Title: DRUGS MIXING DEVICE

Abstract: Disclosed herein is a drugs mixing device for vibrating and rotating a drug bottle containing two or more different drugs to mix the drugs. The drugs mixing device includes a drug bottle receiving unit, a device body, and an eccentric motor and a power supply source mounted in the device body. When the eccentric motor is energized with power supplied from the power supply source and thus generates vibration, the drug bottle, mounted in the drug bottle receiving unit, is vibrated and rotated by the generated vibration. The drugs mixing device according to the present invention is capable of mixing a drug which would be unstable while being mixed with a different ingredient for a long time with another drug or a solvent at high uniformity just before use.
The present invention relates to a drugs mixing device, and, more particularly, to a drugs mixing device for vibrating and rotating a drug bottle containing two or more different drug ingredients to mix the drug ingredients, the drugs mixing device including a drug bottle receiving unit for receiving the drug bottle with a predetermined tolerance, the drug bottle being open at one side thereof, a device body having the drug bottle receiving unit formed at one side thereof, the device body being provided at the outside thereof with a power switch, and an eccentric motor and a power supply source mounted in the device body, wherein, when the eccentric motor is energized with power supplied from the power supply source and thus generates vibration, the drug bottle, mounted in the drug bottle receiving unit, is vibrated and rotated, by the generated vibration, thereby mixing drug ingredients.

Generally, drugs are used in a state of a composition containing diluents. Depending upon the properties of the drugs, the composition is maintained in a solid state, in a suspension state, or in an emulsion state. Also, a composite including two or more drugs may be used. In this way, a large number of drugs are used while being mixed with different ingredients, for example, different kinds of drugs, solvents, suspensions, emulsifying agents, diluents, etc.
However, some drugs would be unstable when the drugs are maintained for a long time while being mixed with the above-specified ingredients, and therefore, the drugs must be mixed with the above-specified ingredients just before use of the drugs. For example, a sustained-release drug of human growth hormone, e.g., Declage (LG Life Sciences), includes a vial containing a solid ingredient with human growth hormone and a vial containing a liquid injection solution, i.e., medium-chain triglyceride (MCT). The solid ingredient and the injection solution are mixed with each other before use, and then the mixture is administrated to a patient.

For the manufacture of such an injection, however, it is very difficult to uniformly mix (concretely, suspend) the solid ingredient, which is an active protein, in the MCT, which is an oil solution. Consequently, it is difficult to expect a generally desired result. Furthermore, it is difficult to uniformly supply drugs to a patient through the administration of an unstable suspension injection, with the result that the efficacy of the drugs is not effectively exhibited.

In order to prepare a suspension injection before the administration of the suspension injection to a patient an administrator (for example, a nurse or a patient) manually shakes a vial containing a solid ingredient and an injection solution such that the solid ingredient and the injection solution are mixed well with each other. However, an injection prepared by the above method, the suspension uniformity is considerably poor, as previously described. The use of existing medical instruments may be considered in order to solve the above problem. But, the medical instruments are generally expensive and large in size. Furthermore, the operation of the medical instruments is complicated. For this reason, the use of the medical instruments to mix drugs is limited.
Consequently, there is a high necessity for a device that is capable of effectively mixing a drug which would be unstable while being mixed with a different ingredient for a long time with another drug or a solvent to administer an injection once or continuously administer injections for a predetermined period of time and that is portable and easy to use.

5 SUMMARY OF THE INVENTION

Therefore, the present invention has been made to solve the above problems, and other technical problems that have yet to be resolved.

Specifically, it is an object of the present invention to provide a drugs mixing device that is capable of effectively mixing a drug which would be unstable while being mixed with a different ingredient for a long time with another drug or a solvent at high uniformity, just before use, to administer an injection once or continuously administer injections for a predetermined period of time, through the vibration and rotating operations thereof.

It is another object of the present invention to provide a drugs mixing device that is constructed in a simple structure enough to be manufactured with low costs and that is constructed in a small structure enough to be portable and convenient to use.

In accordance with the present invention, the above and other objects can be accomplished by the provision of a drugs mixing device for vibrating and rotating a drug bottle containing two or more different drug ingredients to mix the drugs, the drugs mixing device including a drag bottle receiving unit for receiving the drug bottle with a predetermined tolerance, the drug bottle being open at one side thereof, a device body having the drug bottle receiving unit formed at one side thereof, the device body being provided at the outside thereof with a power
switch, and an eccentric motor and a power supply source mounted in the device body, wherein, when the eccentric motor is energized with power supplied from the power supply source and thus generates vibration, the drug bottle, mounted in the drug bottle receiving unit, is vibrated and rotated by the generated vibration, thereby mixing drug ingredients.

In the drugs mixing device according to the present invention, the eccentric motor generates vibration when the eccentric motor is energized with power supplied from the power supply source, and the generated vibration is transmitted to the drug bottle receiving unit, with the result that the vibration is applied to the drug bottle, mounted in the drug bottle receiving unit. At this time, there is a predetermined tolerance between the drug bottle receiving unit and the drug bottle, and the vibrating and rotating operations are simultaneously carried out by the tolerance, with the result that the two or more drug ingredients contained in the drug bottle are mixed with each other. That is, the drug bottle is rotated only by applying a vibrating force through the above-described structure, not by directly applying a rotary force to the drug bottle, mounted in the drug bottle receiving unit, through the physical contact. This principle has been confirmed by the inventors of the present invention for the first time. This principle simplifies the structure of the drugs mixing device and increases the mixing efficiency of the drug ingredients by simultaneously applying vibration and rotation to the drug bottle.

A drug bottle that can be used while being mounted in the drugs mixing device according to the present invention, more specifically, a drug bottle that can be mounted in the drug bottle receiving unit, is constructed in a structure in which the lower end of the drug bottle is generally sealed like a drug bottle for injections, an injection port formed at the upper end of the drug bottle is sealed by a stopper made of an elastic material (for example, rubber), while the drug bottle is filled with contents, and the rubber stopper and the injection port of the drug bottle are
integrated with each other by a metal cap. The drug bottle is inserted into the drugs mixing device such that the injection port of the drug bottle is directed to the upper end of the drugs mixing device. Of course, the drug bottle may be inserted into the drugs mixing device in the reverse direction.

A drug mixture used in the drugs mixing device according to the present invention includes two or more different drug ingredients. The drugs mixing device according to the present invention is used variously for a drug mixture requiring the mixture, preferably suspension, of drug ingredients before the administration of the drug mixture to a human body. In a preferred embodiment, the different drug ingredients include a first solid substance and a second liquid substance. Preferably, the first substance is dispersed in the second substance. More preferably, the first substance is a sustained-release powder drug of growth hormone (for example, Declage), and the second substance is an oil type injection solution, such as MCT.

In the present invention, the tolerance is provided between the drug bottle receiving unit and the drug bottle. The tolerance means that a predetermined gap is formed between the outside of the drug bottle and the inside of the drug bottle receiving unit, when the drug bottle is mounted in the drug bottle receiving unit, such that the tight contact between the drug bottle and the drug bottle receiving unit is prevented, or a predetermined gap is formed between the outside of the drug bottle and the inside of a shock-absorbing member, when the shock-absorbing member is attached to the inside of the drug bottle receiving unit, such that the tight contact between the drug bottle and the shock-absorbing member is prevented. Since the drug bottle is mounted in the drug bottle receiving unit with the predetermined tolerance, as described above, the bottle is vibrated, and, at the same time, is rotated.
In a specific example, the inner diameter of the drug bottle receiving unit may be greater than the outer diameter of the drug bottle by the tolerance.

The size of the tolerance may be decided by various factors, such as the size and weight of the drug bottle, the number of vibrations applied to the drug bottle, etc. However, when the tolerance is too small, the drug bottle may not be easily rotated. On the other hand, when the tolerance is too large, there is a great possibility that the drug bottle will be broken by a vibration shock applied to the drug bottle. Consequently, it is required to decide the size of the tolerance in consideration of the above conditions. The size of the tolerance is preferably 0.5 to 10%, more preferably 1 to 5%, of the inner diameter of the drug bottle receiving unit.

In a preferred embodiment, when the drug bottle is constructed in a cylindrical structure having an outer diameter of approximately 16.1 to 16.4 mm, the drug bottle receiving unit is constructed in a cylindrical structure having an inner diameter of 16.75 to 16.9 mm, which is decided in consideration of the thickness of a label attached to the outside of the drug bottle. In this structure, the tolerance between the drug bottle and the inside of the drug bottle receiving unit may be 0.35 to 0.8 mm excluding the thickness of the label.

Meanwhile, the tight contact between the upper end of the drug bottle and the upper end of the drug bottle receiving unit is preferably prevented in consideration of the easiness in vibration and rotation of the drug bottle. To this end, the drug bottle receiving unit may have a length greater than that of the drug bottle.

In a preferred embodiment, the drug bottle receiving unit is provided at the inside thereof corresponding to the drug bottle mounted in the drug bottle receiving unit with a shock-absorbing
member for absorbing a shock applied to the drug bottle and minimizing the generation of noise. The shock-absorbing member prevents the breakage of the drug bottle due to high vibration generated by the eccentric motor, and, at the same time, serves to control the rotation speed of the drug bottle and greatly restrain the generation of noise. That is, when the rotation speed of the drug bottle is too high, a possibility of bubble generation is increased during the mixing operation. On the other hand, when the rotation speed of the drug bottle is too low, the mixing between the drug ingredients is not properly achieved.

The material for the shock-absorbing member is not particularly restricted so long as the shock-absorbing member exhibits the above-described effect. Preferably, the shock-absorbing member is made of a sponge or rubber.

When the shock-absorbing member is added, the tolerance may be provided or not between the drug bottle and the shock-absorbing member. That is, when the tolerance is created temporarily between the drug bottle and the shock-absorbing member, while vibration is applied to the drug bottle, and therefore, a fictional force is not induced to such an extent that the rotation of the drug bottle is difficult, no nominal tolerance may exist between the drug bottle and the shock-absorbing member when no vibration is applied to the drug bottle while the drug bottle is mounted in the drug bottle receiving unit.

According to circumstances, the drug bottle receiving unit may be further provided at the upper end thereof corresponding to the drug bottle with an elastic shock-absorbing member in order to decrease a strong shock applied to the drug bottle mounted in the drug bottle receiving unit and to increase the mixing efficiency of the drug ingredients through the up-and-down movement of the drug bottle. The elastic shock-absorbing member serves to prevent breakage
of the drug bottle and, at the same time, prevent the drug bottle from deviating from its set position. That is, the drug bottle may be pushed above the drug bottle receiving unit due to a shock applied to the drug bottle, during the vibration and rotation of the drug bottle. The shock-absorbing member elastically presses the upper end of the drug bottle to prevent the separation of the drug bottle from the drug bottle receiving unit while inducing the up-and-down movement of the drug bottle. The shock-absorbing member is not particularly restricted. Preferably, the shock-absorbing member is a compression spring.

Also, the drug bottle receiving unit may be provided at at least one side of the opening thereof with a guide constructed in a skirt structure to fundamentally prevent a possibility that the drug bottle will be separated from the drug bottle receiving unit, while vibration is continuously applied to the drugs mixing device.

The drugs mixing device according to the present invention is characterized in that the drug bottle containing the two or more drug ingredients is vibrated and rotated to mix, preferably suspend, the drug ingredients. The vibration and rotation of the drug bottle is achieved by the eccentric rotary motor.

Also, the power supply source is not particularly restricted. Preferably, the power supply source is a portable battery which minimizes the volume of the drugs mixing device and is easy to carry. For example, the power supply source may be a primary battery or a secondary battery.
Depending upon how to use the drugs mixing device according to the present invention, the drugs mixing device may be constructed in a grip type structure or a floor placement type structure.

When the drugs mixing device according to the present invention is constructed in the grip type structure, a user puts the drug bottle in the drug bottle receiving unit, while holding the device body, and manipulates the power switch to mix the drugs ingredients contained in the drug bottle. Consequently, the device body of this type drugs mixing device is preferably formed in the shape of a cylinder constructed in a grip structure.

On the other hand, when the drugs mixing device according to the present invention is constructed in the floor placement type structure, the user places the drugs mixing device on the floor, puts the drug bottle in the drug bottle receiving unit, and manipulates the power switch. In this case, however, the drug bottle or the drugs mixing device may be damaged due to a shock between the floor and the drugs mixing device. To solve this problem, the device body may be provided at one side of the lower end thereof with a horizontal support for absorbing a shock and maintaining the balance of the drugs mixing device. More preferably, the device body is further provided at one side of the upper end thereof with a shock-absorbing member, by which the drugs mixing device is spaced apart from the floor, during the mixing of the drugs, and therefore, the damage to the drug bottle or the drugs mixing device due to a shock between the floor and the drugs mixing device is effectively prevented. The material or shape of the shock-absorbing member is not particularly restricted. For example, the shock-absorbing member may be an elastic member, such as a compression spring.
DESCRIPTION OF DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a front view illustrating a drugs mixing device according to an embodiment of the present invention;

FIG. 2 is an enlarged see-through view illustrating part A of FIG. 1;

FIG. 3 is a partial sectional view of the drugs mixing device of FIG. 1;

FIG. 4 is a side view of the drugs mixing device of FIG. 1;

FIG. 5 is a front view illustrating a drugs mixing device according to another embodiment of the present invention; and

FIG. 6 is a side view of the drugs mixing device of FIG. 5.

Description of reference numerals

100, 500: drug bottle receiving units 110, 510: shock-absorbing members

200, 600: device bodies 210, 610: power switches

220: eccentric rotary motor 300, 700: drugs mixing devices
400: drug bottle

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Now, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. It should be noted, however, that the scope of the present invention is not limited by the illustrated embodiments.

FIG. 1 is a front view illustrating a drugs mixing device according to an embodiment of the present invention, and FIG. 2 is an enlarged see-through view schematically illustrating part A of FIG. 1.

Referring to these drawings, the drugs mixing device 300 includes a drug bottle receiving unit 100 and a device body 200.

In the drug bottle receiving unit 100 is mounted a vial-shaped drug bottle 400 with a predetermined tolerance. To the inside of the drug bottle receiving unit 100, where the drug bottle 400 is mounted, is attached a sponge 110 as a shock-absorbing member. Also, skirts 120 for preventing the separation of the drug bottle 400 from the drug bottle receiving unit 100 are formed at opposite sides of an opening of the drug bottle receiving unit 100.

The tolerance can be more clearly confirmed from FIG. 2. Referring to FIG. 2, a predetermined tolerance T is provided between the outside of the drug bottle 400 and the inside of each sponge 100 attached to the corresponding inside of the drug bottle receiving unit 100. By the provision of the tolerance T, there is little friction between the drug bottle 400 and the drug bottle receiving unit 100 or the shock-absorbing member 110, such as the sponges, attached to the
drug bottle receiving unit 100. Consequently, when vibration generated by the device body 200 is indirectly applied to the drug bottle 400, the drug bottle 400 can rotate and vibrate. At this time, the size of the tolerance T is preferably approximately 1 to 5% of the inner diameter of the drug bottle receiving unit 100.

Referring back to FIG. 1, the device body 200 is formed in the shape of a cylinder constructed in a grip structure. At one side of the device body 200 is mounted a power switch 210. In the device body 200 are mounted an eccentric rotary motor and a power supply source, which will be described below in more detail with reference to FIG. 3.

FIG. 3 is a partial sectional view of the drugs mixing device of FIG. 1.

As described above, the drugs mixing device 300 includes the drug bottle receiving unit 100 and the device body 200. Hereinafter, the interior structure of the device body 200 will be described in detail.

In the device body 200 are mounted an eccentric rotary motor 220, a power switch 210, and a portable battery 230 as a power supply source. Power, supplied from the portable battery 230, is transmitted to the eccentric rotary motor 220 via a power connection terminal 211. At this time, the power on/off is controlled by the power switch 210, connected to the power connection terminal 211. An eccentric rotary weight 211 is mounted to the rotary motor 220. Consequently, when the rotary motor 220 is operated, high vibration is generated by an eccentric moment induced by the eccentric rotary weight 211. The generated vibration is transmitted to the drug bottle receiving unit 100, with the result that the drug bottle 400, mounted in the drug bottle receiving unit 100.
bottle receiving unit 100 with the predetermined tolerance, is vibrated and rotated, and therefore, 
drugs contained in the drug bottle 400 are mixed with each other.

FIG. 4 is a side view of the drugs mixing device of FIG. 1.

Referring to FIG. 4, the drug bottle 400, mounted in the drug bottle receiving unit 100, is 
surrounded by the skirts 120 for preventing the separation of the drug bottle 400 from the drug 
bottle receiving unit 100 during the mixing operation. The power switch 210 is mounted at one 
side of the device body 200. The power connection terminal, which is connected to the power 
switch 210, controls the supply of power between the power supply source and the eccentric 
rotary motor.

FIG. 5 is a front view illustrating a drugs mixing device according to another 
embodiment of the present invention.

The drugs mixing device 700 of this embodiment is basically identical in operation to 
that shown in FIG. 1 except that the drugs mixing device is operated, while the drugs mixing 
device is placed on the floor, during the mixing operation.

In a drug bottle receiving unit 500 is mounted a vial-shaped drug bottle 400 with a 
predetermined tolerance. To the inside of the drug bottle receiving unit 500, where the drug 
bottle 400 is mounted, is attached a shock-absorbing member 510 made of rubber. Also, a 
compression spring 520 is mounted in the drug bottle receiving unit 500 at a position 
corresponding to the upper end of the drug bottle 400 for locating the drug bottle 400 in position 
and inducing the up-and-down movement of the drug bottle 400 to further improve the mixing 
efficiency of drugs contained in the drug bottle 400.
A device body 600 is formed in the shape of a cylinder. At one side of the device body 600 is mounted a power switch 610. The balance of the drugs mixing device 700 is maintained by a horizontal support 620 mounted at one side of the lower end of the device body 600.

FIG. 6 is a side view of the drugs mixing device of FIG. 5.

Referring to FIG. 6, the drugs mixing device is constructed in a structure in which the drugs mixing device is placed on the floor while the drug bottle 400 is received in the drug bottle receiving unit 500. At the lower end of the drug bottle receiving unit 500 is mounted another compression spring 540. The horizontal support 620 is mounted at the lower end of the device body 600. The device body 600 is maintained horizontal by the compression spring 540 and the horizontal support 620, and, at the same time, the shock transmitted from the floor to the device body 600 is effectively absorbed during the mixing operation.

Although the structures and operations of the drugs mixing devices according to the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

INDUSTRIAL APPLICABILITY

As apparent from the above description, the drugs mixing device according to the present invention is capable of effectively mixing a drug which would be unstable while being mixed with a different ingredient for a long time with another drug or a solvent at high uniformity, just before use, to administer an injection once or continuously administer injections for a
predetermined period of time. Also, the drugs mixing device according to the present invention can be constructed in a simple structure enough to be manufactured with low costs. Furthermore, the drugs mixing device according to the present invention is easy to carry enough to effectively use at a desired place.
WHAT IS CLAIMED IS:

1. A drugs mixing device for vibrating and rotating a drug bottle containing two or more different drugs to mix the drugs, the drugs mixing device comprising:

   a drug bottle receiving unit for receiving the drug bottle with a predetermined tolerance,

   the drug bottle being open at one side thereof;

   a device body having the drug bottle receiving unit formed at one side thereof, the device body being provided at the outside thereof with a power switch; and

   an eccentric motor and a power supply source mounted in the device body, wherein

   when the eccentric motor is energized with power supplied from the power supply source and thus generates vibration, the drug bottle, mounted in the drug bottle receiving unit, is vibrated and rotated by the generated vibration.

2. The drugs mixing device according to claim 1, wherein the tolerance has a size equivalent to 0.5 to 10% of the inner diameter of the drug bottle receiving unit.

3. The drugs mixing device according to claim 2, wherein the size of the tolerance is 1 to 5% of the inner diameter of the drug bottle receiving unit.

4. The drugs mixing device according to claim 1, wherein the different drug ingredients include a first solid substance and a second liquid substance.
5. The drugs mixing device according to claim 4, wherein the first substance is dispersed in the second substance.

6. The drugs mixing device according to claim 4, wherein the first substance is a sustained-release powder drug of growth hormone, and the second substance is an oil type injection solution.

7. The drugs mixing device according to claim 1, wherein the drug bottle receiving unit is provided at the inside thereof corresponding to the drug bottle mounted in the drug bottle receiving unit with a shock-absorbing member for absorbing a shock applied to the drug bottle.

8. The drugs mixing device according to claim 7, wherein the shock-absorbing member is made of a sponge or rubber.

9. The drugs mixing device according to claim 7, wherein the drug bottle receiving unit is further provided at the upper end thereof corresponding to the drug bottle with an elastic shock-absorbing member.

10. The drugs mixing device according to claim 1, wherein the drug bottle receiving unit is provided at at least one side of the opening thereof with a guide constructed in a skirt structure for preventing the separation of the drug bottle from the drug bottle receiving unit.

11. The drugs mixing device according to claim 1, wherein the power supply source includes a portable battery.

12. The drugs mixing device according to claim 1, wherein the device body is formed in the shape of a cylinder constructed in a grip structure.
13. The drugs mixing device according to claim 1, wherein the device body is provided at one side of the lower end thereof with a horizontal support.

14. The drugs mixing device according to claim 13, wherein the device body is provided at one side of the upper end thereof with a shock-absorbing member.

15. The drugs mixing device according to claim 14, wherein the shock-absorbing member includes a compression spring.
A. CLASSIFICATION OF SUBJECT MATTER

A61J 3/00(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 8  A61J 3/00, BOIF 11/00, BOIF 15/00

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)
Delphion, Esp@net

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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Further documents are listed in the continuation of Box C

See patent family annex

* Special categories of cited documents
"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
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"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
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Date of the actual completion of the international search
16 JUNE 2008 (16 06 2008)

Date of mailing of the international search report
17 JUNE 2008 (17.06.2008)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seogu, Daejeon 302-701, Republic of Korea
Facsimile No 82-42-472-7140

Authorized officer
KIM, JI YUN
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