

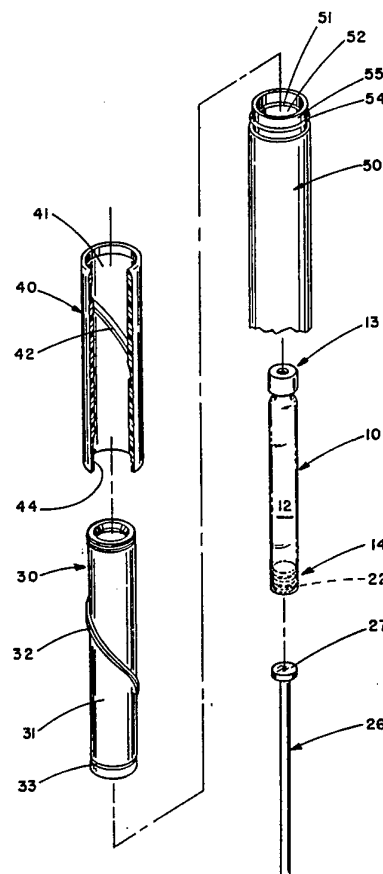


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B01F 9/00	A1	(11) International Publication Number: WO 94/06550 (43) International Publication Date: 31 March 1994 (31.03.94)
(21) International Application Number: PCT/US93/08909 (22) International Filing Date: 21 September 1993 (21.09.93) (30) Priority data: 07/949,596 23 September 1992 (23.09.92) US (60) Parent Application or Grant (63) Related by Continuation US 07/949,596 (CON) Filed on 23 September 1992 (23.09.92) (71) Applicant (for all designated States except US): HABLEY MEDICAL TECHNOLOGY CORPORATION [US/ US]; 22982 Alcalde, Laguna Hills, CA 92653 (US).		(72) Inventors; and (75) Inventors/Applicants (for US only) : HABER, Terry, M. [US/US]; 25011 Castlewood, Lake Forest, CA 92630 (US). FOSTER, Clark, B. [US/US]; 23631 Wadefield Court, Laguna Niguel, CA 92677 (US). SMEDLEY, William, H. [US/US]; 33285 Blanche Drive, Lake Elsinore, CA 92330 (US). (74) Agents: HANN, James, F. et al.; Townsend and Townsend Khourie and Crew, Steuart Street Tower, 20th Floor, One Market Plaza, San Francisco, CA 94105 (US). (81) Designated States: CA, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>
(54) Title: PHARMACEUTICAL MIXING CONTAINER WITH ROTATIONALLY MOUNTED HOUSING		

(57) Abstract

A pharmaceutical mixing container for storing a liquid having at least two factions which tend to separate during storage. A cartridge housing (10) having an inner volume (12) is closed at one end (13) by a septum arrangement (15) and at another end by a slidable sealing member (22). The cartridge housing (10) is installed within a cartridge cover (30) having an outwardly extending pitched land (32). An outer sleeve (40) having a matching pitched groove (42) formed on the inner surface (41) thereof is received about the cartridge cover (30). The cover (30) is rotationally mounted to a base member (50). By translating the outer sleeve (40) away from the base member (50), the cartridge cover (30) and cartridge housing (10) are rotated to provide turbulent mixing action for any liquid within the cartridge housing (10). In an alternate embodiment, the cartridge cover (30) is omitted and the pitched land (32) is provided directly on the outer surface of the cartridge housing (10).



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SUMMARY OF THE INVENTION

The invention comprises a pharmaceutical mixing container which provides thorough admixing of separated components in a pharmaceutical without mechanically damaging those components.

In its broadest aspect, the invention comprises an outer sleeve having a hollow interior with an inner surface, a cartridge housing positioned at least partially within the outer sleeve and arranged for relative motion with respect to said outer sleeve, and means for imparting rotational motion to the cartridge housing when the outer sleeve and the cartridge housing are mutually translated. The cartridge housing has a first end, a second end and a wall structure defining an inner volume for containing the pharmaceutical. A closure member positioned at the first end of the cartridge housing provides a fluid seal at that end; and a sealing member positioned at least partially within the cartridge housing provides a second fluid seal so that the inner volume of the cartridge housing is closed. The closure member for the cartridge housing first end preferably includes a septum and a retaining band for securing the septum to the first end of the housing.

The motion imparting means comprises a mating land and groove formed on the inner surface of the outer sleeve and the outer surface of the cartridge housing, with the groove preferably being formed as an inwardly facing groove in the inner surface of the outer sleeve and the land being formed as an outwardly facing pitched land extending from the outer surface of the cartridge housing. The cartridge housing is preferably rotatably secured to a base member having a central axially extending bore terminating in a first end, with the second end of the cartridge housing being rotatably secured to the first end of the base member.

The outer sleeve preferably includes an end proximate the first end of the base member, and the proximate end of the outer sleeve is releasably secured to the first end of the base member. The outer sleeve and the cartridge housing preferably employ cylindrical geometry.

In an alternate embodiment, the cartridge housing comprises a cartridge cover having an outer surface and an inner surface, and an inner cartridge received within the cover. In this embodiment, the motion imparting means comprises a mating
5 pitched land and groove formed on the inner surface of the outer sleeve and the outer surface of the cartridge cover.

In use, the liquid is stored within the cartridge housing and is admixed prior to administration by mutually translating the outer sleeve and the cartridge housing while
10 preventing rotation of the base member and the outer sleeve, thereby imparting rotational motion to the cartridge housing. During such motion, turbulent currents are formed within the liquid, thereby admixing the liquid with the miscible component.

After thorough mixing, the liquid may be hydraulically
15 withdrawn from the inner volume of the cartridge housing by penetrating the septum with a needle cannula of a syringe and subsequently operating the syringe. The liquid may also be expelled from the inner volume of the cartridge housing by penetrating the septum with a double point needle and forcibly
20 ejecting the liquid using a drive stem coupled to the sealing member and translating the sealing member with the drive stem in the direction of the first end of the cartridge housing.

While the invention may be employed with a wide variety of miscible pharmaceutical components, it is ideally
25 suited for use with pharmaceuticals having a liquid faction and a crystalline faction requiring gentle admixture prior to use. In particular, the gentle mixing afforded by the turbulent motion in the liquid resulting from the rotation of the cartridge housing is sufficient to thoroughly admix the
30 constituents without damaging the crystal structure.

For a fuller understanding of the nature and advantages of the invention, reference should be had to the ensuing detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view showing a first embodiment of the invention;

Fig. 2 is a sectional view of the assembled device;

5 Fig. 3 is a sectional view of the cartridge housing illustrating the rotational motion resulting from the use of the invention of Fig. 1;

Fig. 4 is a sectional view of an alternate embodiment of the invention; and

10 Fig. 5 is an enlarged detail view showing the structures for retaining the outer sleeve and the cartridge housing to the base member.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

15 Turning now to the drawings, Figs. 1-3 illustrate a first embodiment of the invention. As seen in these Figs., a cartridge housing generally designated with reference numeral 10 has a generally cylindrical geometrical configuration defining an inner volume 12, a distal end 13 and a proximal end 20 14. Housing 10 may be fabricated from glass or any suitable plastic material which is compatible with the pharmaceutical to be contained therewithin. Secured to distal end 13 is a closure member comprising an elastomeric septum 15 (Fig. 2) which is retained to first end 13 by means of a metal band 17. Septum 15 and band 17 are fabricated and arranged in such a manner that 25 access to the inner volume 12 may be gained by penetrating the band 17 and septum 15 with a needle-like probe, such as a needle cannula of a syringe or a double-ended syringe needle.

A sealing member 22 having an outer diameter providing 30 a sealing engagement with the inner walls of cartridge housing 10 is installed adjacent the proximal end 14 of cartridge housing 10. Sealing member 22 may be fabricated from a wide variety of suitable materials, such as butyl rubber, silicone rubber or the equivalent. Sealing member 22 functions to 35 provide a fluid seal for the proximal end of inner volume 12. For this purpose, sealing member 22 is provided with a plurality of lands 23 and grooves 24 along the outer surface thereof.

A drive stem 26 having a contact end 27 is provided (when desired) to enable manual expulsion of the liquid within inner volume 12 after the liquid has been admixed in the manner described below and is ready to be dispensed. Drive stem 26 may
5 either be mechanically coupled to sealing member 22 by a conventional snap fit arrangement, or may be a detached member.

In the first embodiment, cartridge housing 10 is frictionally received within a cartridge cover generally designated with reference numeral 30 and having an outer wall
10 surface 31 provided with an outwardly extending pitched land 32.

An outer sleeve generally designated with reference numeral 40 has an inner surface 41 provided with a pitched groove 42 having the same pitch angle as land 32. The pitch
15 angle for land 32 and groove 42 is selected to minimize the force required to operate the device, as described below.

Cartridge cover 30 is rotatably mounted to a base member 50 having an inner retaining ring 51 formed on the inner wall surface 52 thereof. Cartridge cover 30 is provided with a
20 corresponding circumferential groove 33 which receives the ring 51 when members 30 and 50 are secured together. The groove 33 - ring 51 mechanical combination permits rotation of the cartridge cover 30 without permitting translational motion between the cover 30 and the base 50.

Outer sleeve 40 is provided with a detent groove 44
25 at the lower end thereof which mates with a circumferential ring 54 formed on the outer surface 55 of base member 50. The groove 44 - ring 54 combination provides a releasable detent between outer sleeve 40 and base member 50. Members 30, 40 and 50 are
30 arranged such that translational motion of outer sleeve 40 in the upward direction as viewed in Fig. 1 (or to the right as viewed in Fig. 2) can impart rotational motion to cartridge cover 30 and thus cartridge housing 10 if the user firmly grasps both outer sleeve 40 and base 50. As the outer sleeve 40 and
35 base 50 are translationally separated, the linear motion of outer sleeve 40 is converted to rotary motion of cartridge cover 30 by the land 32 - groove 42 coupling. Stated differently, as the outer sleeve 40 is translated away from base 50, slidable

motion occurs between groove 42 of outer sleeve 40 and land 32 of cartridge cover 30. Since the cartridge cover is secured against translation by means of the groove 33 - ring 51 mechanical coupling but is free to rotate, this sliding motion
5 between land 32 and groove 42 is converted to rotational motion of cartridge cover 30 and thus cartridge housing 10. The rotational motion of the cartridge housing 10 results in turbulence in the liquid as illustrated in Fig. 3 by the curved
10 arrows. This turbulence causes the mixing action within the volume 12.

In use, sealing member 22 is installed from the proximal end of cartridge housing 10. The inner volume 12 is then filled with the pharmaceutical liquid, and septum 15 and closure band 17 are installed to seal volume 12. Thereafter,
15 cartridge 10 is inserted within cover 30, and cover 30 is secured to the upper end of base member 50. Thereafter, outer sleeve 40 is threaded onto outer sleeve 30 until groove 44 makes contact with outer ring 54 formed at the upper end of base member 50.

When the pharmaceutical is to be administered, the
20 user grasps the base 50 about the outer surface and also outer sleeve 40 and then provides a pulling force tending to separate the two elements. This translational motion is converted to rotary motion by the coupling between land 32 and groove 42,
25 thereby causing the cartridge housing 10 to revolve about the longitudinal axis thereof. This rotational motion provides turbulent currents within the liquid so that the constituent ingredients are admixed without mechanically damaging any delicate constituents, such as the crystalline fraction found in
30 NPH type insulin. After thorough admixture, the septum 15 is penetrated by means of a needle cannula of a syringe or a double point needle, and the liquid is withdrawn from inner volume 12 either hydraulically or by pushing drive stem 26 against sealing member 22 so as to translate sealing member 22 in the direction
35 of distal end 13 of cartridge housing 10.

Figs. 4 and 5 illustrate an alternate embodiment of the invention. In this embodiment, the cartridge cover 30 is dispensed with and the land 32 is formed directly on the outer

surface of cartridge housing 10. Fig. 5 illustrates the coupling between base member 50, cartridge housing 10 and outer sleeve 40. This mechanical coupling is essentially that described above with respect to the embodiment of Figs. 1-3. Operation of the embodiment of Figs. 4 and 5 is essentially identical to that described above, with the exception that the rotational motion is imparted by outer sleeve 40 directly to the cartridge housing 10 (as opposed to indirectly via cartridge cover 30).

As will now be apparent, the invention provides a pharmaceutical mixing container capable of thoroughly admixing the pharmaceutical constituent ingredients in a relatively simple and expedient fashion. In addition, mixing containers fabricated according to the invention are relatively simple and inexpensive to fabricate, can be readily filled with the appropriate liquid pharmaceutical, and can easily be employed for administering the pharmaceutical to a patient.

While the above provides a full and complete disclosure of the preferred embodiments of the invention, various modifications, alternate constructions and equivalents may occur to those skilled in the art. For example, while the rotational motion imparting mechanism has been shown as a matching pitched land and groove formed respectively on the cartridge cover 30 (or the cartridge housing 10) and the inner surface of the outer sleeve 40, a reverse arrangement may be employed, if desired. Similarly, the land 32 can be replaced by a simple outwardly extending protrusion which is capable of sliding within groove 42, as desired. In addition, the slidable sealing member 22 may be omitted in some applications and the inner volume 12 may be sealed by a solid cartridge housing bottom or a wall formed internally of the cartridge housing walls. Therefore, the above descriptions should not be construed as limiting the scope of the invention, which is defined by the appended claims.

WHAT IS CLAIMED IS:

1. A pharmaceutical mixing container for storing a liquid with a miscible component, said container comprising:
- 5 an outer sleeve having a hollow interior with an inner surface;
- a cartridge housing positioned at least partially within said outer sleeve and arranged for relative motion with respect thereto, said cartridge housing having a first end, a
- 10 second end and a wall structure defining an inner volume;
- a closure member at said first end providing a fluid seal;
- means for providing a second fluid seal so that said inner volume is closed; and
- 15 means for imparting rotational motion to said cartridge housing when said outer sleeve and said cartridge housing are mutually translated so that the liquid and the miscible component can be admixed by the rotational motion of said cartridge housing.
- 20
2. The invention of claim 1 wherein said motion imparting means comprises a mating land and groove formed on said inner surface of said outer sleeve and said outer surface of said cartridge housing.
- 25
3. The invention of claim 1 wherein said motion imparting means comprises an outwardly facing land formed on said outer surface of said cartridge housing and an inwardly facing groove formed in the inner surface of said outer sleeve.
- 30
4. The invention of claim 1 wherein said closure member comprises a septum.
5. The invention of claim 4 wherein said closure member further includes a retaining band.
- 35
6. The invention of claim 1 wherein said outer sleeve and said cartridge housing have cylindrical geometry.

7. The invention of claim 1 wherein said means for providing a second fluid seal is located adjacent said second end.

5

8. The invention of claim 1 wherein said fluid seal providing means comprises a sealing member at least partially within said cartridge housing.

10

9. The invention of claim 8 further including means for enabling the liquid within the container to be ejected from said first end when said closure member is opened.

15

10. The invention of claim 9 wherein said sealing member is slidably received by said cartridge housing; and wherein said enabling means comprises a drive stem coupled to said sealing member.

20

11. The invention of claim 1 further including a base member having a central axially extending bore terminating in a first end; and wherein said second end of said cartridge housing is rotatably secured to said first end of said base member.

25

12. The invention of claim 11 wherein said outer sleeve has an end proximate said first end of said base member; and wherein said proximate end of said outer sleeve is releasably secured to said first end of said base member.

30

13. The invention of claim 1 wherein said cartridge housing comprises a cartridge cover having an outer surface and an inner surface, and an inner cartridge received within said cover, said inner cartridge having an outer surface; and wherein said motion imparting means comprises a mating land and groove formed on said inner surface of said outer sleeve and said outer surface of said cartridge cover.

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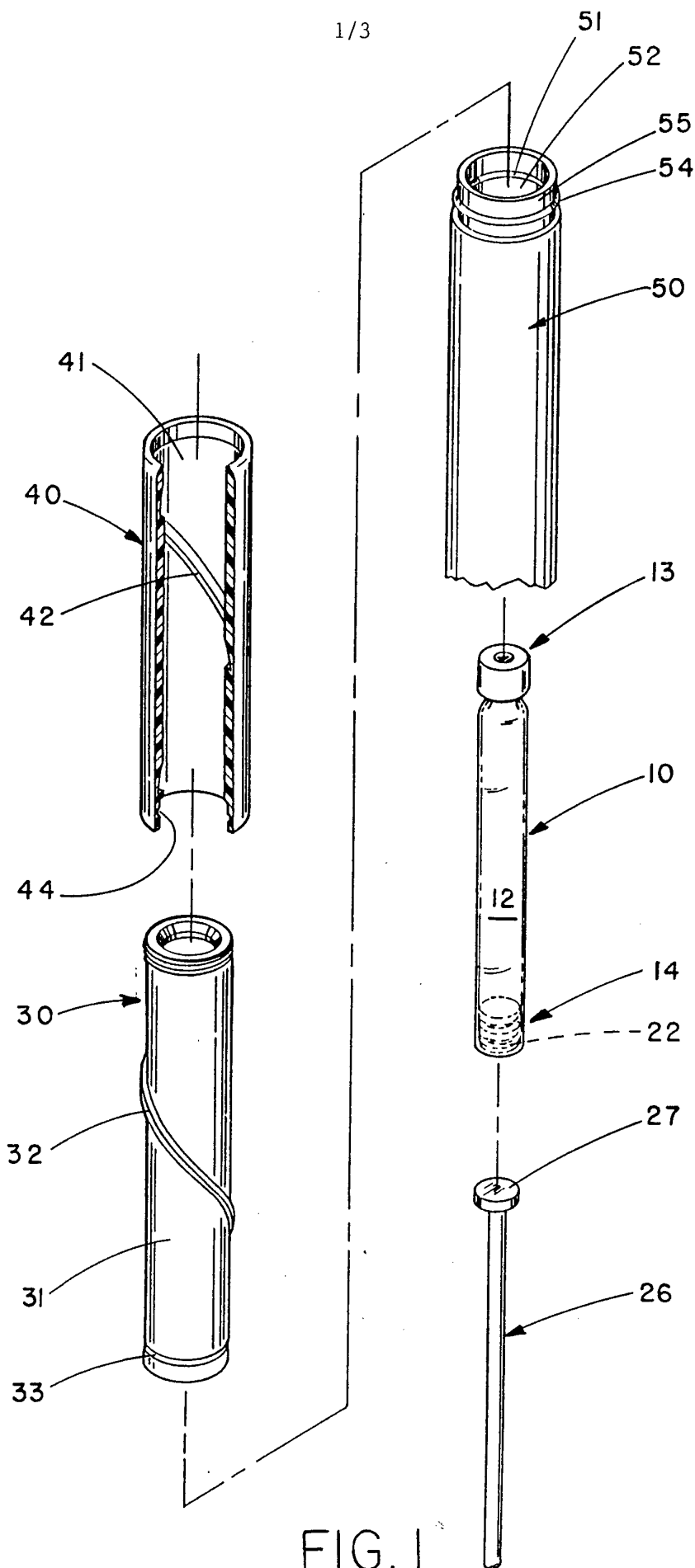


FIG. 1

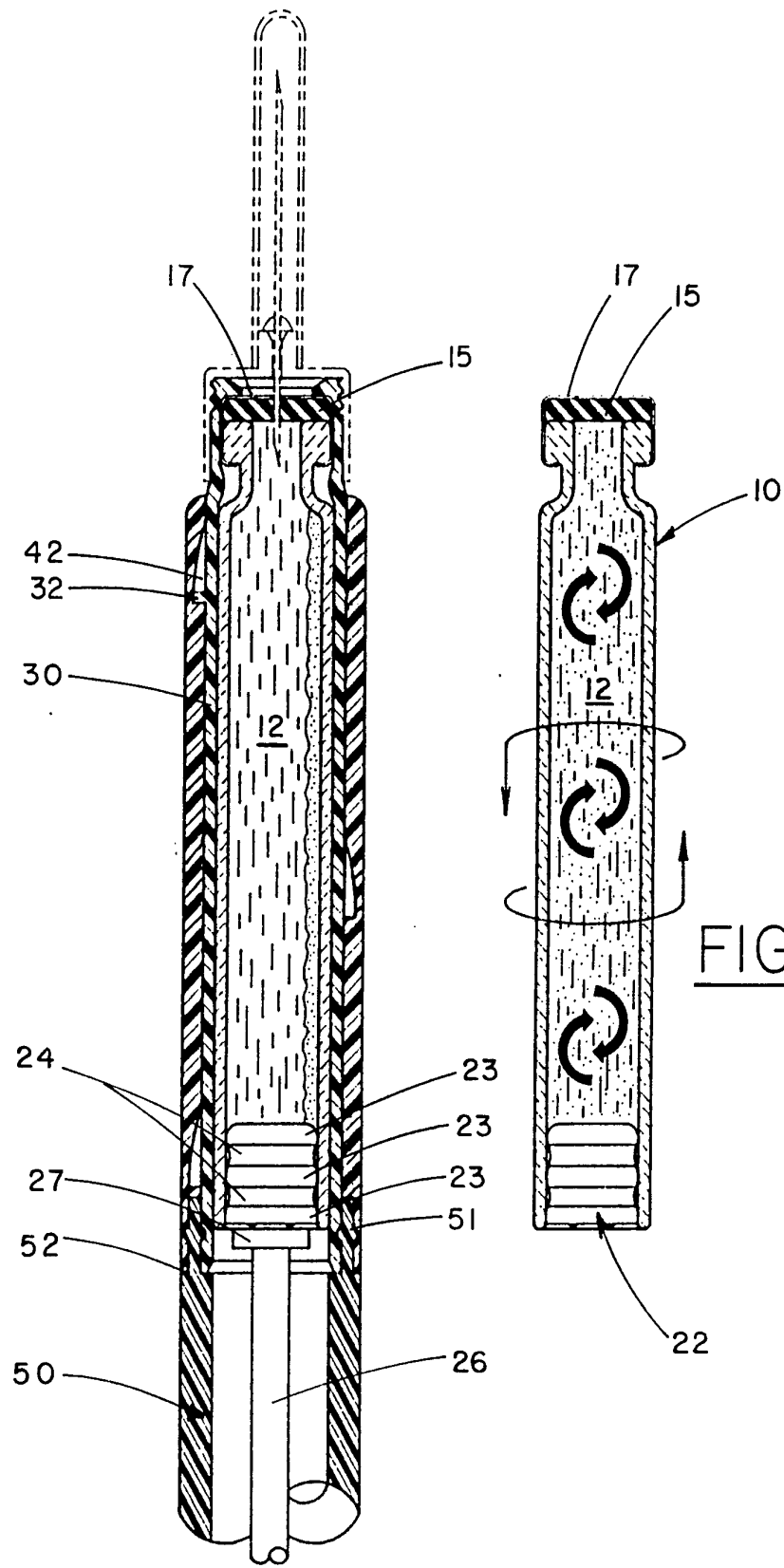


FIG. 2

FIG. 3

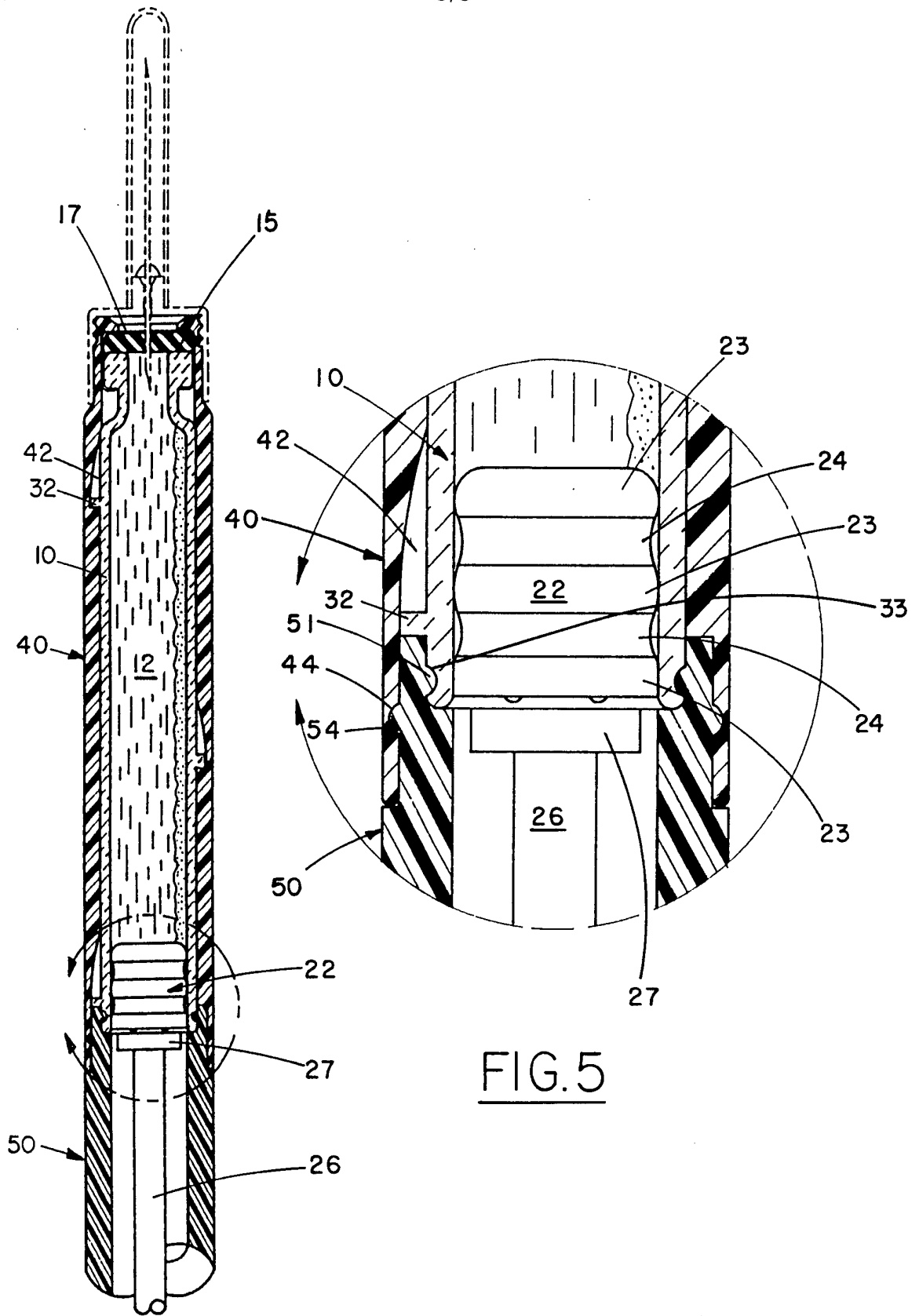


FIG. 4

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/08909

A. CLASSIFICATION OF SUBJECT MATTER IPC(5) :B01F 9/00 US CL :206/219, 221; 215/Dig.8; 366/130, 208, 216, 219; 604/416, 903 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) U.S. : Please See Extra Sheet. 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)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4,848,917 (BENIN ET AL.) 18 July 1989, Column 4, lines 44-68 and Column 2, lines 1-12 and Figures 3 and 5	1, 6, 7, 11
Y	EP, A, 298,067 (AHLSTRAND ET AL.) 04 January 1989, Column 6, lines 45-58 and Figures 1 and 5	4-5 and 8-10
A	US, A, 2,449,968 (SMITH) 21 September 1948	4, 7, 8, 9, 10
A	US, A, 3,291,454 (ROSENBLATT) 13 December 1966	1
A	US, A, 3,330,282 (VISSER ET AL.) 11 July 1967	8, 9, 10
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,289,648 (HOSKINS ET AL.) 15 September 1981	4, 5, 7, 8, 9, 10
A	US, A, 4, 445,895 (MARGULIES) 01 May 1984	4, 5, 7, 8, 9, 10
A	US, A, 4,461,578 (TIEBOUT) 24 July 1984	1
A	US, A, 5,137,528 (CROSE) 11 August 1992	4, 5, 7, 8, 9, 10
A	DE, A, 2,173,678 (ROHR) 05 October 1978	1
A	US, A, 4,850,966 (GRAU ET AL.) 25 July 1989	7, 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/08909

B. FIELDS SEARCHED

Minimum documentation searched

Classification System:-U.S.

206/219, 221; 215/228, 231, 247, Dig. 3, Dig. 8; 366/129, 130, 184, 189, 197, 203, 204, 208, 209, 210, 212, 213,
216, 219, 220, 232, 237, 347; 604/56, 82, 201, 228, 232, 416, 903