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- (71) **Applicant:** BIOMET BIOLOGICS, LLC [US/US]; 56 E. Bell Drive, Warsaw, Indiana 46582 (US).
- (72) **Inventors:** KING, William; 154 Sand Hill Lane, Warsaw, Indiana 46582 (US). WOODSELL-MAY, Jennifer E.; 218 E. Dellview Dr., Warsaw, Indiana 46582 (US). HIGGINS, Joel C.; 8025 S. Beaver Dam Rd., Claypool, Indiana 46510 (US). LEACH, Michael D.; 2730 East Setter Lane, Warsaw, Indiana 46582 (US).
- (74) **Agents:** WARNER, Richard W. et al.; Harness, Dickey & Pierce, P.L.C., P.O. Box 828, Bloomfield Hills, Michigan 48303 (US).
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[Continued on next page]

(54) **Title:** SYSTEM AND METHOD FOR SEPARATING A FRACTION

(57) **Abstract:** A material separation system and method is disclosed. The system may include a hollow buoy (20) having a volume (72) that includes or houses a reacting component (70). The buoy may be placed in a container (202) to hold the material to be separated during a separation procedure. After separation, a selected component is moved into the volume of the buoy to interact with thereacting component.

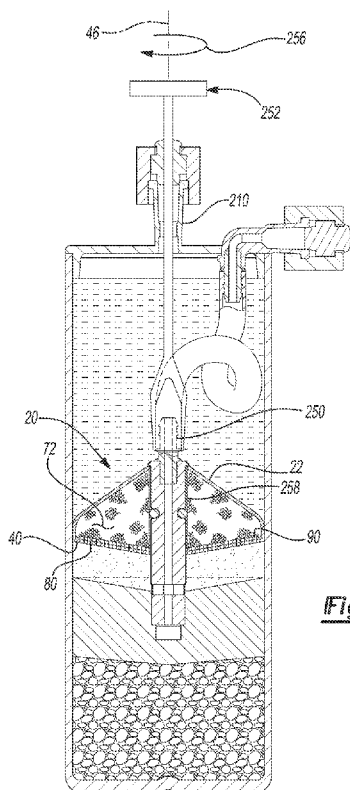


Fig-4C





HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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SYSTEM AND METHOD FOR SEPARATING A FRACTION

FIELD

[0001] The subject disclosure relates to a system for separating materials, and particularly to a buoy system for separating a component from a multiple component material.

BACKGROUND

[0002] This section provides background information related to the present disclosure which is not necessarily prior art.

[0003] A multiple component material, such as whole blood, plasma, bone marrow aspirate, other suspensions, such as environmental water samples, mercury samples, and the like, may be selected to be separated. Various systems can be used to separate the whole material, such as a centrifuge system. A centrifuge system centrifuges a whole sample to cause a separation of the sample based upon densities and specific densities of materials within the whole material. For example, a centrifuge can be used to separate red blood cells from a whole blood sample.

SUMMARY

[0004] This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

[0005] A centrifuge system can be used to separate a selected component of a whole or multiple component sample, such as separating a selected portion of whole blood or separating a reaction product from a sample. According to various embodiments, a buoy system can be positioned within a separation container to assist in separation. For example, a buoy can be provided with a specific density that is equivalent to a selected component within a mixture such that the buoy will move to a position adjacent to the selected component to assist in separating and maintaining a separation of the selected component. The buoy may also include a plurality of portions such that the buoy

may sequester a specific area between a first buoy portion and second buoy portion.

[0006] Further, the buoy may include a volume that includes or houses a reacting component, such as glass beads, desiccating beads, a reagent, or the like. According to various embodiments, the buoy can include a first buoy member or portion that has a substantially hollow interior to house the reacting component, such as glass beads, and an opening that allows for selective entry of the selected component to interact with the beads housed within the buoy member.

[0007] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

15 DRAWINGS

[0008] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

[0009] Fig. 1 is a side plan view of a buoy system according to various embodiments;

[0010] Fig. 2 is a cross-section view of the buoy system of Fig. 1 along line 2-2;

[0011] Fig. 3A-3C schematically illustrate movement and/or alignment of a portion of the buoy system;

[0012] Figs. 4A-4E illustrate an exemplary method of use of a system including the buoy system, according to various embodiments;

[0013] Fig. 5A is a side plan view of a buoy system with a blocking wall in a first position, according to various embodiments; and

[0014] Fig. 5B is a side plan view of a buoy system with a blocking wall in a second position, according to various embodiments.

[0015] Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

[0016] Example embodiments will now be described more fully with reference to the accompanying drawings.

5 **[0017]** With reference to Figs. 1 and 2, a buoy system 20 is illustrated. The buoy system 20 can include portions that are similar to buoy systems included or disclosed in U.S. Patent Nos. 7,179,391; 7,374,678; 7,832,566; 7,845,499; or 8,567,609; all of which are incorporated herein by reference; and in various devices, such as the Platelet Separate System GPS II® sold by
10 Biomet, Inc., having a place of business in Warsaw, Indiana. Generally, the buoy system 20 can include a first or upper buoy member 22 and a lower or second buoy member 24 that can be interconnected with a third buoy portion or member 26. According to various embodiments, the first buoy member 22 can move relative to the second buoy member 24 such as by moving or sliding
15 axially along the third buoy member 26 generally towards the second buoy member 24. If the first buoy member 22 is provided to move relative to the second buoy member 24 a seal, such as a rubber or rubberized O-ring 28 can be provided to assist in providing a seal between an area or volume, such as a collection volume 30. between the first buoy member 22 and the second buoy
20 member 24 and the volume outside of the collection volume 30, such as above the first buoy member 22 and below the second buoy member 24.

[0018] Further, according to various embodiments, the second buoy member 24 can be provided of a single or multiple materials in single or multiple sections. Multiple sections may all be made of the same material as well.
25 Further, the second buoy member 24 can be substantially solid. The second buoy member 24 can include a density or specific gravity, as discussed further herein, that in combination with the other portions of the buoy system 20 can be formed to reach a selected region or section within a separation container, as discussed further herein. Further, the second buoy member can include a non-
30 flat or non-planar bottom surface 34, such that the bottom surface 34 may include an apex or point 36 that can assist with initial movement of the buoy

member or assembly 20 during the separation, again as discussed further herein.

[0019] The buoy assembly 20 can include the collection area 30 that is bounded at least on two sides by the buoy assembly 20. On a first side, a bottom wall 40 of the first buoy 22 can be formed and extend from the third buoy member 26 to an edge of the first buoy member 22. On a second side, a second wall 42, formed as a top surface of the second buoy 24 may extend out from the third member 26 to an edge of the second buoy member 24. The first wall 40 may extend at an angle 44 from a central or long axis 46 of the buoy assembly 20. The second wall 42 can extend at an angle 48 relative to the long axis 46. The angles 44 and 48 may be substantially complimentary such that the first wall 40 may mate with the second wall 42 if the first buoy member 22 is configured to move relative to the second buoy member 24. As illustrated, the first wall 40 may be convex and the second wall 42 may be concave. Accordingly, the collection area 30 can be substantially closed or eliminated by the contact of the first wall 40 with the second wall 42, such as during withdrawal of a material from the collection volume 30.

[0020] The third buoy member 26 may have central bore 50 that can extend to terminate in an access bore or extending bore 52. Accordingly, material that is collected within the collection of volume 30 can be withdrawn through the collection bore 52 and the central bore 50 through a collection tube or assembly 54, as discussed further herein. The central bore 50 can be in communication with a bore or passage 56 of the collection tube 54 to assist in withdrawal of material from the collection volume 30.

[0021] The first buoy 22 and/or the second buoy member 24 can house a selected material such as glass beads, desiccating beads, a reagent, or other selected material. As exemplarily illustrated in Fig. 2, a desiccating bead 70 or a plurality of desiccating beads 70 can be contained within a containment volume 72 of the first buoy 22. The containment volume 72 can be formed to be an entire volume within the first buoy 22 or any selected portion of the volume within the first buoy 22. The first wall 40 may define a plurality of passages 80

through the wall 40 such that a material within the collection area 30 can move into the volume 72 of the first buoy member 22.

[0022] With reference to Fig. 3A and continuing reference to Figs. 1 and 2, the first wall 40 including the passages 80 can also include a wall or blocking member 90 that may have one or more complimentary or equivalent passages 92. The blocking wall 90 in a first position, as illustrated in Fig. 3A, has the passages 80 through the first wall 40 completely blocked by the blocking wall 90 due to the offset or displacement of the blocking wall passages 92 from the passages 80. In a selected embodiment, as discussed further herein, the blocking wall 90 can be moved to a second position, such as in the direction of arrows 94 such that the blocking wall passages 92 can be aligned in the second position with the passages 80 in the first wall 40, as illustrated in Fig. 3b. With reference to Fig. 3C, the passages 80 and the blocking wall passages 92 can be aligned such that material can generally freely move from the collection reservoir 30 into the volume 72 of the first buoy member 22.

[0023] As illustrated in Fig. 3C, when the passage 80 in the first wall is aligned with the blocking wall passage 92 in the blocking wall 90 in the second position, an open passage from the collection area 30 into the volume 72 of the first buoy 22 is made. The blocking wall 90, therefore, can be manipulated to either open or close the wall passages 80 through the first wall 40 to allow material to move into the volume 72 of the first buoy member 22. The blocking wall 90 can also be moved to block or hold the material within the volume 72 of the first buoy member 22 by manipulating the blocking wall 90. In various embodiments, the blocking wall 90 may move in a track or groove that is formed on or in the buoy member 22.

[0024] The passages 80 can have a selected diameter or dimension, such as diameter 100 that is sized to ensure that the beads 70 are maintained within the volume 72 even when the passages 80 are in the open configuration, as illustrated in Fig. 3C. Accordingly, a diameter 100 can be equal to, smaller than, or at a dimension selected such that a plurality of the beads will not pass through the passages 80 in the open configuration. For example, the dimension 100 can be about 5 micrometers (μm) to about 1 mm.

[0025] Turning to Figs. 4A-4E, the buoy assembly 20 can be implemented in a separation and collection system 200. The collection system 200 can include a collection or separation container 202 that can be a container of any appropriate type. For example, the container 202 can be similar to the
5 centrifuge or collection container disclosed in U.S. Patent Nos. 7,179,391; 7,374,678; 7,832,566; 7,845,499; or 8,567,609; all of which are incorporated herein by reference. The container 202 can be any appropriate container operable with the buoy system 20 to affect separation of a material positioned therein. Accordingly, the container 202 can be a container known to those
10 skilled in the art. Briefly, the container 202 can include a bottom wall 204, a side wall, such as a cylindrical side wall 206, and a top wall 208. Each of the walls 204-208 can be formed as a single portion or can be interconnected to form the separation container 202. For example, as illustrated in Fig. 4A, the top wall 208 can be included in a cap that is separable from the side wall 206.

[0026] The top wall 208 can include an introduction or first passage or valve 210 and a second withdrawal passage or valve 212. In selected configurations, such as a cap 214 can be provided to cap either or both of the passages 210 and 212. The ports 212 and 214 allow for introduction and/or
15 withdrawal of material from the container 202.

[0027] Generally, a whole material, such as any appropriate material including whole blood, can be introduced into the separation container 202. The whole material 220 can be introduced through the introduction passage 210 into the volume of the container 202. The buoy system 20 can be initially positioned in the appropriate location within the separation container 202, such as near the
20 bottom wall 204. Further, the introduction system that introduces the whole material 220 can be any appropriate system such as a syringe 222 that includes a plunger 224 that can be pushed in the direction of an arrow 226 to deliver the material to within the separation container 202.

[0028] With reference to Fig. 4B, the container 202 including the whole
30 material 220 can be subjected to a separation force, such as within a centrifuge including those generally known in the art, for example the 755VES Centrifuge system, sold by The Drucker Company having a place of business at Port

Matilda, PA and including those described in U.S. Patent Nos. 7,179,391; 7,374,678; 7,832,566; 7,845,499; or 8,567,609; all of which are incorporated herein by reference. After centrifugation, the whole material 220 can be separated into two or more components or fractions, such as including three
5 fractions. Three fractions can include a first fraction 230, a second fraction 232, and a third fraction 234. During a centrifugation, the heaviest fraction 230 can move towards the bottom wall 204 if the separation container 202 is positioned within the centrifuge such that the centripetal force is towards the bottom wall 204. The second fraction 232 can be a middle density fraction and the third
10 fraction 234 can be a substantially light fraction. Further, as illustrated in Fig. 4B, the buoy system 20 can move to a selected area between or amongst the fractions 230-234. For example, the buoy system 20 can move such that the collection volume 30 substantially collects, or is positioned at the location of, the second fraction 232.

15 **[0029]** The buoy system 20 can be designed and include a selected density such that the collection volume 30 is positioned at the level of the second fraction 232. For example, the density of the second fraction 232 can be known or selected and the buoy system 20 can be formed to include a similar density. The buoy system 20, for example, may have a density of about
20 1.059 grams per cubic centimeter (g/cm^3) to about 1.061 g/cm^3 . Further, according to various embodiments, the second fraction 232 can have a density that is slightly greater (such as about 0.5% to about 5% greater) than the density of the buoy system 20 and include materials such as a buffy coat of whole blood. The buffy coat of whole blood can include platelets, white blood cells, and
25 interleukin-1 receptor antagonist (IL-1RA or IRAP). IRAP is a protein generally encoded in humans.

[0030] After separation of the whole material into the selected fractions, the blocking wall 90 may be moved to allow for the opening of the passages 80 through the first buoy 22 into the volume 72. The movement may
30 include sliding or lifting of the blocking wall. Further, the movement may include linear and/or rotational movement.

[0031] The movement of the blocking wall 90 can be performed according to various mechanisms. In various embodiments the blocking wall 90, as illustrated in Fig. 4C, may be moved by engaging a portion of the buoy assembly 20, such as near a withdrawal port 250 with a key or lever 252. The lever 252 can be passed through the port 210 to engage a portion, such as the withdrawal port 250, to rotate the blocking wall 90 around an axis 46 to allow for alignment of the blocking wall passages 92 with the wall passages 80 of the wall 40 of the first buoy member 22. For example, the lever 252 can be rotated generally in the direction of arrow 256 around the axis 46 to move the blocking wall 90 relative to the first buoy 22. In rotating the lever 252, an extension or a movable wall member 258 that can be interconnected with the withdrawal port 250 can be moved to rotate the blocking wall 90. Accordingly, the blocking wall 90 can be moved to allow opening or forming the complete passages through passages 80 into the volume 72 of the first buoy 22.

[0032] Once the blocking wall 90 has been moved to align the blocking wall passages 92 and the first wall passages 80, the container 202 can be manipulated, such as inverted, to cause the second fraction 232 to move generally in the direction of arrows 260 such that the second fraction 232 moves into the volume 72 within the first buoy 22. As the second fraction 232 moves into the volume 72, it may contact and interact with the beads 70 positioned within the volume 72 of the first buoy member 22. As discussed above, the beads 70 can be any appropriate bead, such as a glass bead, a desiccating bead, or the like. Accordingly, for example, if the beads 70 are desiccating beads, then a portion of the water or aqueous portion of the second fraction 232 can be drawn into the desiccating beads 70. This allows the second fraction 232 to be dried and concentrated to concentrate non-water portions of the second fraction 232. This may decrease an overall volume of the second fraction 232 and allow for an optimization of the withdrawal and collection of the non-water portions of the second fraction 232.

[0033] After a selected passage of time, the container 202 can be reoriented such that the bottom wall 204 is moved or positioned generally in the direction of the force of gravity to allow a desiccated or dried portion 232a of the

second fraction 232 to be moved back into the collection volume 30. The desiccated fraction 232a may also be an augmented fraction, it is understood that an augmented fraction may be augmented in various manners. For example, a fraction separated from the whole material may be reacted with a chemical agent in the buoy member 22. It is understood that the container 202
5 can be repositioned into a centrifuge to allow for centrifugation to assist in the removal of the dried portion 232a from the desiccating beads 70 within the volume 72. According to various embodiments, after a selected period of time, removal of the dried portion 232a of the second fraction 232 from the volume 72
10 may occur through withdrawal by way of the withdrawal bore 50 and withdrawal tube 54 to a withdrawal syringe 270.

[0034] The withdrawal syringe 270 can interconnect with the withdrawal port 212 and a plunger 272 or other mechanism, such as a pump or vacuum, can be used to withdraw the desiccated fraction 232a into the syringe
15 270. A water or aqueous portion 232b can be captured or maintained in the volume 72 of the first buoy member 22 such that the withdrawn desiccated fraction 232a is substantially concentrated relative to the initial second fraction 232. The collected fraction 232a can have a higher concentration of IRAP, such as about 10,000 picograms/milliliter (pg/ml) to about 110,000 pg/ml relative to
20 the initial second fraction 232. Further, the collected fraction 232a can have a higher concentration of IRAP, such as about 5% higher to about 1,000% higher relative to the initial second fraction 232 (including about 10,000 picograms/milliliter IRAP to about 40,000 picograms/milliliter IRAP).

[0035] Turning reference to Figs. 5A and 5B, the buoy assembly 20
25 illustrated therein may include the first buoy member 22, the second buoy member 24, and the third buoy portion or connecting portion 26. The buoy assembly 20 can be substantially similar to the buoy assembly 20 discussed above and can include a volume 72 formed within the first buoy member 22. The buoy assembly 20, therefore, can also be used with a separation container
30 202 and any system and method as described above. The buoy assembly 20, as illustrated in Figs. 5A and 5B, may include a blocking plate 300 rather than the blocking plate 90. The blocking plate 300 may include the blocking passages

302 that can be moved from an unaligned first position to an aligned position second position relative to the passages 80 in the first buoy member 22 through the first wall 40. The blocking plate 300 can include a configuration, such as a magnetic configuration or portion. The magnetic portion includes a south pole at a first end 310 and a north pole at a second end 312. The north and south poles can be magnetic poles and allow for an external magnet 320 to interact with the poles 310, 212 of the blocking plate 300.

[0036] For example, as illustrated specifically in Fig. 5A, the external magnet 320 can have a north pole 322 that is positioned near the south pole 310 of the blocking plate 300. Due to the magnetic interaction, exemplarily illustrated by the arrows 324, the blocking plate 300 can generally move in the direction of the arrow 326 to an unaligned or blocking orientation. The movement of the blocking plate or wall 300 may be substantially linear and transverse to the axis 46. Also, a track or groove may be formed in the buoy member 22 to guide the movement of the blocking wall 300. As discussed above, the buoy assembly 20 can then be used to assist in separation of various fractions of the whole material, including the separation of the second fraction 232 into the collection volume 30.

[0037] The buoy assembly 20 can then have an external magnet 320 oriented such that a south pole 330 is positioned near the south pole 310 of the blocking plate 300. Due to the magnetic interaction, illustrated by the arrows 332, the south pole 330 of the external magnet 320 can repel the south pole 310 of the blocking plate 300 to move the blocking plate 300 generally in the direction of arrow 334. Upon moving the blocking plate 300 the blocking plate passages 302 may be aligned with the passages 80. In this way, the collection volume 30 can be open to the internal volume 72 within the first buoy member 22, similar to the manner discussed above.

[0038] It is understood that various indicia may be used to indicate orientation of the blocking wall 300 relative to the buoy member 22. For example, the blocking wall 300 may be positioned and held in the buoy member 22 such that the south pole end 310 is near an "S" indicia on the buoy member 22. The container 202 may be clear or transparent such that the "S" may be

seen through the container wall 206. Similarly the buoy member 22 may include an "N" indicia near the north pole 312 of the blocking wall 300. The external magnet 320 may also include a "N" indicia near the north pole end 322 and a "S" near the south pole end 330. Thus, a user will be able to read the indicia and
5 determine the appropriate end of the external magnet 320 to place near the selected end of the blocking wall 300 to move the blocking wall 300 in the selected direction. The blocking wall 300, for example, may be rotationally fixed relative to the axis 46 but able to slide transversally relative thereto.

[0039] Accordingly, the external magnet 320 can be oriented relative to
10 the blocking plate 300 positioned within the or relative to the first buoy member 22 to move the blocking plate 300. By moving the blocking plate 300, the blocking plate passages 302 can be selectively aligned or unaligned with the passages 80 through the first surface 40 of the first buoy member 22. As discussed above, this can allow for access to the internal volume 72 within the
15 first buoy member 22 to allow a material to interact with the reactant in the volume 72, such as the beads or material positioned within the volume 72. Thus, the material positioned within the collection volume 30 can be moved or allowed to access the volume 72 within the first buoy member 22 by passing through aligned passages and a blocking plate with the passages 80 in the first
20 buoy member.

[0040] According to various embodiments, the beads 70 positioned within the volume 72 can include polyacrylamide beads. The polyacrylamide beads can be used to desiccate or remove water from the second fraction 232 positioned within the collection volume 30 and moved into the volume 72 within
25 the first buoy member 22. The fraction 232, as discussed above, can include a buffy coat fraction of whole blood. Further, the second fraction 232 can include a fraction including various components of bone marrow aspirate, adipose tissue, and the like. Generally, the desiccation of the second fraction 232 can concentrate and/or release free IRAP. The IRAP can be released and or
30 concentrated with the desiccation of the second fraction 232. Accordingly, once the desiccated fraction 232a is removed from the first buoy member 22, as discussed above, and withdrawn from the collection container 202, the

concentrated IRAP can be removed and used for various procedures, such as those generally known in the art.

[0041] Example embodiments are provided so that this disclosure will be thorough, and will fully convey the scope to those who are skilled in the art.

5 Numerous specific details are set forth such as examples of specific components, devices, and methods, to provide a thorough understanding of embodiments of the present disclosure. It will be apparent to those skilled in the art that specific details need not be employed, that example embodiments may be embodied in many different forms and that neither should be construed to

10 limit the scope of the disclosure. In some example embodiments, well-known processes, well-known device structures, and well-known technologies are not described in detail.

[0042] The foregoing description of the embodiments has been provided for purposes of illustration and description. It is not intended to be

15 exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. The same may also be varied in many ways. Such variations are not to be regarded as a departure from

20 the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

CLAIMS

What is claimed is:

1. A system for separation of a selected component of a multiple
5 component material, comprising:
a container having a first end surface and a second end surface
with a connecting wall connecting the first end surface and the second end
surface;
a buoy system moveably positioned within the container, the buoy
10 system having:
a first buoy member having a first buoy open volume;
a selected reactant placed within the first buoy open volume;
and
a first buoy passage;
15 wherein the selected component is operable to selectively move
into and out of the first buoy open volume.
2. The system of Claim 1, wherein the selected reactant includes a
desiccating bead.
20
3. The system of Claim 1, further comprising:
a blocking wall; and
a blocking wall passage;
wherein the blocking wall is configured to be moved between a
25 blocking configuration and an open configuration;
wherein the blocking wall includes a magnetic portion configured to
be acted upon by an external magnetic member to move the blocking wall
relative to the first buoy.

4. The system of Claim 1, further comprising:
a blocking wall;
a blocking wall passage; and
a lever member extending from the container, wherein the lever
5 member is configured to move the blocking wall relative to the first buoy member
between a blocking configuration and an open configuration.

5. The system of Claim 1, wherein the buoy system includes a
second buoy member.

10

6. The system of Claim 5, wherein the first buoy member is
configured to move relative to the second buoy member.

7. The system of Claim 1, wherein the blocking wall includes solid
15 portions configured to be aligned with the first buoy passage to block movement
of any portion of the multiple component material into the first buoy member.

8. A system for separation of a selected component of a multiple component material, comprising:

a container having a first end surface and a second end surface with a connecting wall connecting the first end surface and the second end surface;

5

a buoy system moveably positioned within the container, the buoys system having:

a first buoy member having a first buoy open volume;

a selected reactant placed within the first buoy open volume;

10

a first buoy passage configured to be opened and closed;

and

a second buoy member;

wherein at least a first portion of the multiple component material is operable to move into the first buoy open volume through the first buoy passage when opened.

15

9. The system of Claim 8, wherein the first buoy passage is formed through a first wall of the first buoy member;

wherein the first wall forms a collection volume with at least a second wall of the second buoy member.

20

10. The system of Claim 9, further comprising:

a blocking wall; and

a blocking wall passage;

25

wherein the blocking wall is configured to slide relative to the first buoy member;

wherein the blocking wall is configured to be moved from a blocking configuration to an open configuration.

11. The system of Claim 10, further comprising:
an external magnetic member;
wherein the external magnetic member is configured to interact
5 with the blocking wall to move the blocking wall relative to the first buoy member.

12. The system of Claim 8, further comprising:
a blocking wall;
a blocking wall passage; and
10 a third buoy member that interconnects the first buoy member and
the second buoy member;
wherein the blocking wall is configured to be moved from a
blocking configuration to an open configuration;
wherein the blocking wall rotates around the third buoy member.

15

13. The system of Claim 8, wherein the buoy system has a density to
be positioned in a separation of the multiple component material such that the
selected component is in a collection volume between the first buoy member and
the second buoy member following a separation of the multiple component
20 material.

14. The system of Claim 8, further comprising:
an inlet port configured to allow the multiple component material
into the container; and
25 an outlet port configured to allow the selected component to be
withdrawn from the container.

15. A method of separating a selected component of a multiple component material, comprising:
placing the multiple component material in a container;
causing the selected component of the multiple component
5 material to be sequestered by a first buoy member;
forming an augmented fraction of the multiple component material
by moving at least a portion of the multiple component material into the first buoy
member to interact with a selected reactant; and
withdrawing the augmented fraction including the selected
10 component from the container.

16. The method of 15, further comprising:
centrifuging the container including the multiple component
material to cause the selected component of the multiple component material to
15 be sequestered by the first buoy member.

17. The method of Claim 15, further comprising:
moving a blocking wall relative to the first buoy member;
wherein forming the augmented fraction includes contacting at
20 least the portion of the multiple component material with a desiccating bead that
is the selected reactant within the first buoy member.

18. The method of Claim 15, further comprising:
moving a blocking wall relative to the first buoy member;
25 wherein moving the blocking wall relative to the first buoy member
includes rotating a lever connected to the blocking wall within the first buoy
member.

19. The method of Claim 15, wherein moving the blocking wall relative
30 to the first buoy member includes moving an external magnetic member relative
to the blocking wall to cause a magnetic interaction with the blocking wall to
move the blocking wall.

20. The method of Claim 15, further comprising:
moving a blocking wall relative to the first buoy member;
wherein moving the blocking wall allows forming the augmented
5 fraction.

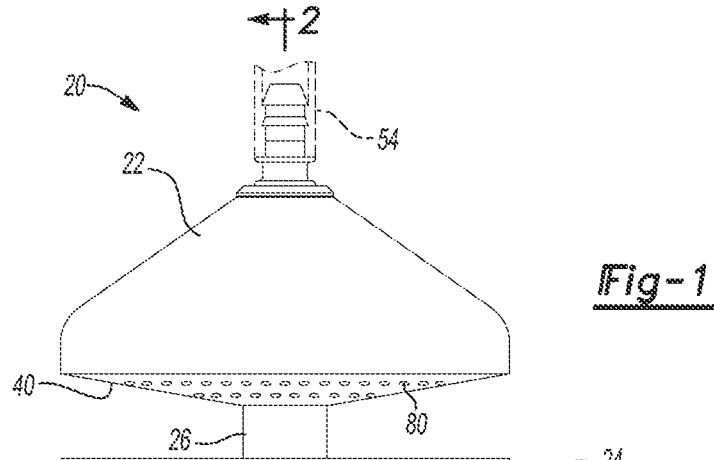


Fig-1

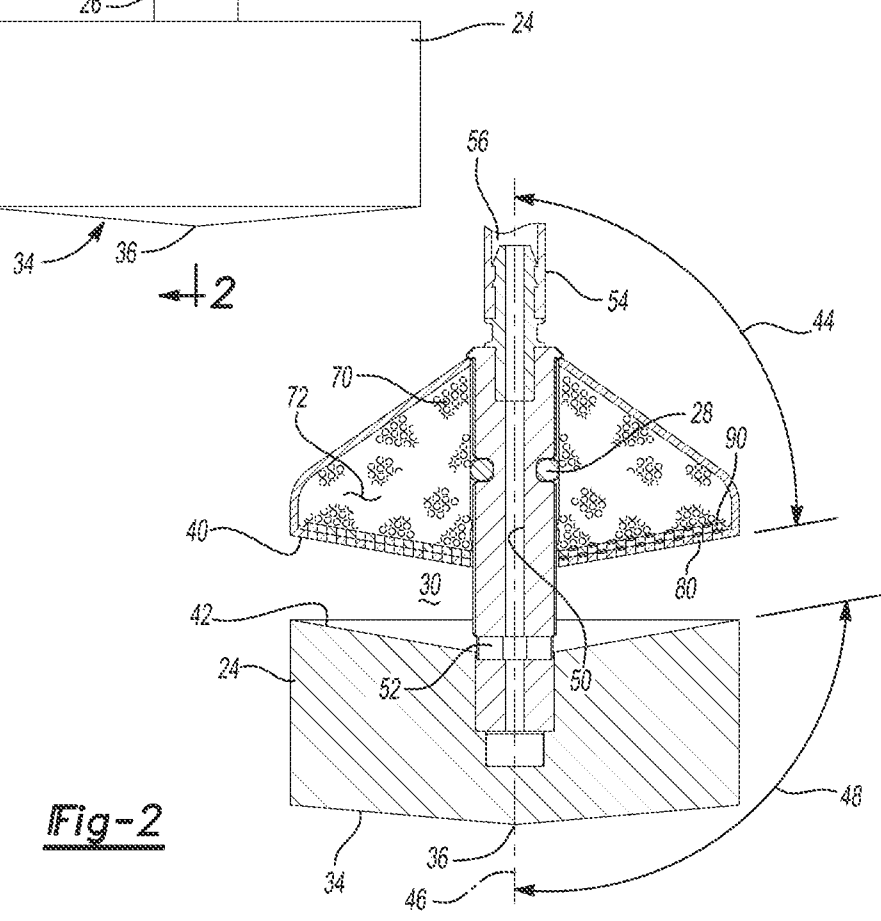


Fig-2

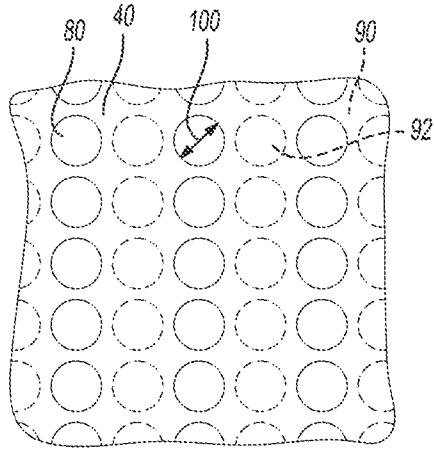


Fig-3A

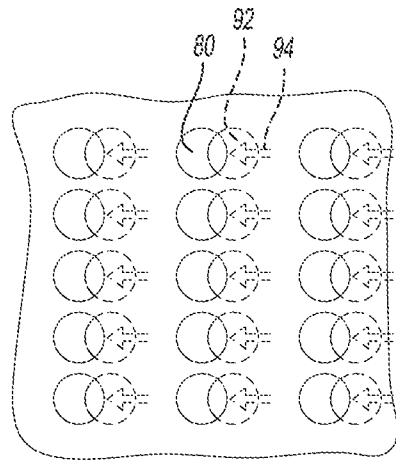


Fig-3B

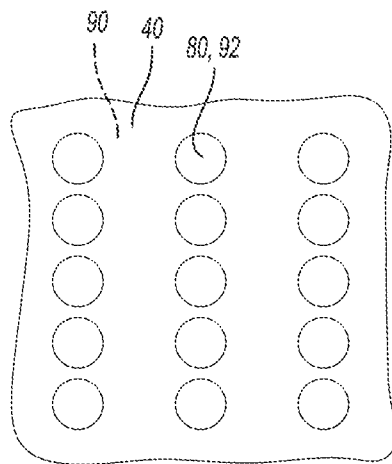


Fig-3C

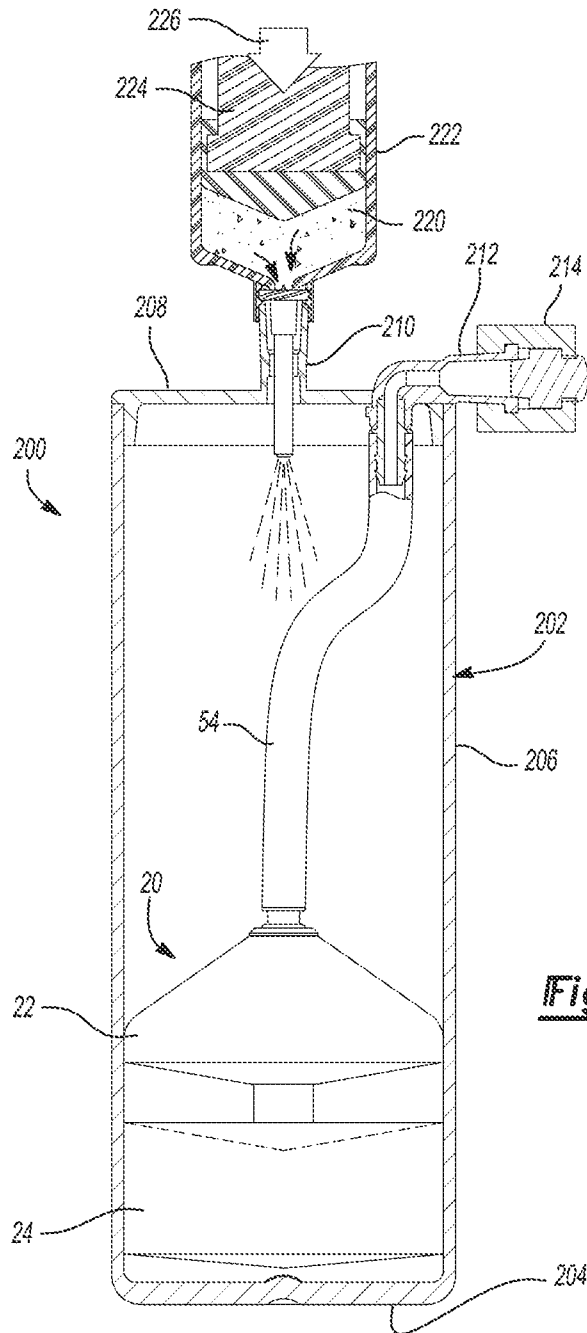


Fig-4A

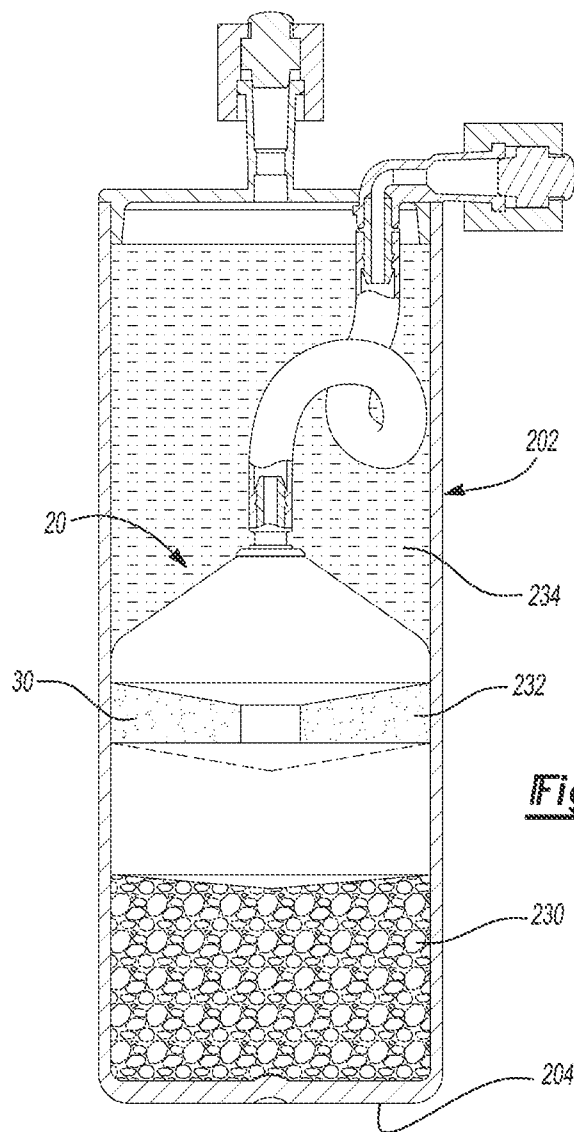


Fig-4B

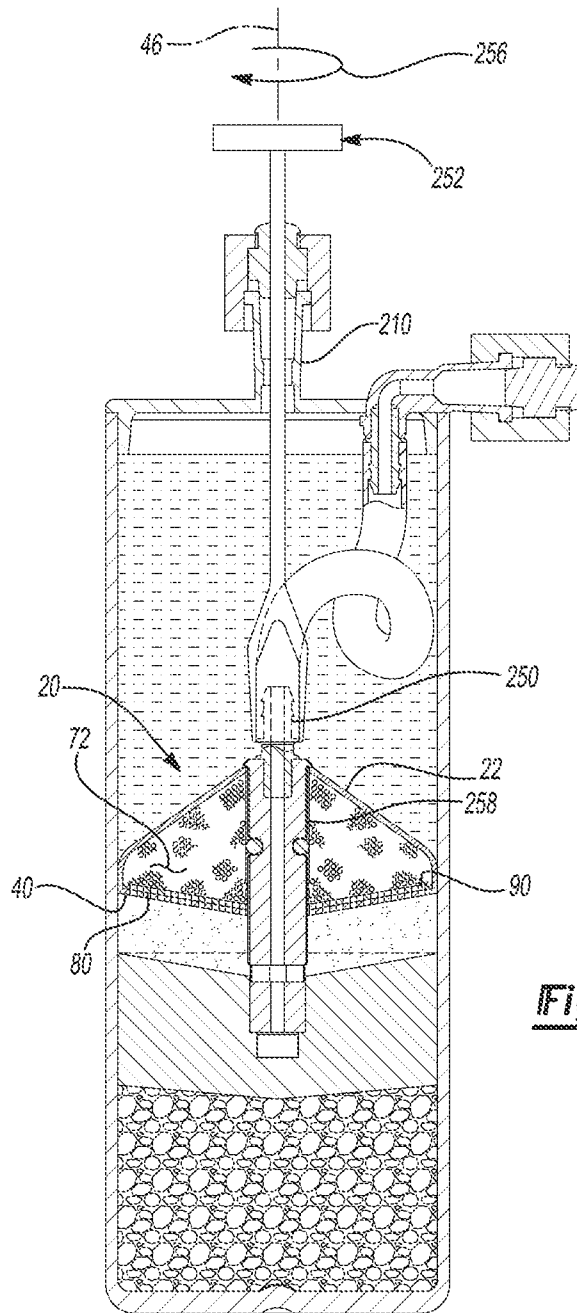


Fig-4C

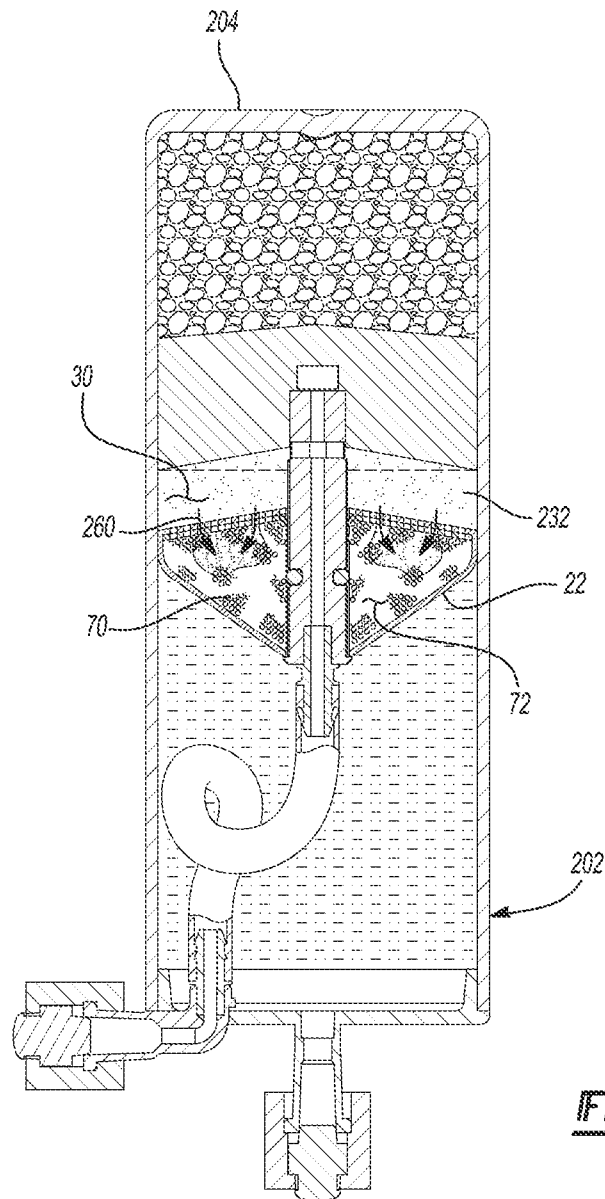


Fig-4D

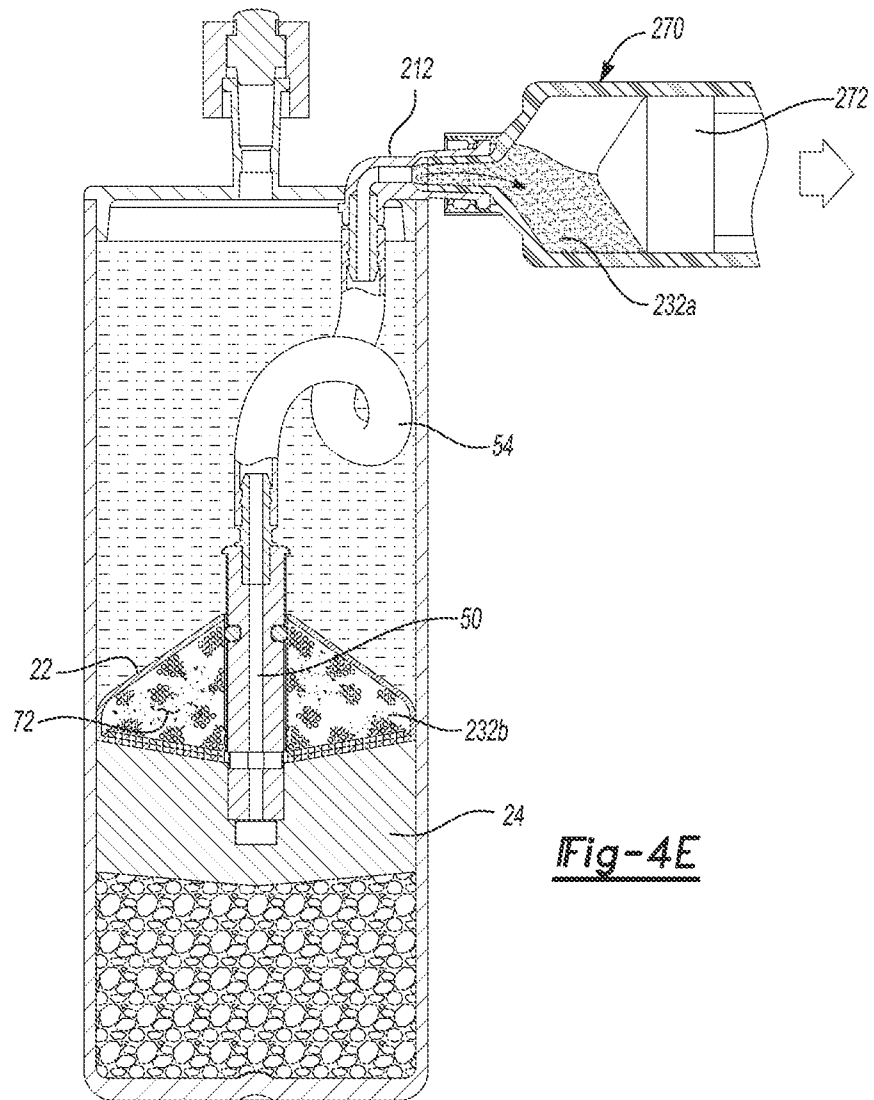
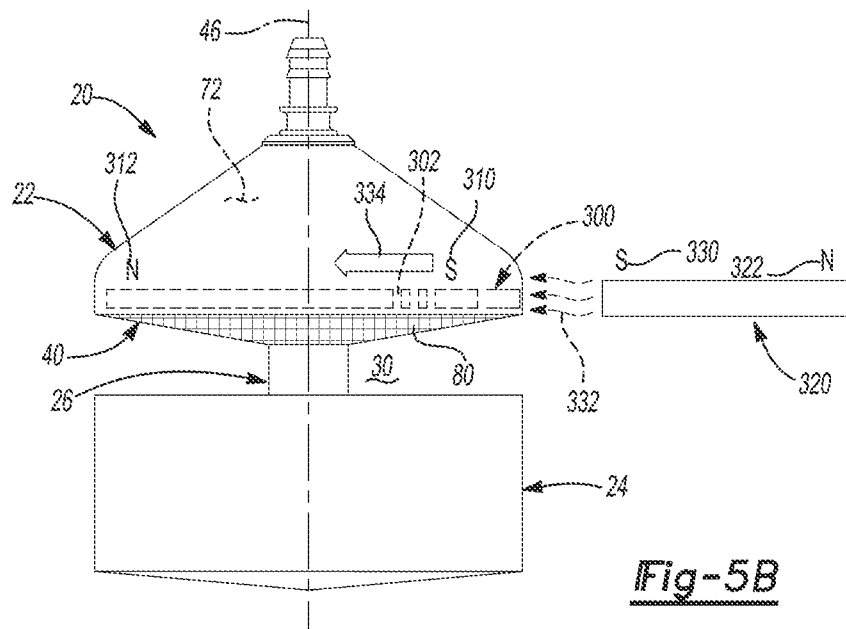
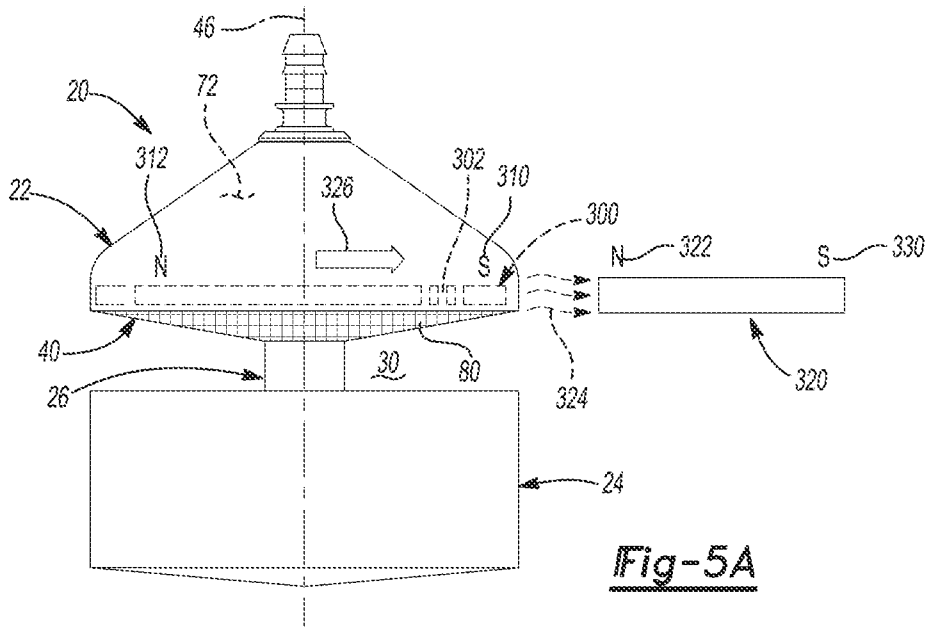


Fig-4E



INTERNATIONAL SEARCH REPORT

International application No PCT/US2015/022619

A. CLASSIFICATION OF SUBJECT MATTER INV. B01L3/00 G01N33/49 B01D17/02 B01D21/00 B01D21/26 B01D21/30 ADD. 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) B01L G01N B01D Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	FR 2 338 084 A1 (SHERWOOD MEDICAL IND INC [US]) 12 August 1977 (1977-08-12) figures 1, 2, 3 -----	1-14		
X	US 3 957 654 A (AYRES WALDEMAR A) 18 May 1976 (1976-05-18) figures 1-3 -----	1-14		
A	US 2013/259951 A1 (O'CONNELL JR PATRICK S [US]) 3 October 2013 (2013-10-03) paragraph [0027] -----	2		
A	US 5 560 830 A (COLEMAN CHARLES M [US] ET AL) 1 October 1996 (1996-10-01) column 13, lines 20-56; figures 10, 11 -----	15-20		
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "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 </td> <td style="width: 50%; border: none; vertical-align: top;"> "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 </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "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
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "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			
Date of the actual completion of the international search	Date of mailing of the international search report			
11 June 2015	25/06/2015			
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Campbell, Paul			

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2015/022619

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
FR 2338084	A1	12-08-1977	AU 499776 B2	03-05-1979
			AU 1656376 A	09-02-1978
			BE 845177 A1	01-12-1976
			BR 7606696 A	16-11-1977
			CA 1060862 A1	21-08-1979
			DE 2639389 A1	21-07-1977
			FR 2338084 A1	12-08-1977
			GB 1552326 A	12-09-1979
			JP S5288864 A	25-07-1977
			JP S5935663 B2	30-08-1984
			US 4055501 A	25-10-1977

US 3957654	A	18-05-1976	NONE	

US 2013259951	A1	03-10-2013	EP 2830765 A1	04-02-2015
			JP 2015513954 A	18-05-2015
			US 2013259951 A1	03-10-2013
			WO 2013148654 A1	03-10-2013

US 5560830	A	01-10-1996	AT 209352 T	15-12-2001
			AU 4421896 A	03-07-1996
			CA 2181462 A1	20-06-1996
			DE 69524063 D1	03-01-2002
			DE 69524063 T2	29-08-2002
			EP 0744026 A1	27-11-1996
			ES 2167467 T3	16-05-2002
			US 5560830 A	01-10-1996
WO 9618897 A1	20-06-1996			
