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(54) VAPORIZER FOR INHALATION AND METHOD FOR EXTRACTION OF ACTIVE INGREDIENTS FROM A CRUDE NATURAL PRODUCT OR OTHER MATRIX

VERDAMPFER ZUM INHALIEREN UND METHODE ZUM EXTRAHIEREN VON AKTIVEN
INHALTSSTOFFEN AUS EINEM NATURPRODUKT ODER EINER ANDEREN MATRIX

BRUMISATEUR POUR INHALATION ET TECHNIQUE D'EXTRACTION D'INGREDIENTS ACTIFS
D'UN PRODUIT NATUREL BRUT OU D'UNE AUTRE MATRICE

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Description**BACKGROUND OF THE INVENTION**

[0001] The present invention relates to a vaporizer for inhalation and a method for extraction of active ingredients from a crude natural product or other matrix, by means of an ascending airstream heated to the temperature appropriate to volatilize the molecules.

[0002] The use of plants as medicinal agents has a long and successful history. The majority of medicines used today are either derived directly from plants or synthesized as variations on natural molecules. However, modern medical practice has, for the most part, abandoned the use of whole plant products because of objections concerning variability in concentration of active ingredients, and unpredictable rates of active drug release from orally ingested crude drugs. Even teas made from medicinal plants cannot fully overcome the latter objection, as the dose provided depends on compound solubility and the conditions of extraction. In addition, accurate self-titration of this dose cannot be expected to overcome either objection, considering the excessive time-lag between oral ingestion and the onset of action.

[0003] The best resolution of these problems is through pulmonary ingestion of vaporized compounds, if they are sufficiently volatile. This provides a more immediate means of relief and a more accurate method for dose self-titration, as well as allowing a means for applying compounds to the pulmonary tract itself, as is necessary with diseases such as bronchial asthma, etc. Pulmonary ingestion of drugs also circumvents the "first-pass effect" by which oral drugs are transferred from the intestines and then partially or entirely metabolized by the liver, before entering the blood stream.

[0004] Unfortunately, the only technique available to accomplish pulmonary application of crude natural drugs has been via the method of smoking. This is objectionable from the medical perspective because pyrolysis products are irritating and long-term ingestion of smoke has been implicated in the etiology of various pulmonary disease states (e.g., emphysema, cancer, etc.)

[0005] Other objections to inhalers such as U.S. Pat. No. 87,603 (Tichenot) which continuously heats or pyrolyzes a substance on a grating, and U.S. Pat. No. 1,858,580 (Collins) which steam heats a carrying agent permeated with a medicated substance, involve the lack of ability to either maximize the extraction exposure of the specimen particles, or to promote a uniform extraction of the aggregate charge through its periodic mixing. Additionally, prevention of large particle inhalation which may prove irritating to the pulmonary system of the user, and providing a demand-only flow of heated gas upon each inhalation, which spares wasteful loss of active ingredient during periods of device disuse, is not achieved.

[0006] US-676,713 discloses a therapeutical vaporizer, including a generator fitted with a base. The base has an opening through which a heater may be introduced

or withdrawn. A suitable liquid is supplied through a funnel to the generator. The heater generates sufficient heat to bring the liquid contents of the generator to a boil. Trays or shelves contain herbs or other medicaments which are permeated by the vapor, to produce medicated vapor, which is provided to a diffusing-tray and inhaler via flexible tubes, respectively. The inhaler has a base and a shelf containing herbs or other suitable medicaments adapted for absorption by the vapor and carried to the patient. Chamber collects water resulting from condensation of the vapor. The preambles of claim 1 and 16 are based thereon.

[0007] US-4,360,018 discloses an anesthesia system with a gas filter located between a Y-connector and a mask or endotracheal tube for connecting with a patient. The filter filters during both inhalation and exhalation of the patient.

SUMMARY OF THE INVENTION

[0008] An object of the present invention is to provide a vaporizer and a method by which a hot gas stream vaporizes and uniformly extracts the active ingredients of a crude natural product or other specimen without pyrolysis, thereby avoiding the potentially detrimental effects of smoking.

[0009] A further object of the present invention is to spare the wasteful loss of active ingredients extracted by the vaporizer due to a continuous gas flow instead of a demand-only gas flow, and also to prevent the inhalation of large particles by the user due to a lack of a filtering mechanism.

[0010] A still further object of the present invention is to prevent clogging of the vaporizer apparatus due to evaporated compounds condensing on the permeable support structure of the vaporizer apparatus.

[0011] Yet another object of the present invention is to initiate a high speed of air flow through the vaporizer, such that lofting of the crude natural product is more easily achieved, in order to maximize the extraction of the active ingredients, without excessive inhalation force.

[0012] All these objects are provided by the feature of claims 1 and 16. Further advantageous features are defined in the dependent claims.

[0013] The present invention extracts volatile active ingredients from a crude natural product, as well as other volatile substances (e.g., essential oils) impregnated into an inert matrix (e.g., paper), by means of a moving airstream heated to the temperature appropriate to volatilize the molecules of the product or substance. Transfer of these agents or ingredients as a water-free aerosol is simultaneously accomplished by this same airstream. In addition, the means of introducing the heated gas into the pulverized crude drug from below provides for the solid particulates to be suspended in the airstream, completely exposing them to the extractive gases, as well as causing a mixing of the aggregate charge upon each inhalation.

[0014] In cases where prevention of labile active compound denaturation (e.g., oxidation) is required, the substitution of a stream of hot inert gas (e.g., helium, argon) for the stream of hot air can be implemented. The use of helium carries the additional advantage of raising the voice pitch of the inhaler, reminding the user that air has not been inhaled.

[0015] Upon each inhalation, the heated gas is introduced from below and ascends through, in most embodiments, a permeable support structure (e.g., fritted glass disk, etc.), subsequently causing specimen particles to be suspended within the confines of the isolation chamber. This allows a maximized gas extraction exposure for each suspended particle and promotes a uniform extraction of the aggregate charge through its periodic mixing. In addition, this method ensures that the support structure is kept clean and unclogged, since evaporated compounds are constantly swept away from its upper surface. A filter provided downstream from the permeable support structure prevents large particles from being inhaled by the user.

[0016] During device disuse in one embodiment, the heated airstream flows through a side-arm of the vaporizer apparatus, preventing wasteful loss of active ingredients. In another embodiment, the side arm can also be used to divert mixed purge gases from the specimen, when the specimen is required to be under the flow of inert gas during its extraction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings, wherein:

FIGURE 1 shows an exploded view of the completed assembly of the vaporizer apparatus according to a first embodiment of the invention.

FIGURE 2 shows the completed assembly of the vaporizer apparatus according to a first embodiment of the invention.

FIGURE 3A shows the isolation chamber of the vaporizer apparatus with the specimen particles in their normal state.

FIGURE 3B shows the isolation chamber of the vaporizer apparatus with the specimen particles suspended by the ascending heated gas flow through the isolation chamber.

FIGURE 4 shows the disk filter screen retention assembly of the vaporizer apparatus and a metal clip removal tool.

FIGURE 5 shows the hollow cylindrical filter screen of the invention.

FIGURE 6 shows the assembly of the hollow cylindrical filter screen of the vaporizer apparatus and a metal clip removal tool.

FIGURES 7A and 7B show the hot air gun with cradle and rod assembly of the vaporizer apparatus.

FIGURES 8, 9, and 10, show a more detailed view of the cradle and rod assembly of the vaporizer apparatus.

FIGURE 11 shows the completed assembly of the vaporizer apparatus according to a second embodiment of the invention.

FIGURE 12 shows a conical fritted disk and the isolation chamber of the vaporizer apparatus according to a third embodiment of the invention.

FIGURE 13 shows a bottom view of the integral baffle in the tubing of the vaporizer apparatus according to a third embodiment of the invention.

FIGURE 14 shows a cap in the isolation chamber of the vaporizer apparatus according to a fourth embodiment of the invention.

FIGURE 15 shows a top view of the cap in the isolation chamber of the vaporizer apparatus according to a fourth embodiment of the invention.

FIGURE 16 shows the specimen particles lofted in the isolation chamber of the vaporizer apparatus according to a fourth embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] A completed assembly of the first embodiment of the vaporizer apparatus 1 of the present invention is shown in Figure 2, with an exploded view shown in Figure 1. The vaporizer apparatus 1 is mounted on a source of hot air 2 (e.g., Bosch Model 1943 or Model PHG 630-2 LCE hot air gun), and includes an optional internal diverter 3, which acts as a baffle-cum-brace within a glass tubing 4 which connects the source of hot air 2 to an isolation chamber 5 containing a permeable support structure 6 (e.g., fritted glass disk), and to a side-arm 7. The optional internal diverter 3, which increases efficiency if used, is fitted on the source of hot air 2 in order to secure the vaporizer apparatus 1 to the hot air source 2. When the user inhales, the partial vacuum created allows hot air to stream past the curved section of the upper portion of the diverter 3 through the permeable support structure 6. Between inhalations, the diverter 3 acts as a baffle, encouraging hot air to stream out through the side-arm 7 rather than flowing upward through the permeable support structure 6.

[0019] The isolation chamber 5 holds the specimen particles 8 (see Figures 3A and 3B) on the surface 9 of the permeable support structure 6. The permeable support structure 6 is fixed to the walls of the glass tubing 4. A disk filter screen 10 is disposed above, or downstream of the isolation chamber 5, and a tubing 11 (see Figure 2) leads from the disk filter screen 10 to a mouthpiece 12 or a mask (not shown) through which the user inhales. The tubing 11 may be corrugated which allows flexing of the tube without kinking (not shown).

[0020] The side arm 7 (see Figures 1 and 2) provides means to duct the heated air stream away from the permeable support structure 6 when the vaporizer apparatus

1 is not in use (e.g., when the user is resting between inhalations). The side arm 7 can be equipped with a valve 24 to manually re-route the entire heated airstream through the permeable support structure 6 for ancillary purposes such as device cleaning, or as a room vaporizer upon removal of the tubing 11. As an example, the valve 24 could be provided with either a silicone stopper or, alternatively, could be manually clamped by a hemostat, pinchcock or other similar compression device (not shown). The wall thickness of this short piece of silicone tubing also provides the user insulation from the hot glass side arm 7 underneath it.

[0021] Figure 4 shows the disk filter screen retention assembly. In order to assemble the disk filter screen retention assembly, the disk filter screen 10, which is made of a finely meshed material (e.g., stainless steel), is first seated in an outer filter retention ring 13. Then, the arms 20 of a metal clip tool 21 are inserted into holes 19 which are located in the inner peripheral surface of inner filter retention ring 14, and disposed directly across from one another. The inner filter retention ring 14 is then threaded into the outer filter retention ring 13 by turning the tool 21 to tighten the inner filter retention ring 14 within the outer filter retention ring 13 and keep the disk filter screen 10 stable between the two structures 13, 14.

[0022] Next, the outer filter retention ring 13 is inserted into an interface ring 15 made of a heat-resistant synthetic material (e.g., fluorocarbon). The interface ring 15 is provided in the lower portion of a glass headpiece 16, which fits onto the upper portion of the glass tubing 4. The interface ring 15 is laterally compressed into an ovoid shape and is inserted through the bottom of the glass headpiece 16. Interface ring 15 includes an upper lip 18d, a lower lip 18c, a groove 18a, and gap 18b within the lower lip 18c of the groove 18a, all within its inner periphery, which are operative to provide a locking fit to the outer filter retention ring 13.

[0023] Namely, pins 17a, 17b, which are disposed on the outer peripheral surface of the outer filter retention ring 13, are aligned with gap 18b of groove 18a of the interface ring 15, and are inserted through the gap 18b into the groove 18a. The subassembly of the outer filter retention ring 13, inner filter retention ring 14 and disk filter screen 10, is then turned using the tool 21, to provide a locking fit of the subassembly within the interface ring 15 (bayonet-type coupling).

[0024] To remove the disk filter screen retention assembly, the steps above are conducted in reverse order.

[0025] A hollow cylindrical filter screen 22, shown in Figure 5, can be used as an alternative to the disk filter screen 10, in order to increase the surface area of the filtering means and provide additional height for specimen particles 8 to ascend from their origin on the surface 9 of the permeable support structure 6. The cylindrical filter screen 22 is made of a meshed material (e.g., stainless steel), and is assembled within the inner filter retention ring 14 and outer filter retention ring 13 as shown in Figure 6 (like elements being denoted by like reference

numerals), in the same manner as the disk filter screen 10, discussed above. The closed top portion 23 of the hollow cylindrical filter screen 22 can have any shape, including a domed, conical or flat surface.

[0026] The vaporizer apparatus 1 (see Figures 7A-10) is supported by a support cradle 25, which can be semi-permanently attached by screws or the like, mounted in threaded holes 30 and fixed to the handle 26 of a hot air gun 2. The support cradle 25 accommodates an easily mountable/demountable rod 27 via a rod receiving channel 28 disposed in the lower portion of the support cradle 25. A receiving groove 29 fixes rod 27 via a spring-ball screw or the like, mounted in threaded hole 31. Accordingly, by using the support cradle 25 and rod 27 apparatus, the entire vaporizer apparatus 1 can be laterally stabilized. Removal of the rod 27 allows flat storage of the vaporizing apparatus 1 or alternative uses of the hot air gun 2 itself in a variety of unrelated hand-held applications.

[0027] The operation of the present invention, with respect to the first embodiment shown in Figures 1 and 2, begins when the glass headpiece 16 of the isolation chamber 5 is removed and a small charge of specimen particles 8 (crude natural product or inert particulate matrix impregnated with the desired compounds) is placed in the isolation chamber 5, and the glass headpiece 16 replaced to close the isolation chamber 5.

[0028] The source of hot air (e.g., hot air gun) 2 is then turned on to bring the air-stream to the proper predetermined temperature. The source of hot air 2 provides a heated gas flow, which the internal diverter 3, acting as a baffle, routes through the side-arm 7. Inhalation provides the drop in pressure necessary to re-route a portion of the heated gas stream past the internal diverter 3 and through the permeable support structure 6. The proper predetermined working temperature of the air stream through the vaporizer apparatus 1 will vary according to the nature of the materials being volatilized, from approximately 50 to 250 degrees Celsius, but it is generally in the 100 to 200 degree Celsius range.

[0029] Inhalation draws a portion of the diverted hot airstream upwards through the permeable support structure (e.g., fritted glass disk) 6, to enter the isolation chamber 5 under the specimen charge.

[0030] The aggregate charge is suspended as a cloud of particles 8, completely exposing each component particle to the extractive stream of hot air (see Figure 3B). Accordingly, volatile components of the specimen are vaporized from the suspended specimen particles 8 by the hot air and this vapor is drawn into the pulmonary tract by inhaling, via the tubing 11 through the mouthpiece 12 or a mask (not shown).

[0031] Cessation of inhalation stops the upward flow of heated air through the chamber and allows gravity to collapse the cloud of suspended particles 8 back into its original state as a layer on the surface 9 of the permeable support structure 6 (see Figures 3A and 3B).

[0032] Backflow of outside unheated air through the

side arm 7 during inhalation is avoided due to an over-pressure maintained by the source of hot air 2 that is in excess of the pressure removed by the inhalation.

[0033] Inhalation of large particles 8 is prevented by the filter screen 10 disposed above the isolation chamber 5.

[0034] When not in active use, the system functions to allow the air and, therefore, the entire vaporizer apparatus 1, to maintain its optimal temperature, while avoiding a constant flow of heated gas through the specimen particles 8 whose active ingredients are to be extracted. This bypass effect is interrupted only on demand by inhalation, thereby sparing wasteful loss of active ingredients during periods of device disuse.

[0035] The disk filter screen 10 is self-cleaned at the end of each inhalation, of most specimen particles 8 by this same gravitational action. However, a sharp momentary exhalation into the tubing 11 also helps to force most residual specimen particles 8 away from the disk filter screen 10.

[0036] The exhausted charge of specimen particles 8 is emptied from the vaporizer apparatus 1 by turning off the heat source air flow, removing the glass headpiece 16 from the top of the isolation chamber 5 and then either scooping or vacuuming out the contents, or by lifting the cooled glass tubing 4 from the source of hot air 2 and inverting the vaporizer apparatus 1 to empty the contents of the isolation chamber 4. The specimen particles 8 may also be removed by simply lifting the glass headpiece 16 while sharply inhaling, thereby ensuring particles are adherent on the disk filter screen 10.

[0037] In a second embodiment of the present invention as shown in Figure 11, a heated inert gas (i.e., helium, argon) is used instead of heated air. The heated inert gas is used to evaporate volatile compounds from their matrix in order to prevent their decomposition due to exposure to atmospheric gases (e.g., oxygen). Again, like elements are denoted by like reference numerals.

[0038] The second embodiment of the vaporizer apparatus 1 (see Figure 11) includes a high pressure tank 32 of inert gas equipped with a demand-type SCUBA regulator 33 equipped with a refill port 34. A hose or tubing 35 from this regulator 33 is routed to a heat-exchange device 36. The heat exchange device 36 includes a heating band 37 or other resistance heating device made of metal, silicone, or other material, that generates heat from electrical input. A thermostatic control 38 regulates the electrical input to the heating band 37 so that the chamber or vessel 39 contained within the heat exchange device 36 is limited to a desired predetermined range of temperatures. A thermostatic sensor 40 acts as a heat detection device that determines the temperature of the heated vessel 39, and transmits the data to the thermostatic control 38. A thermometer 41 measures the internal temperature status of the contents of the vessel 39, and provides visual feedback to the user.

[0039] The heating band 37 heats the heat exchange spheres 42, which are made of metal, glass, ceramic, or

other suitable material. The heat exchange spheres 42 provide a large surface area upon which the percolating gases can be instantaneously heated.

[0040] The insulation 43 surrounding the vessel 39 of the heat exchange device 36 is made of glass, ceramic, or other suitable material, and traps the heat generated by the heating band 37 to ensure temperature stability for the heat exchange spheres 42. The insulation 43 is normally contained within an outer protective casing 44 made of metal or other material.

[0041] A vertical pipe 45 disposed within the vessel 39 amongst the heat exchange spheres 42, and which has an upper portion which projects upwardly out of the heat exchange device 36, has a glass tubing 46 fitted over its upper portion. The glass tubing 46 contains an isolation chamber 5, the lower portion of which seats a permeable support structure 6. A glass headpiece 16 is fitted into the isolation chamber 5.

[0042] As with the first embodiment, the isolation chamber 5 holds the specimen particles 8 (see Figures 3A and 3B) on the surface 9 of the permeable support structure 6. The permeable support structure 6 is fixed to the walls of the glass tubing 46. A filter screen 10 is disposed above, or downstream of the isolation chamber 5, and a tubing 11 leads from the filter screen 10 to a mouthpiece 12 or a mask (not shown) through which the user inhales. As with the first embodiment, the tubing 11 may be corrugated (not shown) which allows flexing of the tube without kinking. A hollow cylindrical filter screen 22 can be used instead of the disk filter screen 10.

[0043] In initial operation of the invention with respect to the second embodiment, the demand-type pressure regulator 33 of the tank 32 of inert gas, is first opened via its purge valve 47 so that the gas flows through the tubing 35 into the heat exchange vessel 39 and then out via tube opening 7, purging residual air in the vaporizer apparatus. Tube 7 is then blocked by using a stopper or suitably clamping the attached silicone tubing 24 (not shown) (see Figure 2).

[0044] Once in the heat exchange device 36, the inert gas is heated by heat exchange spheres 42 in the heat exchange vessel 39 to the proper predetermined temperature. After charging the isolation chamber 5 with a specimen to be extracted (e.g., crude natural product or inert particulate matrix impregnated with the desired compounds), inhalation draws additional inert gas from the pressure tank 32 via the heat exchange device 36. The heated inert gas proceeds upwards through the vertical pipe 45 and through the permeable support structure 6, entering the isolation chamber 5 which contains the charge of specimen particles 8. The remaining structure and steps in the procedure are the same as that described above with the first embodiment.

[0045] In the second embodiment of the invention, side-arm 7 venting of gas is not absolutely necessary. However, if the isolation chamber 5 is to be charged with specimen particles 8 before the purging of residual air from the heat exchange vessel 39, a manually valved

side-arm 7 venting feature is useful to prevent heated mixed gases from sweeping over the specimen particles 8 until the system is free of air.

[0046] Removal of the exhausted charge of specimen particles 8 is initiated by removing the glass headpiece 16 from the top of the isolation chamber 5. The cooled glass tubing 46 that houses the permeable support structure 6 can then be removed from the glass tubing 45 and inverted to empty its contents resting on the surface 9. All the other removal techniques discussed above with respect to the first embodiment, can also be used.

[0047] In a third embodiment of the present invention, the baffle 103 (see Figures 12 and 13) of the vaporizer apparatus 101 is formed integrally with the vertical tubing 104, the latter of which can be made from glass, plastic material (e.g., polysulfone, Torlon®, PEEK, Liquid Crystal, etc.) or other suitable material (see Figure 12). Radial air-cooling fins, to prevent finger burns, may optionally be provided on the outside of side-arm 102 and tubing 104 of the vaporizer apparatus 101. The side-arm 102 has a bevel (e.g., 70°) for more diffuse air dispersal.

[0048] A Venturi restriction 105 is provided in the upper portion of tubing 104, which has an optional cylindrical flotation chamber 106 provided above the Venturi restriction (see Figure 12). A permeable support structure made from fritted glass or other appropriate porous material, which is a conical disk 107, is provided immediately below the Venturi restriction 105 and above baffle 103. The tubing 104 has a waisted portion 108 below the Venturi restriction 105, which parallels the shape of the conical fritted disk 107. A headpiece 116 is provided above the tubing 104 at the point where tubing 104 regains its full diameter above the Venturi restriction 105, and includes a cylindrical filter screen 110, made of a meshed material (e.g., stainless steel), similar to that of the filter screen 22 or 10 of the first embodiment of the invention.

[0049] In operation of the third embodiment of the present invention, the specimen particles 118 (crude natural product or inert particulate matrix impregnated with the desired compounds) are placed in the top of the tubing 104 and settle on the surface of the conical fritted disk 106. As with the first embodiment, the source of hot air (e.g., hot air gun) (not shown in Figure 12) is then turned on to bring the air-stream to the proper predetermined temperature, to provide a heated gas flow. Inhalation provides the drop in pressure needed to re-route a portion of the heated gas stream past the baffle 103 and through the conical permeable disk 107 to loft the specimen particles 118. However, due to the shape of the conical fritted disk 107, more surface area is provided which makes it easier to draw air through for the user. Further, the narrow gap between the conical fritted disk 107 and the parallel wall 108 of the waisted section of tubing 104, maintains a high speed air flow induced by the Venturi restriction 105, to make it easier for the user to loft the material while inhaling more normally.

[0050] As described in the first embodiment, upon inhalation, the aggregate charge is suspended as a cloud

of particles, completely exposing each component particle to the extractive stream of hot air, and volatile components are vaporized. The vapor is drawn through the headpiece and via tubing, to the user. The filter screen 110 prevents the inhalation of large particles.

[0051] The fourth embodiment of the present invention is similar to the third embodiment of the invention, with the exception that the hourglass-like Venturi restriction 105 in the cylindrical tubing 104 in the third embodiment, is replaced with that of spherical tubing 201 containing a cap 202 atop cylindrical neck or support tube 203 (see Figure 14). The spherical tubing 201 is made from glass, plastic or other suitable material as described above in the third embodiment. The cap 202 is a conical disk made of glass, plastic or other suitable material as described in the third embodiment, which is welded or molded onto tube 203 in the base of the tubing 201. The cap 202 has support struts 204 (see Figure 15) at the base which is used for attachment (welding or molding) onto the cylindrical tube 203. Other than the support struts 204, the cap 202 is open at its base, and forms an internal Venturi that accelerates airflow in a manner similar to that of the Venturi restriction 105 of tube 104 of the third embodiment. This arrangement also serves to momentarily divert the flow of air in a reversed direction. In the fourth embodiment, the air diverter baffle 206 also deflects particles, which may fall down cylindrical tube 203, away from the opening of the hot air source (not shown).

[0052] In operation of the fourth embodiment, the specimen particles 207 are placed in the top of the tubing 201, and settle around the cylindrical support 203. Due to the small orifice provided by the gap between the vertical cylindrical support 203, and the cap 202, when the user inhales, there is a localized increase in airspeed through this gap which then flows between the cylindrical support 203 and cap 202 (see Figure 16). The specimen particles 207 are then lofted by the high speed airflow more easily, and the user can inhale more normally.

[0053] It is contemplated that numerous modifications may be made to the apparatus and procedure of the invention without departing from the scope of the invention as defined in the following claims.

45 **Claims**

1. An apparatus (1) for extracting active ingredients from a specimen (8) of at least one of a crude natural product and an inert particulate matrix impregnated with compounds to be vaporized, comprising:

means (2; 32, 36) for providing an ascending heated gas stream such that said specimen is heated by said heated gas stream to a predetermined temperature wherein said active ingredients of said specimen are volatilized; means (5) for isolating said specimen, said isolation means being disposed downstream from

said heating means; and
means (10) for filtering said particles of said specimen provided downstream from said isolation means,

characterized in that said apparatus further comprises means (2; 32, 36; 105; 202) for generating a high speed of gas flow through the apparatus such that the specimen is lofted in use.

2. The apparatus according to claim 2, further comprising:

means (3; 103) for diverting said heated gas stream away from said specimen during intermittent periods of apparatus disuse by said user, said diverting means being provided downstream from said heating means.

3. The apparatus according to claim 1 or 2, wherein said heated gas stream is comprised of at least one of air and an inert gas.

4. The apparatus according to any of the preceding claims, wherein said heating means (2) comprises a hot air gun.

5. The apparatus according to any of the preceding claims, wherein said isolation means (5) comprises:

a permeable support structure (6) which provides upstream physical support for said unsuspended specimen during apparatus disuse.

6. The apparatus according to any of the preceding claims, wherein said filter means (10) comprises a screen made of a meshed material.

7. The apparatus according to claim 5, wherein said permeable support structure comprises a fritted glass disk.

8. The apparatus according to any of claims 1-3, said heating means comprises:

a heat exchanger (36) to heat the gas stream, a thermostatic control (38) to control the temperature, and the gas stream is provided from a high pressure tank having a regulator which allows said gas to be fed on-demand to said heat exchanger and heated.

9. A vaporizer apparatus according to claim 1, further comprising a removable cradle and rod assembly.

10. An apparatus as claimed in claim 5 wherein the permeability support structure (106) is shaped to provide an increased surface area such that hot gas can

be drawn through the support structure more easily.

5 11. An apparatus as claimed in claim 10, wherein the support structure is conical.

12. An apparatus as claimed in claim 10 or 11 further comprising a Venturi restriction (105) in the apparatus above the support structure.

10 13. An apparatus as claimed in claim 12 wherein a gap between the support structure and a parallel wall (108) of a waisted section of tubing (104) below the Venturi restriction (105) is narrow such that a high speed gas flow speed is maintained.

15 14. An apparatus as claimed in claim 12 wherein an increased gas flow speed is induced by an arrangement forming an internal Venturi.

20 15. An apparatus as claimed in claim 14 comprising a tube (201) containing a cap (202) atop a neck (203) of the tube, which is open at its base such that hot gas is drawn at increased speed through the gap between the support (203) and the cap (202).

25 16. A method of extracting active ingredients from a specimen of at least one of a crude natural product and an inert particulate matrix impregnated with compounds to be volatilized using a vaporizer apparatus, comprising the steps of:

30 providing an ascending stream of hot gas to said specimen in an isolation chamber provided downstream from said hot gas source at a temperature causing vaporization,

characterized in that said hot gas is provided at a speed which causes the particles to be suspended, thereby allowing maximum exposure to said extractive hot gas flow while simultaneously volatilizing active ingredients of said specimen; and subsequently filtering said particles.

45 Patentansprüche

1. Vorrichtung (1) zum Extrahieren aktiver Bestandteile aus einer Probe (8) aus zumindest einem unbearbeiteten natürlichen Erzeugnis und einer inerten partikelförmigen Matrix, die mit zu verdampfenden Verbindungen getränkt ist, aufweisend:

50 eine Einrichtung (2; 32; 36) zum Bereitstellen eines ansteigenden erhitzen Gasstroms derart, dass die Probe durch den erhitzen Gasstrom auf eine bestimmte Temperatur erwärmt wird, wobei die aktiven Bestandteile der Probe verflüchtigt werden;

eine Einrichtung (5) zum Isolieren der Probe, wobei die Isolationseinrichtung stromabwärts von der Heizeinrichtung angeordnet ist; und eine Einrichtung (10) zum Filtern der Partikel der Probe, die stromabwärts von der Isolationseinrichtung vorgesehen ist, **dadurch gekennzeichnet, dass** die Vorrichtung außerdem eine Einrichtung (2; 32; 36; 105; 202) zum Erzeugen eines Gasstroms hoher Geschwindigkeit durch die Vorrichtung derart aufweist, dass die Probe im Gebrauch aufgerichtet bzw. schwebend gehalten ist.

2. Vorrichtung nach Anspruch 1, außerdem aufweisend:

eine Einrichtung (3; 103) zum Ablenken des erhitzen Gasstroms weg von der Probe während diskontinuierlicher Perioden der Nicht-Nutzung der Vorrichtung durch den Nutzer, wobei die Ablenkeinrichtung stromabwärts von der Heizeinrichtung vorgesehen ist.

3. Vorrichtung nach Anspruch 1 oder 2, wobei der erhitze Gasstrom aus zumindest entweder Luft oder inerter Gas besteht.

4. Vorrichtung nach einem der vorangehenden Ansprüche, wobei die Heizeinrichtung (2) eine Heißluftkanone umfasst.

5. Vorrichtung nach einem der vorangehenden Ansprüche, wobei die Isolationseinrichtung (5) aufweist:

eine permeable Stützstruktur (6), welche eine stromaufwärtige physikalische bzw. körperliche Abstützung für die nicht schwebend gehaltene Probe während der Nicht-Nutzung der Vorrichtung bereitstellt.

6. Vorrichtung nach einem der vorangehenden Ansprüche, wobei die Filtereinrichtung (10) ein aus einem Maschenmaterial bestehendes Sieb aufweist.

7. Vorrichtung nach Anspruch 5, wobei die permeable Stützstruktur eine Frittenglasplatte aufweist.

8. Vorrichtung nach einem der Ansprüche 1 bis 3, wobei die Heizeinrichtung aufweist:

einen Wärmetauscher (36) zum Erhitzen des Gasstroms, eine thermostatische Steuerung (38) zum Steuern der Temperatur, wobei der von einem Hochdrucktank bereitgestellte Gasstrom einen Regler aufweist, der es erlaubt, dass das Gas bedarfswise dem Wärmetauscher zugeführt und

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erhitzt wird.

9. Verdampfungsvorrichtung nach Anspruch 1, außerdem aufweisend:

einen entfernbarer Schlitten- und Stangenaufbau.

10. Vorrichtung nach Anspruch 5, wobei die permeable Stützstruktur (106) derart geformt ist, dass sie eine vergrößerte Flächeninhalt derart bereitstellt, dass heißes Gas durch die Stützstruktur problemloser angesaugt werden kann.

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11. Vorrichtung nach Anspruch 10, wobei die Stützstruktur konisch ist.

12. Vorrichtung nach Anspruch 10 oder 11, außerdem aufweisend eine Venturi-Engstelle (105) über der Stützstruktur.

13. Vorrichtung nach Anspruch 12, wobei ein Spalt zwischen der Stützstruktur und einer parallelen Wand (108) eines Rohrausbauungabschnitts (104) unter der Venturiengstelle (105) derart eng vorliegt, dass eine Hochgeschwindigkeitsgasstromgeschwindigkeit beibehalten wird.

14. Vorrichtung nach einem der vorangehenden Ansprüche, wobei die erhöhte Gasstromgeschwindigkeit durch eine Anordnung induziert wird, die ein internes Venturirohr bildet.

15. Vorrichtung nach Anspruch 14, aufweisend ein Rohr (201), das eine Kappe (202) auf einem Hals (203) des Rohrs enthält, welches an seiner Basis derart offen steht, dass heißes Gas mit erhöhter Geschwindigkeit durch den Spalt zwischen der Stütze (203) und der Kappe (202) angesaugt wird.

16. Verfahren zum Extrahieren aktiver Bestandteile aus einer Probe aus zumindest einem unbehandelten natürlichen Erzeugnis und einer interten partikelförmigen Matrix, die mit zu verflüchtigenden Verbindungen getränkt ist, unter Verwendung einer Verdampfungsvorrichtung, aufweisend die Schritte:

Bereitstellen eines aufsteigenden Stroms aus heißem Gas zu der Probe in einer Isolationskammer, die stromabwärts von der Heißgasquelle vorgesehen ist, mit einer Temperatur, welche eine Verdampfung hervorruft,

dadurch gekennzeichnet, dass das heiße Gas mit einer Geschwindigkeit bereitgestellt wird, welche die Partikel verlässt, suspendiert zu werden, wodurch diese den extrahierenden heißen Gasstrom maximal ausgesetzt werden, während gleichzeitig aktive Be-

standteile der Probe verflüchtigt werden, und gefolgt von einem Filtern der Partikel.

Revendications

1. Dispositif (1) permettant d'extraire des ingrédients actifs d'un échantillon (8) d'au moins un échantillon de produit naturel brut et une matrice particulaire inerte imprégnée de composants à vaporiser comprenant :

des moyens (2 ; 32, 36) permettant de fournir un courant gazeux chauffé ascendant de telle sorte que ledit échantillon est chauffé par ledit courant gazeux chauffé à une température pré-déterminée, lesdits ingrédients actifs dudit échantillon étant volatilisés ;
 15 des moyens (5) permettant d'isoler ledit échantillon, lesdits moyens d'isolation étant agencés en aval dudit moyen de chauffage ; et
 20 des moyens (10) permettant de filtrer lesdites particules dudit échantillon fournis en aval desdits moyens d'isolation ;

caractérisé en ce que ledit dispositif comprend en outre des moyens (2 ; 32, 36 ; 105 ; 202) permettant de générer une vitesse élevée d'écoulement de gaz circulant dans le dispositif de telle sorte que l'échantillon est projeté lorsque le dispositif est utilisé.

2. Dispositif selon la revendication 1, comprenant en outre :

des moyens (3 ; 103) permettant de dériver ledit courant de gaz chauffé en éloignement dudit échantillon pendant des périodes intermittentes lorsque ledit utilisateur n'utilise pas le dispositif, lesdits moyens de dérivation étant fournis en aval desdits moyens de chauffage.

3. Dispositif selon la revendication 1 ou 2, dans lequel ledit courant de gaz chauffé comprend au moins de l'air et un gaz inerte.

4. Dispositif selon l'une quelconque des revendications précédentes, dans lequel ledit moyen de chauffage (2) comprend un pistolet à air chaud.

5. Dispositif selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens d'isolation (5) comprennent :

une structure de support perméable (6) qui fournit audit échantillon non suspendu un support physique en amont lorsque le dispositif n'est pas utilisé.

6. Dispositif selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens de filtrage (10) comprennent un écran en matériau maillé.

5 7. Dispositif selon la revendication 5, dans lequel ladite structure de support perméable comprend un disque en verre fritté.

8. Dispositif selon l'une quelconque des revendications 1 à 3, dans lequel lesdits moyens de chauffage comprennent :

un échangeur de chaleur (36) permettant de chauffer le courant gazeux, un contrôle thermostatique (38) permettant de contrôler la température, le courant gazeux étant fourni par un réservoir haute pression comprenant un régulateur qui permet audit gaz d'être alimenté à la demande audit échangeur de chaleur et d'être chauffé.

9. Dispositif de vaporisateur selon la revendication 1, comprenant en outre un berceau amovible et un assemblage de tiges.

25 10. Dispositif selon la revendication 5, dans lequel la structure de support perméable (106) est formée de façon à fournir une plus grande surface de telle sorte que le gaz chaud peut s'écouler plus facilement à travers la structure de support.

11. Dispositif selon la revendication 10, dans lequel la structure de support est de forme conique.

35 12. Dispositif selon la revendication 10 ou 11, comprenant en outre une restriction Venturi (105) dans le dispositif au-dessus de la structure de support.

40 13. Dispositif selon la revendication 12, dans lequel un espace entre la structure de support et une paroi parallèle (108) d'une section cintrée d'un tube (104) en dessous de la restriction Venturi (105) est étroit de façon à maintenir une vitesse élevée de l'écoulement de gaz.

45 14. Dispositif selon l'une quelconque des revendications précédentes, dans lequel une vitesse accrue de l'écoulement de gaz est obtenue au moyen d'un agencement formant un effet Venturi interne.

50 15. Dispositif selon la revendication 14, comprenant un tube (201) contenant un capot (202) au-dessus d'un col (203) du tube, ce dernier étant ouvert à sa base de telle sorte que le gaz chaud s'écoule plus rapidement dans l'espace entre le support (203) et le capot (202).

55 16. Procédé d'extraction d'ingrédients actifs à partir d'un

échantillon d'au moins un parmi un produit naturel brut et une matrice particulière inerte imprégnée de composants à volatiliser utilisant un dispositif de vaporisateur, comprenant les étapes consistant à :

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fournir un courant ascendant de gaz chaud audit échantillon dans un compartiment d'isolation fourni en aval de ladite source de gaz chaud à une température provoquant la vaporisation, **caractérisé en ce que** ledit gaz chaud est fourni à une vitesse qui provoque la suspension des particules, permettant ainsi une exposition maximum audit écoulement de gaz chaud d'extraction tout en volatilisant simultanément les ingrédients actifs dudit échantillon ; puis 10
15 filtrer lesdites particules.

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FIG. 1

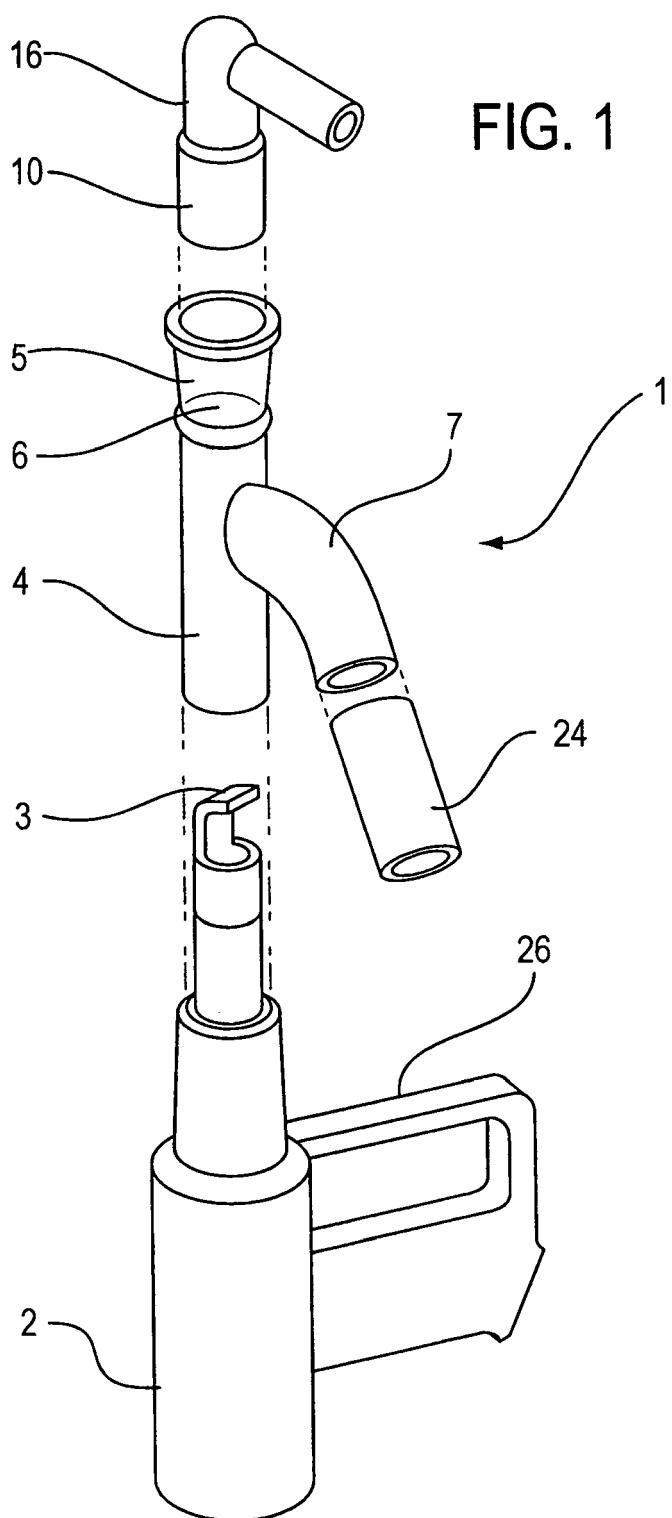


FIG. 2

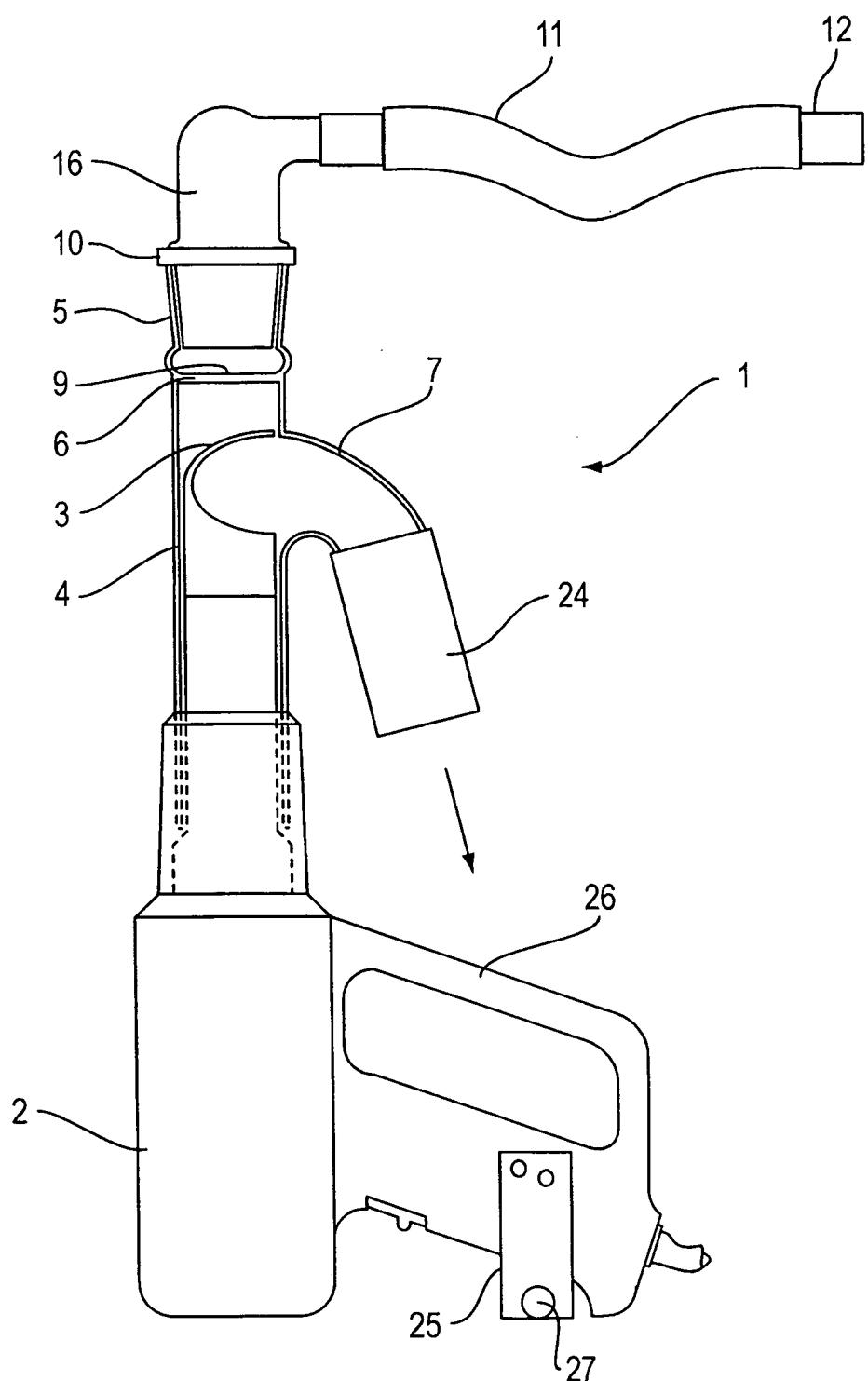


FIG. 3B

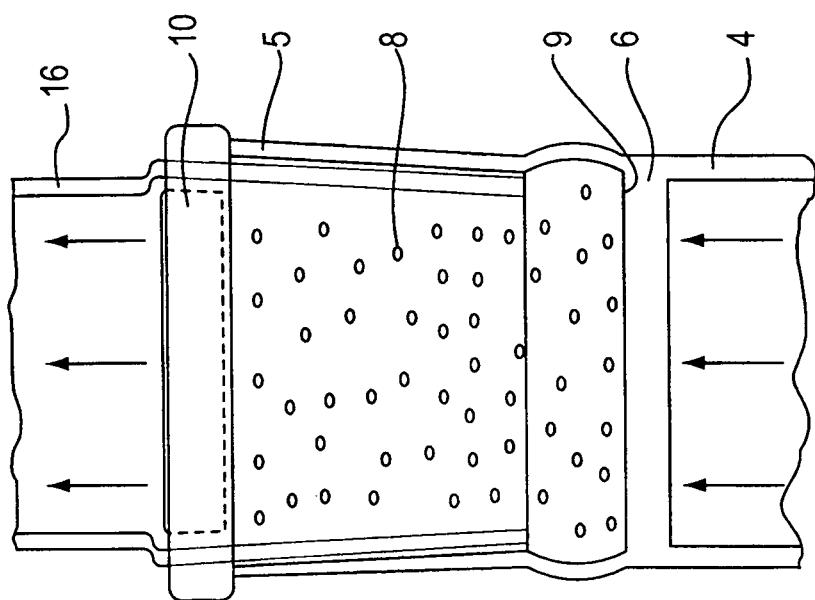
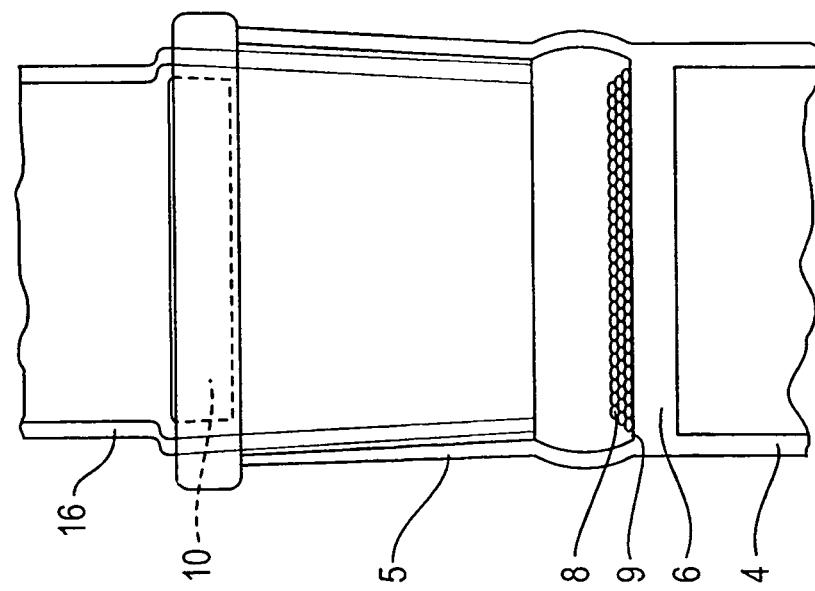


FIG. 3A



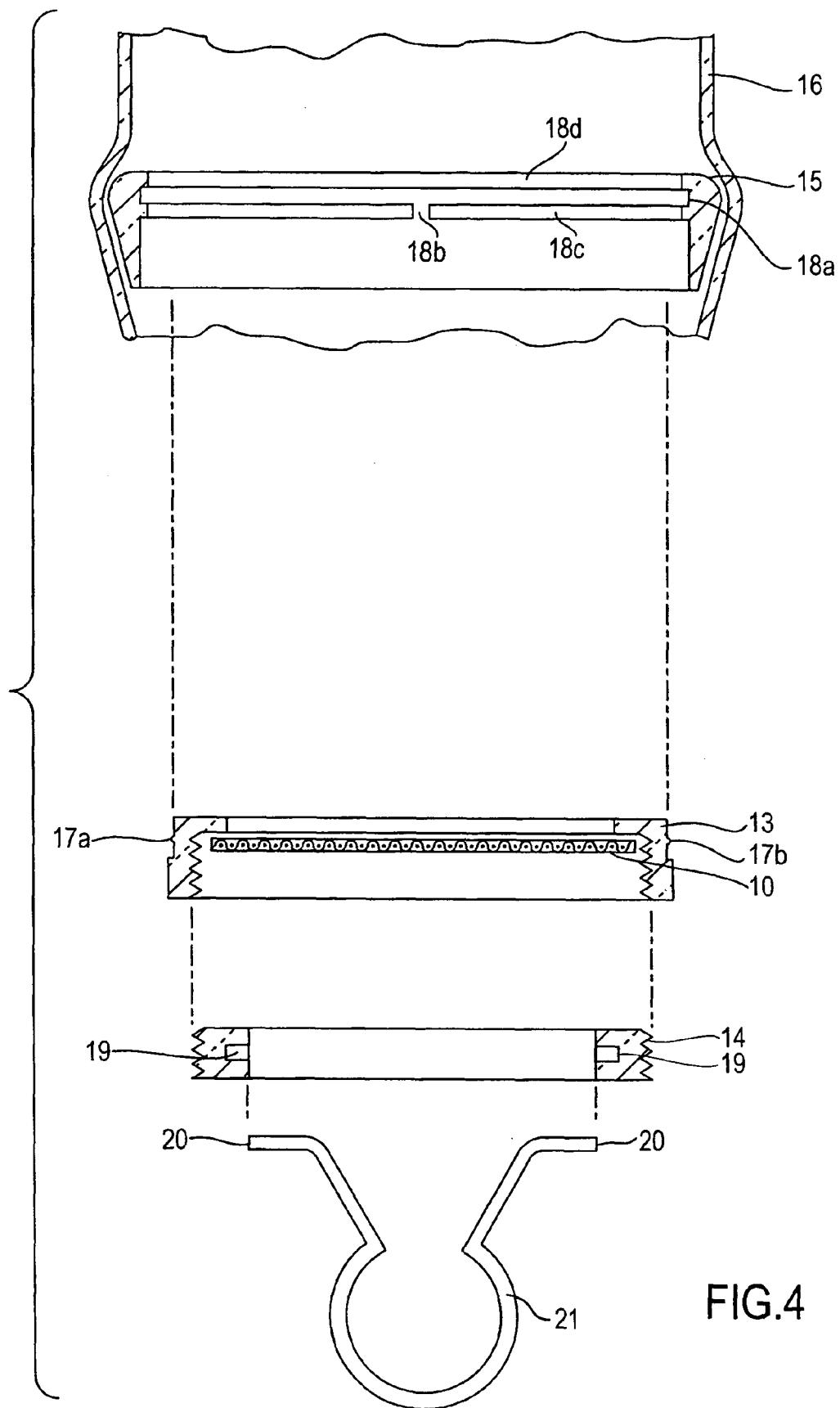


FIG.4

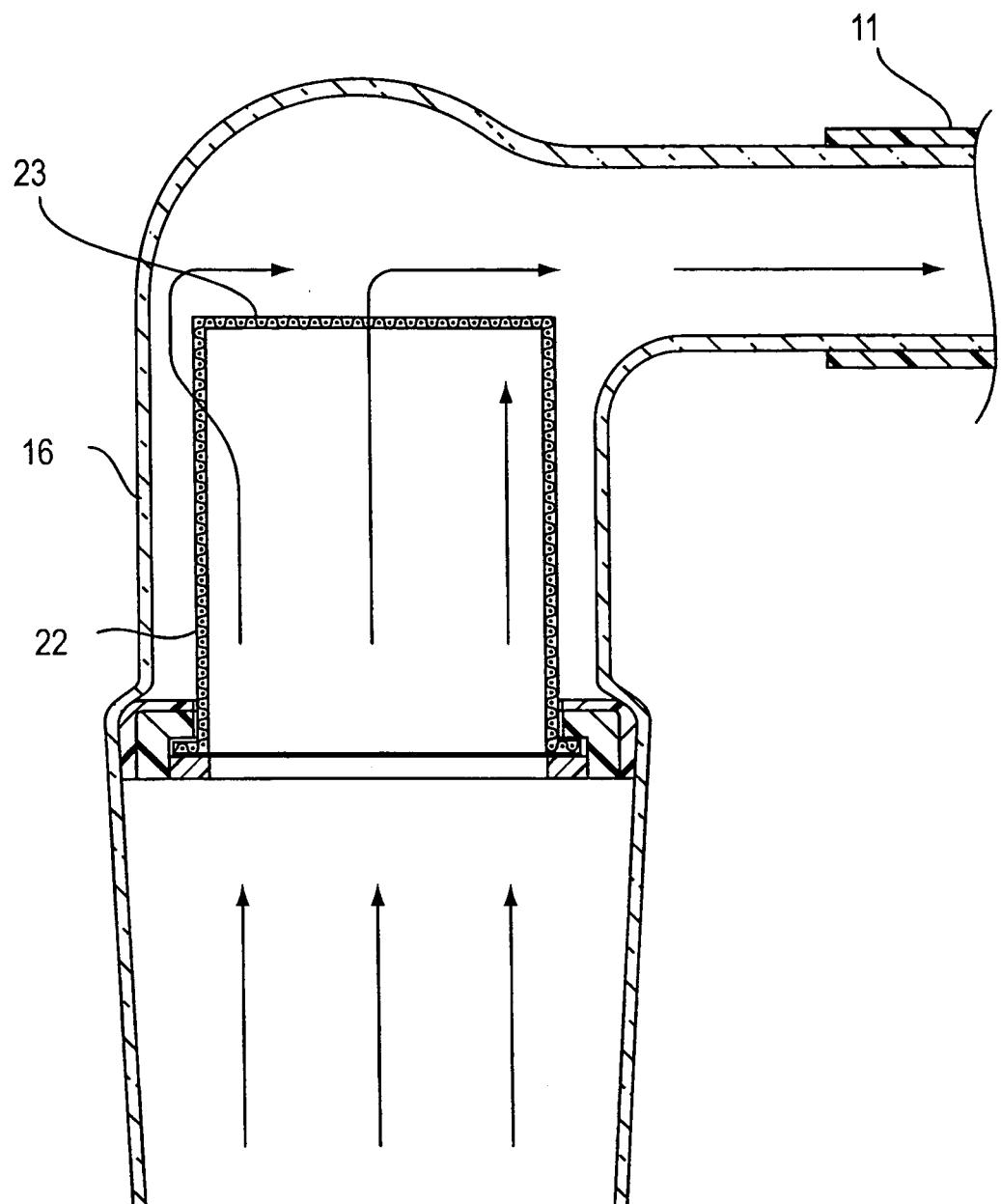


FIG. 5

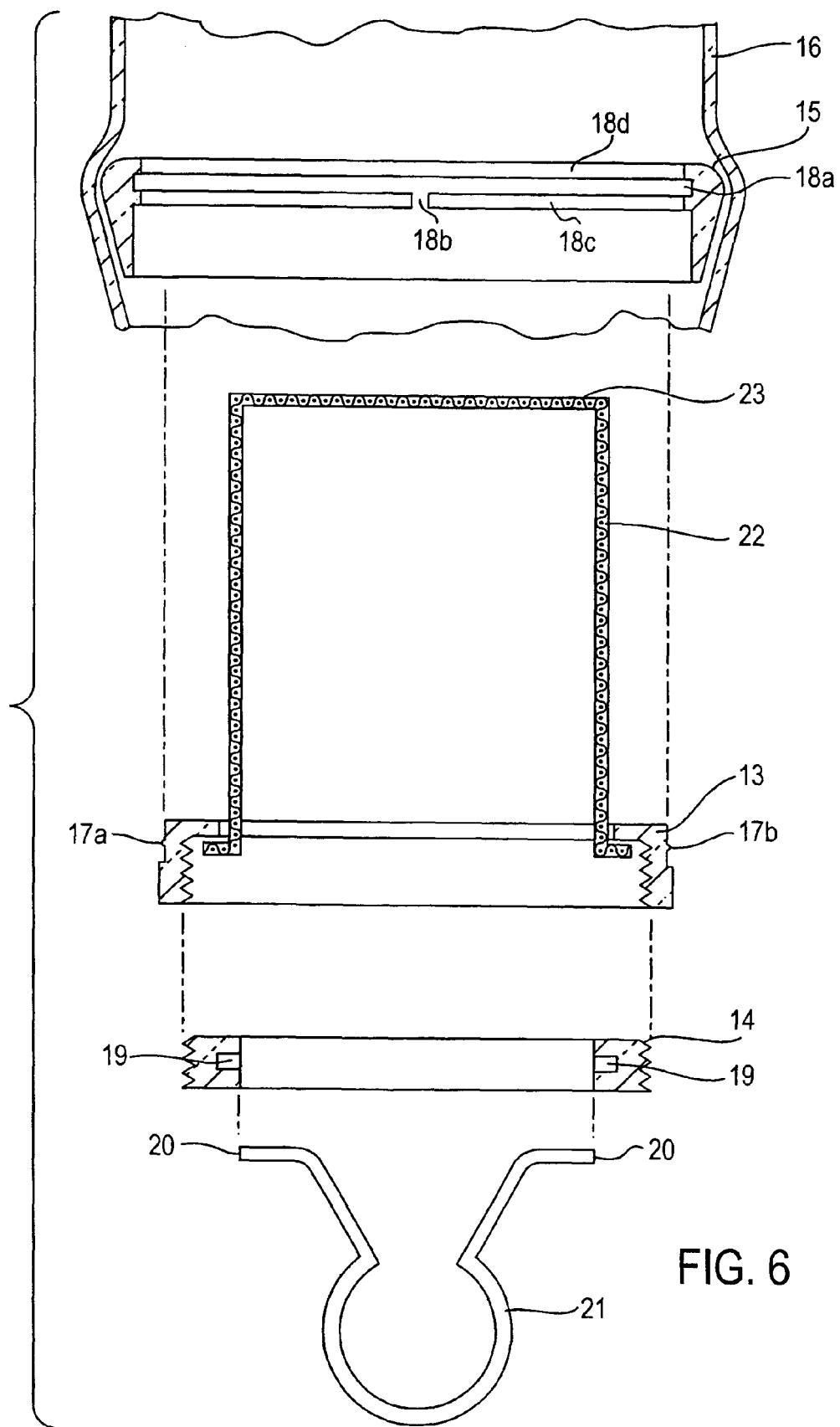


FIG. 6

FIG.7B

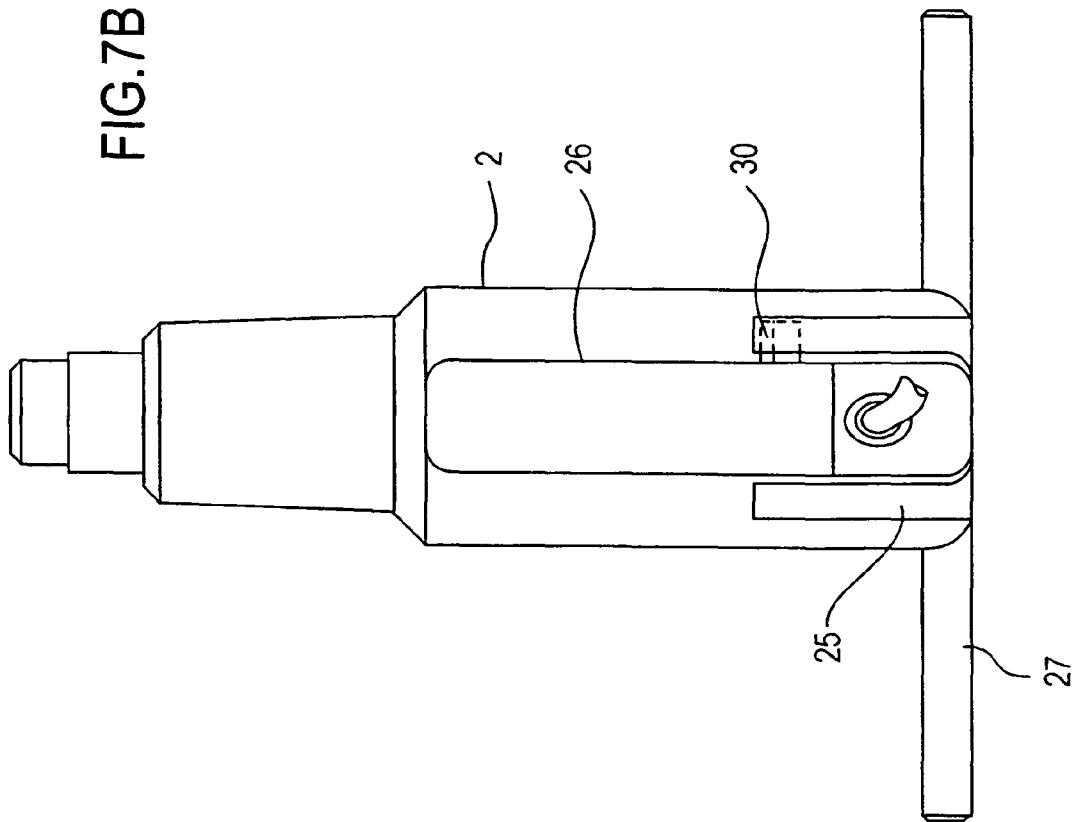


FIG.7A

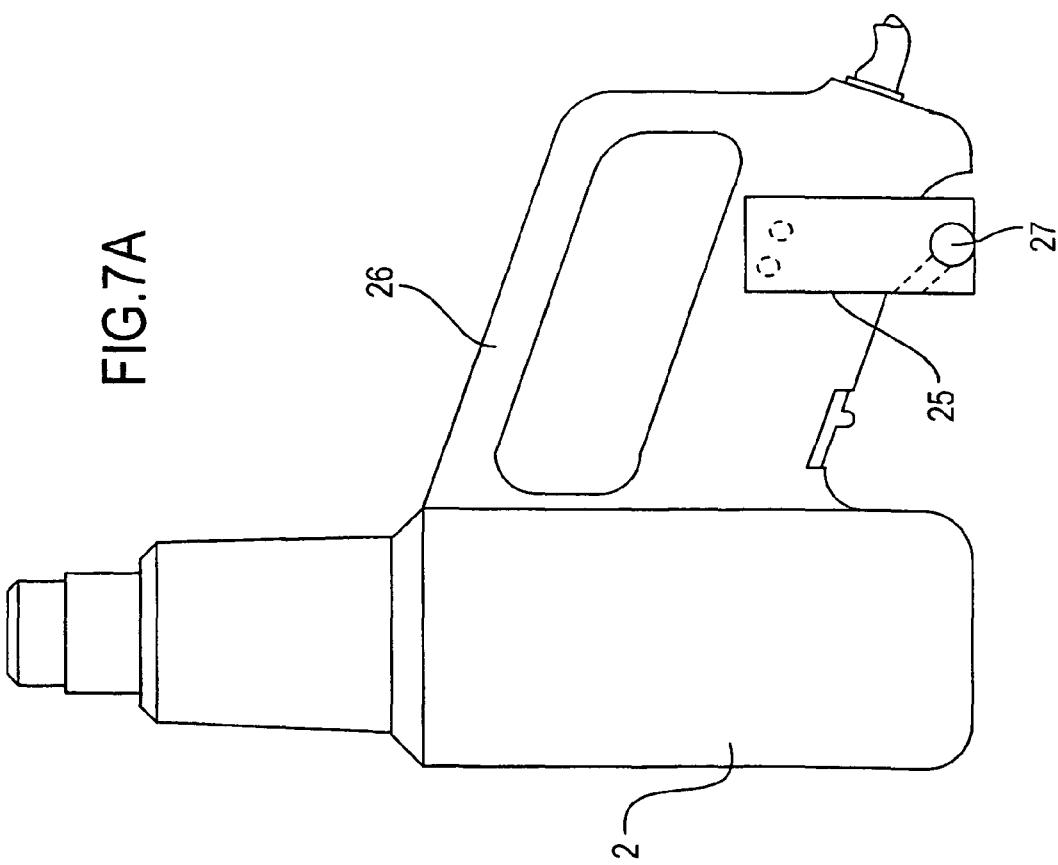


FIG. 8

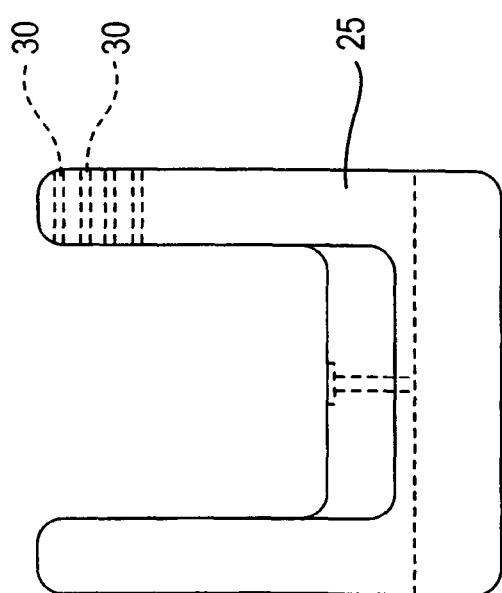


FIG. 9

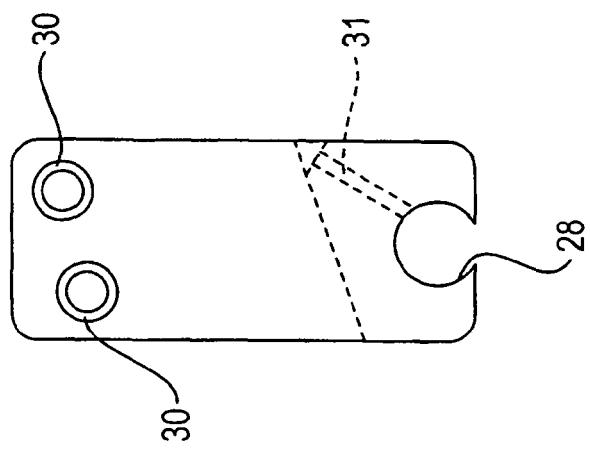
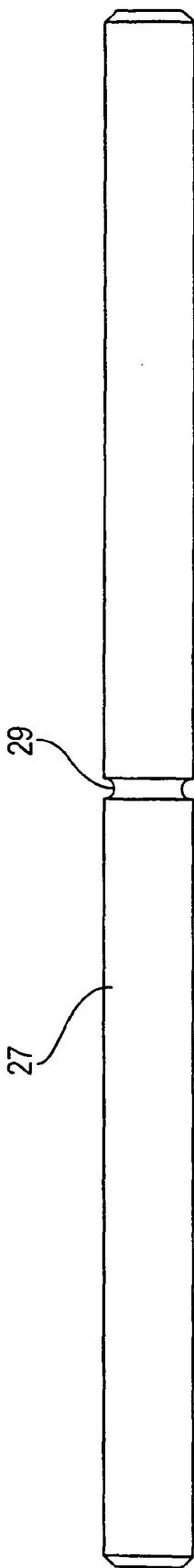


FIG. 10



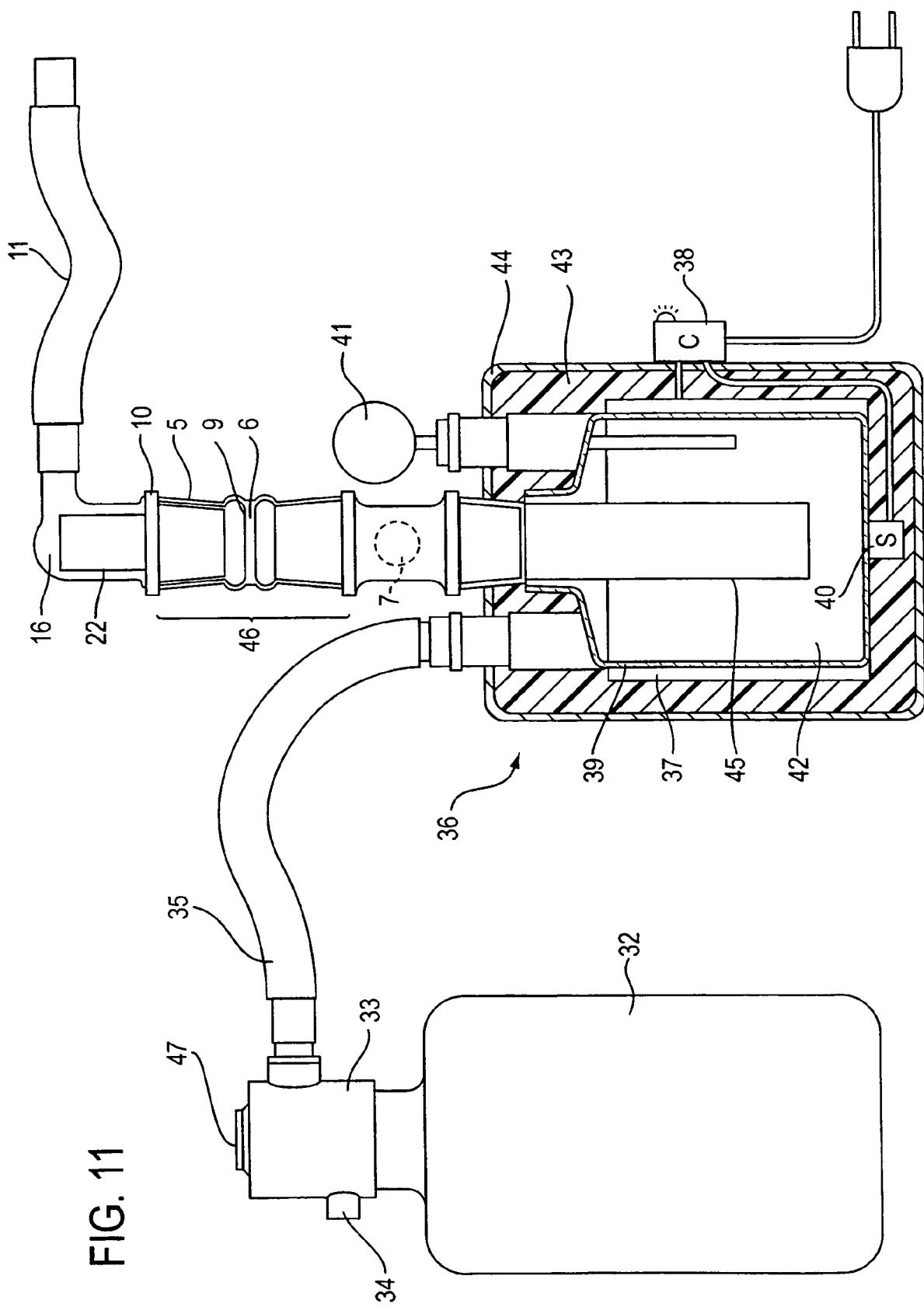
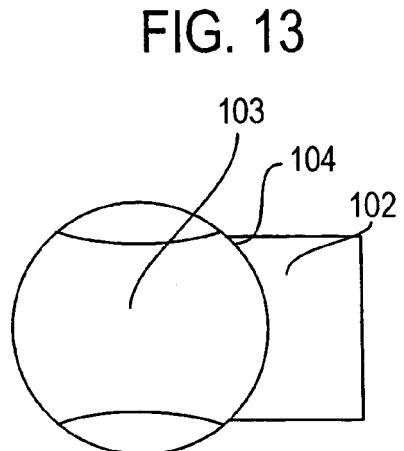
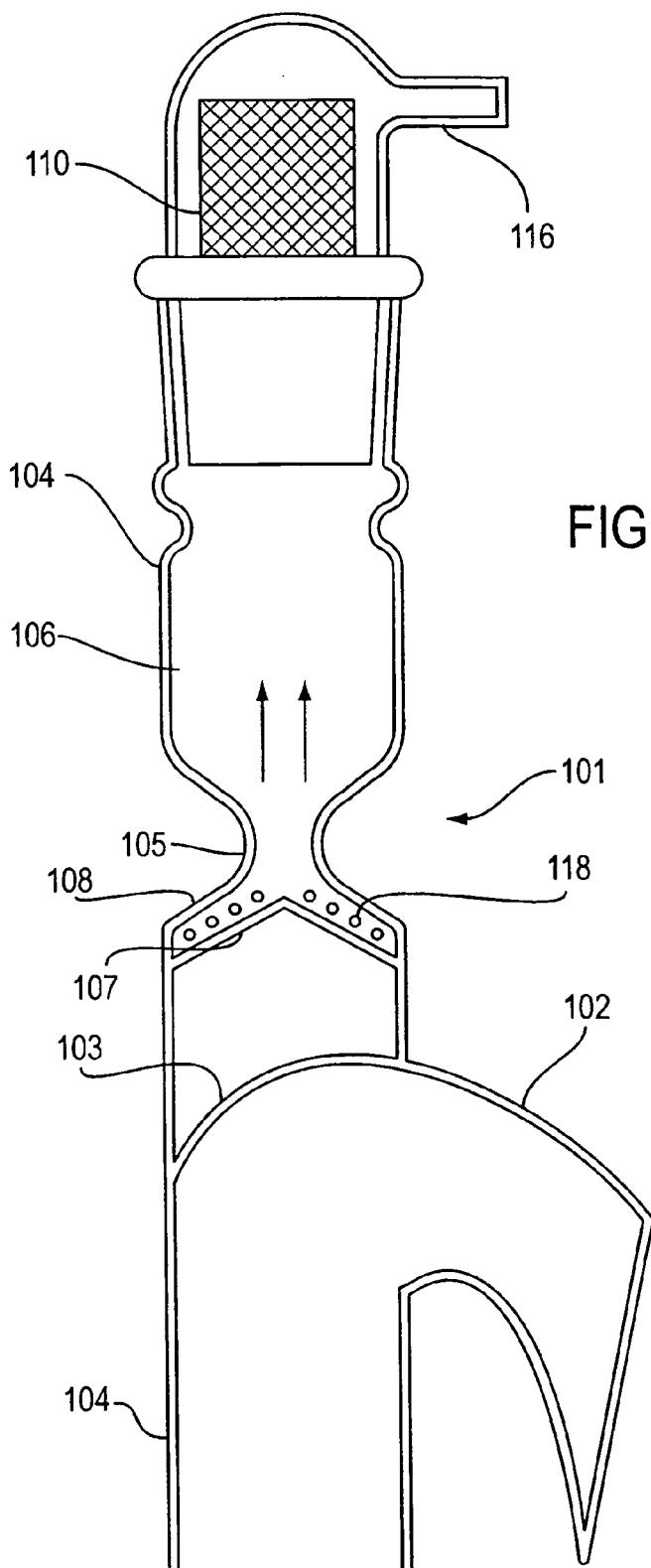


FIG. 11



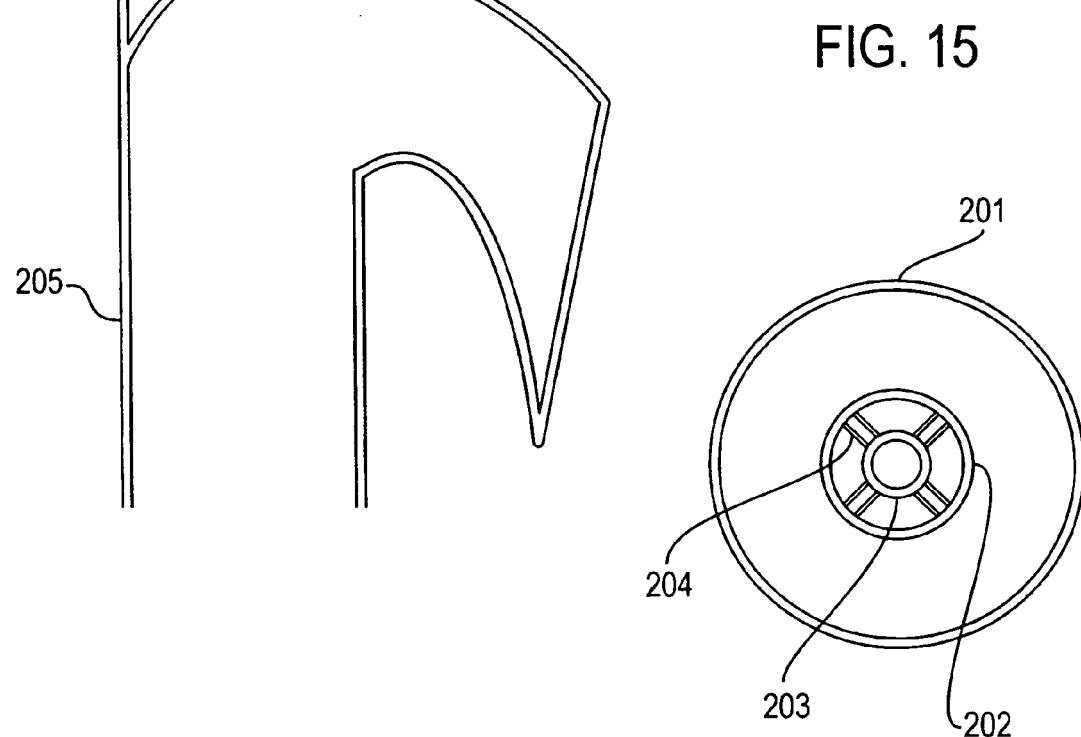
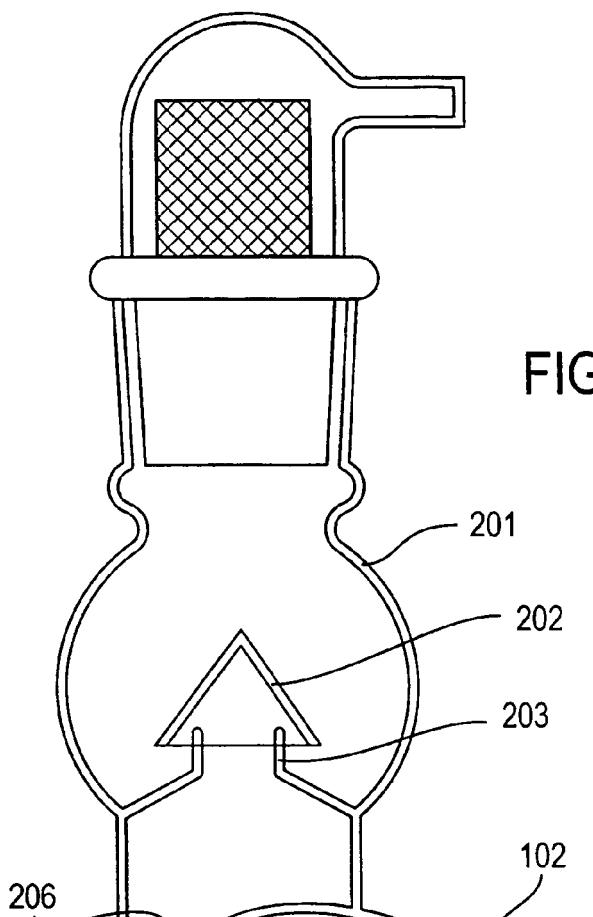
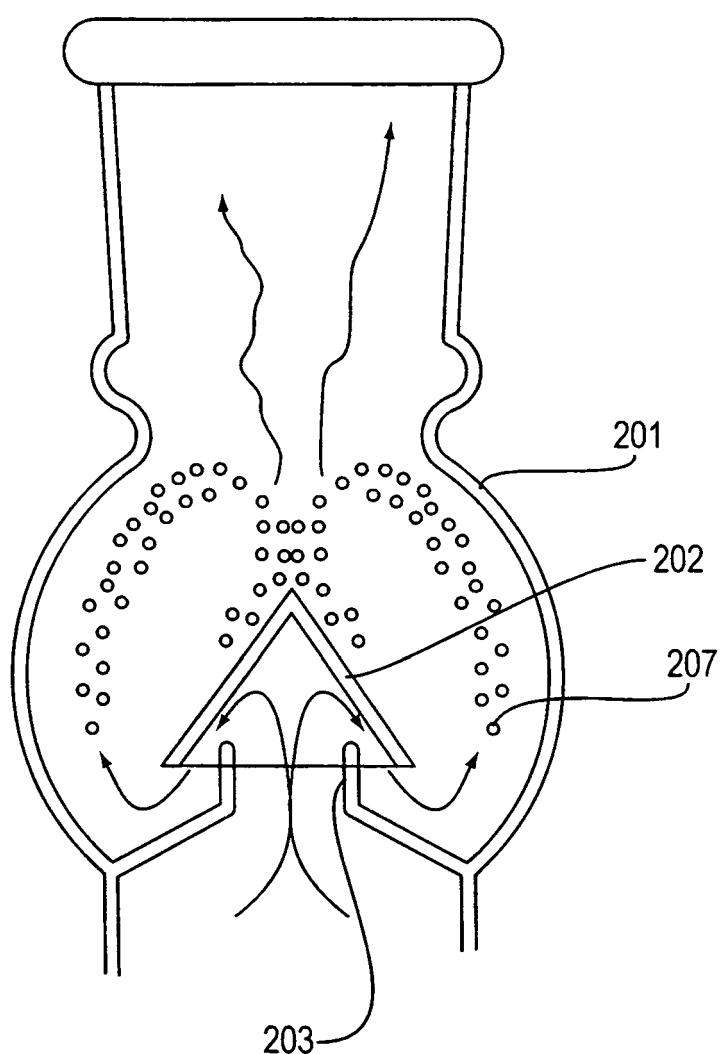


FIG. 16



REFERENCES CITED IN THE DESCRIPTION

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