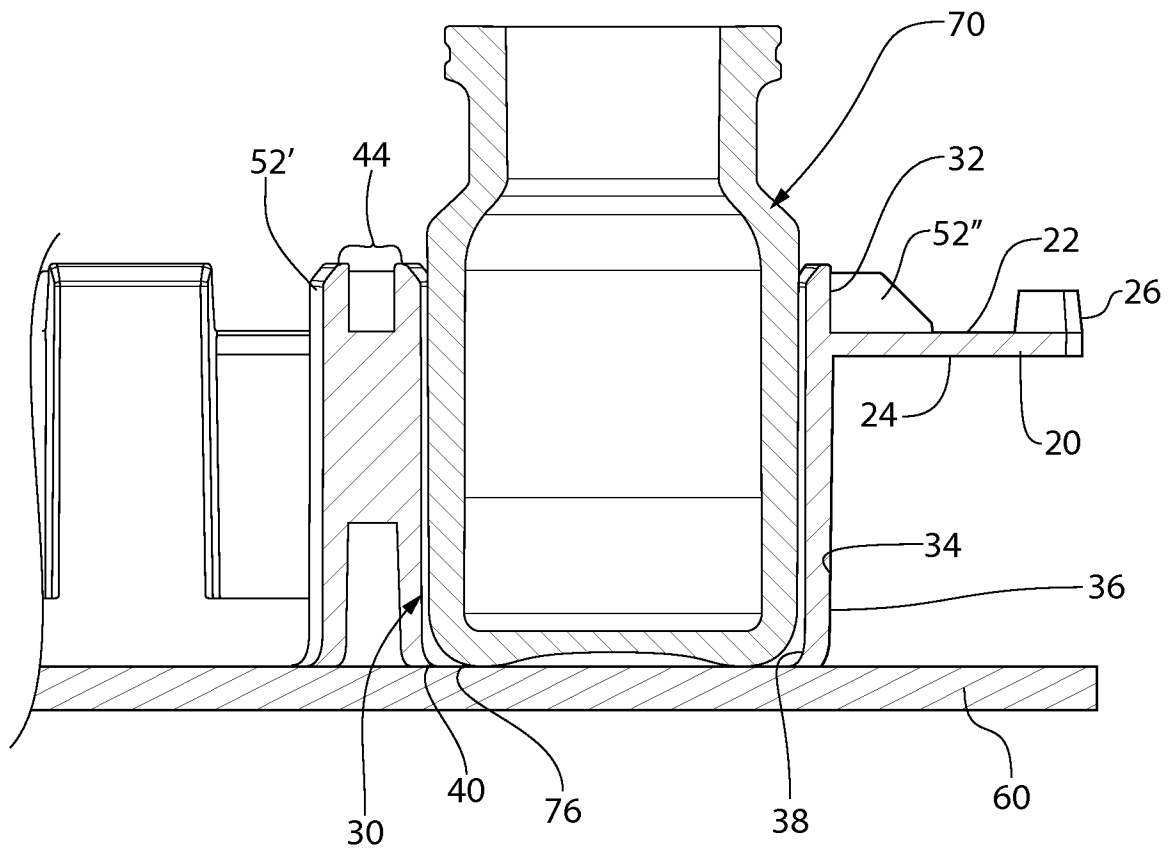


FIG. 8

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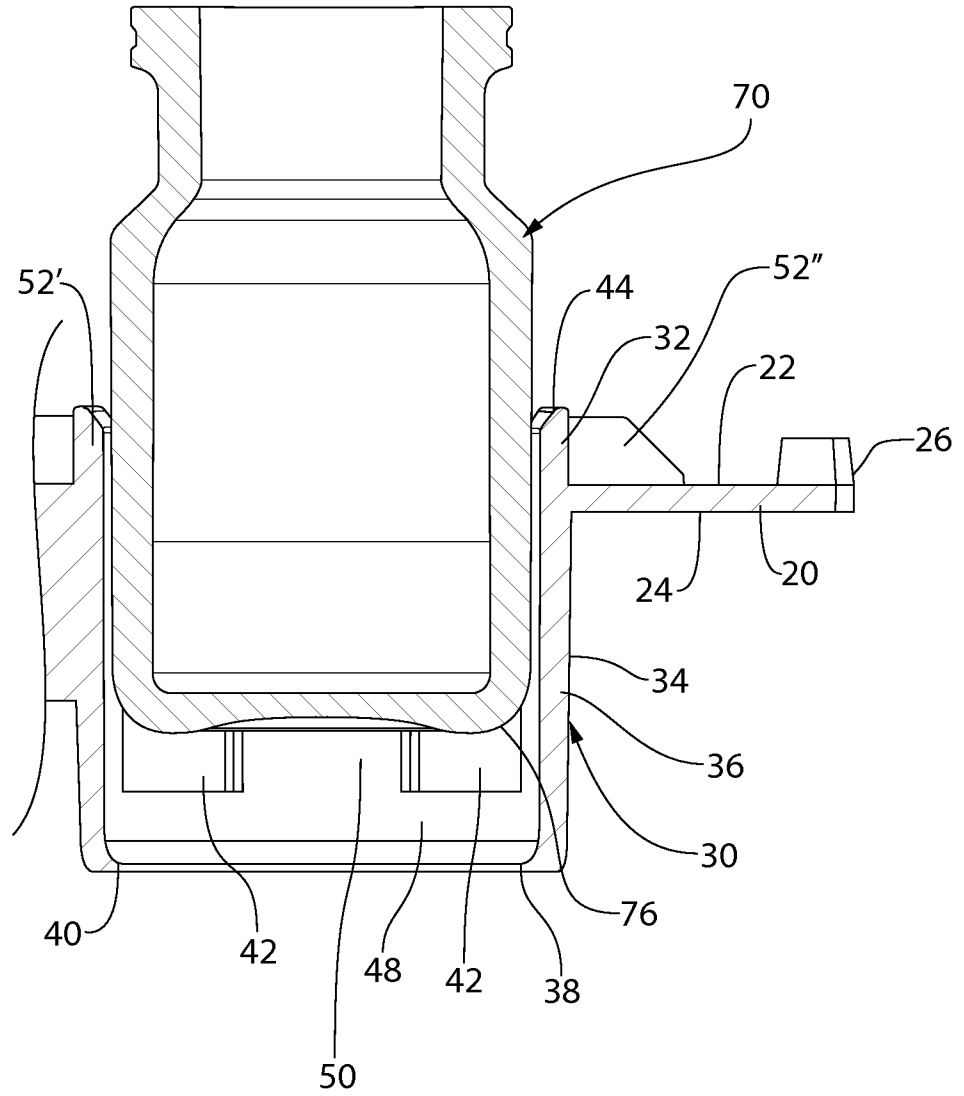


FIG. 9

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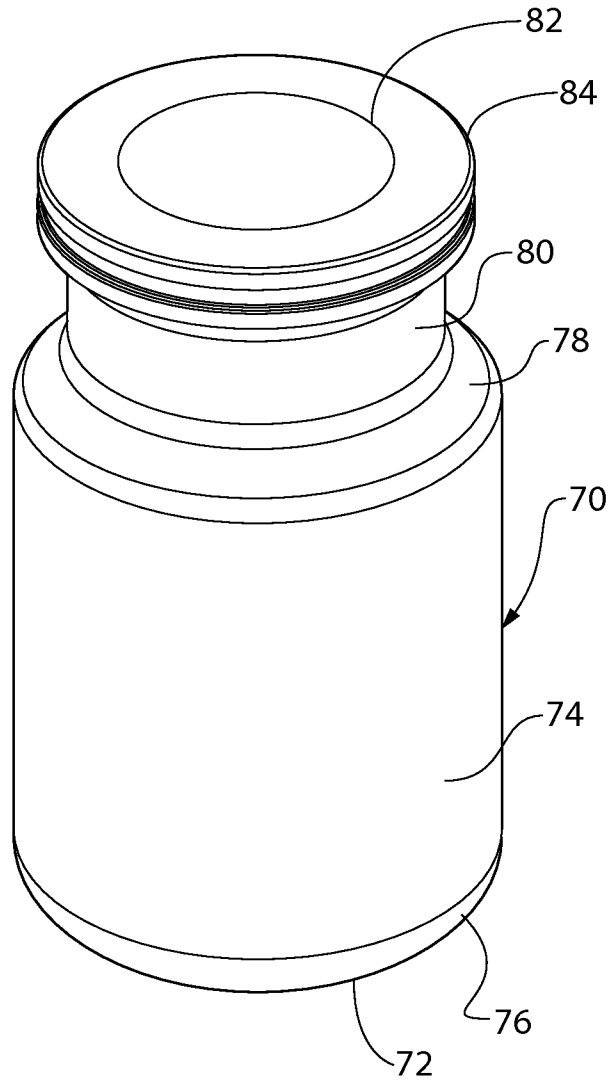


FIG. 10

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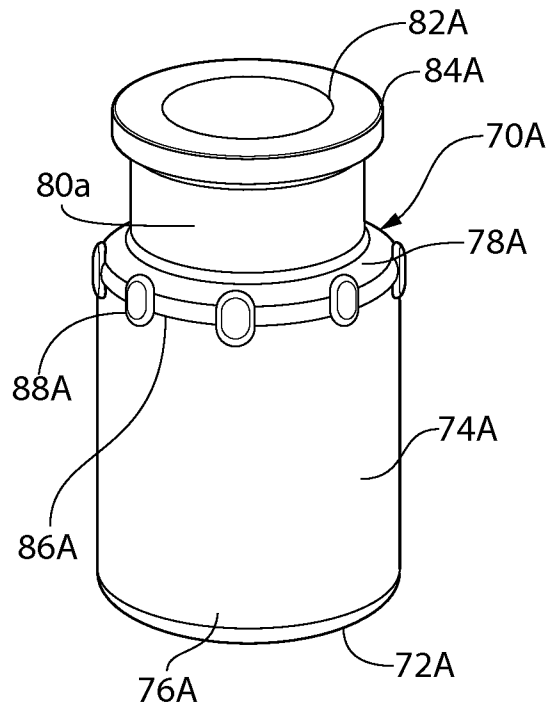


FIG. 11

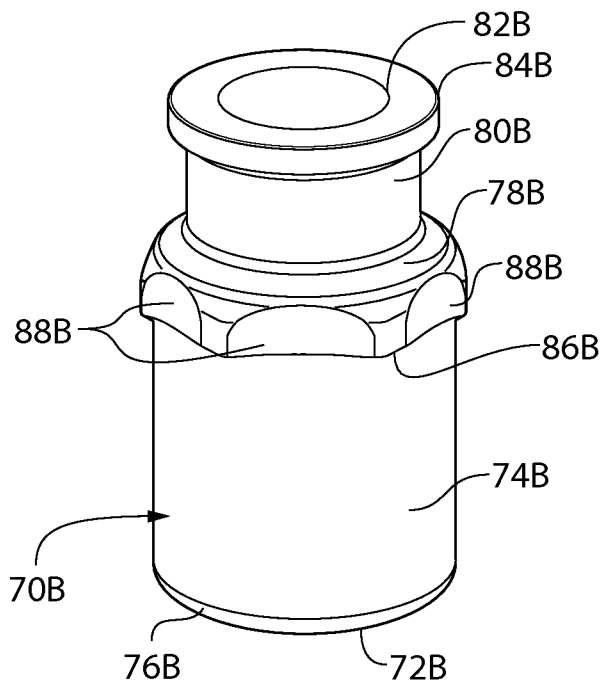


FIG. 12

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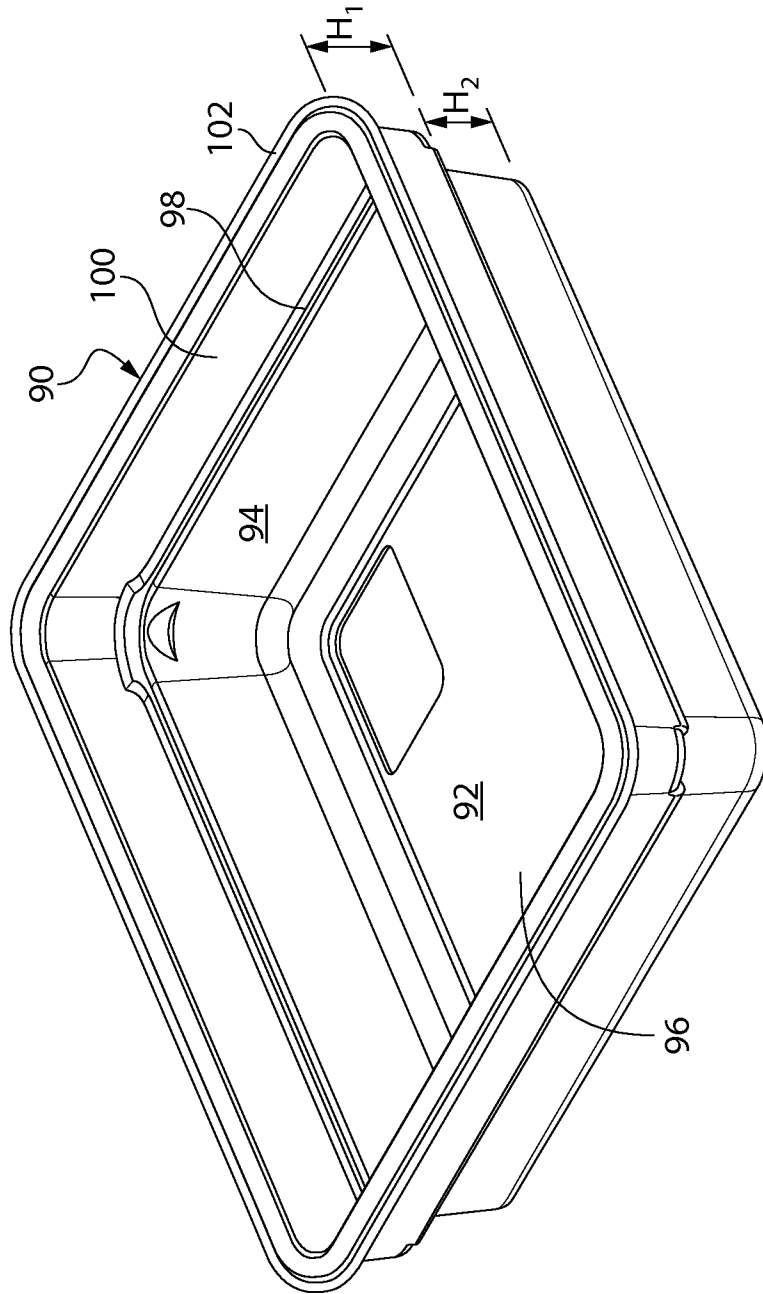


FIG. 13

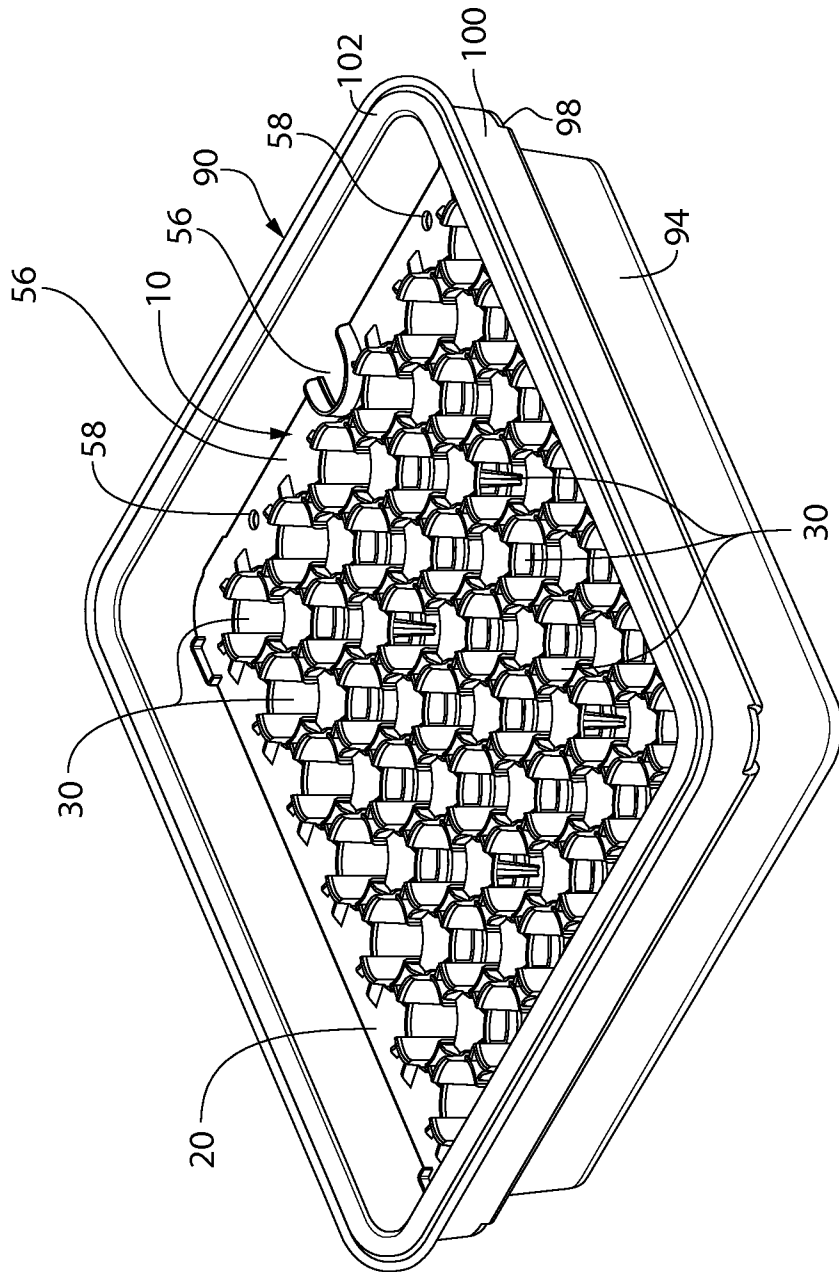


FIG. 14

A. CLASSIFICATION OF SUBJECT MATTER**A61J 1/16(2006.01)i, A61J 1/06(2006.01)i, A61B 19/02(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61J 1/16; B01L 9/00; A61J 7/00; A61M 5/00; A61J 1/00; A61J 1/14; B65D 81/20; B65D 25/10; A61J 1/06; A61B 19/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: tray, vial, tray base, receptacle, prefilled syringe

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| A | WO 2009-015862 A1 (SEMAFRA S.A.) 05 February 2009 See claims 1, 4, 6-12 and figures 1-6. | 1-7 |
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| A | JP 2004-033607 A (KANA E CO., LTD. et al.) 05 February 2004 See claim 1 and figure 1. | 1-7 |
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 Further documents are listed in the continuation of Box C. See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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Information on patent family members

International application No.

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