1 338 254

PATENT SPECIFICATION

(11) 1 338 254

DRAWINGS ATTACHED

(21) Application No. 14544/70 (22) Filed 25 March 1970

(23) Complete Specification filed 19 April 1971

(44) Complete Specification published 21 Nov. 1973

(51) International Classification A61M 15/00

(52) Index at acceptance

A5T 420

A5R 33E

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(54) POWDER BLOWING DEVICE

(71) We, FISONS LIMITED, a British Company, of Harvest House, Felixstowe, Suffolk, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a device for the application of medicaments in finely divided form.

The application of finely powdered medicaments by inhalation is of considerable value in the treatment of certain conditions such as ailments of the bronchial and nasal tracts and of the lungs. The present invention provides a device which facilitates the nasal inhalation of medicaments in such a finely divided form. The device may also be used in the administration of medicaments to other bodily passages, e.g. the ear or throat.

Accordingly, the present invention provides a device for dispensing a medicament in finely divided powder form, which comprises a hollow elongate housing having a passageway to permit the passage of air through the device, the passage have first end adapted insertion into a nasal or other bodily passage; means capable of forcing air through the passageway from a second end thereof; mounting means forming part of the passageway and adapted to receive a container for the finely divided medicament, such as a gelatine or like capsule; and perforating means, mounted, within the means capable of forcing air through the device, for reciprocating movement substantially along the long axis of the housing to perforate the container for the finely divided medicament.

The shape of the housing is not critical, but it is conveniently substantially tubular. Finger grips or corrugations to facilitate the holding and/or operation of the device may be provided if desired. The housing may be formed of any suitable material such as metal, for example steel, or a plastics material such as nylon, rigid polyethylene, or polystyrene, and may have apertures at or near both ends.

The means of forcing air through the device is preferably a collapsible bulb or like container made of rubber or a flexible polymer. The bulb or container is mounted on the second end of the device so that air is forced through the device on squeezing or otherwise collapsing the bulb or container. Preferably the bulb or container includes a non-return air-inlet valve in order that the amount of air sucked back into the bulb or container through the device is kept to a minimum as the bulb or container is returned to its original configuration after use. To prevent the operator's fingers blocking the non-return valve as the bulb returns to its original configuration cross pieces or other spacer members may be provided on the outer side of the valve such that air may pass between them if a finger is placed over the valve. The size of the bulb is preferably such that the medicament container is substantially emptied in less than 4 and preferably about 2 squeezes of the bulb.

The first (nose-piece) end of the passageway may be formed integrally with or secured to the housing, but is preferably formed as a removable nose-piece. The removable nose-piece may be mounted on the housing by a screw thread, by one or more co-operating ribs and grooves on the housing and nose-piece, by frictional engagement, by an external or internal catch, or by any other suitable means. A removable nose-piece forms a convenient access to the mounting means for the container for the medicament, and is particularly useful for the changing of the container after use. The device preferably also includes a removable cover for the nose-piece to keep the nose-piece and the interior of the device clean and free from dust etc. when not in use.

The mounting means is suitably a

chamber formed within the housing adjacent to the first end of the passageway. The end of the chamber adjacent to the first end of the passageway, e.g. the inner end of a removable nose-piece, preferable includes a recessed portion at its inner end to form part of the chamber for accommodating the medicament container. The base of the mountir.g means, e.g. the end of the chamber remote from the nose-piece, may have an aperture therein through which the perforating means and air may pass. The aperture may be formed integrally in the chamber walls or may be a separate member such as an annular ring having radial projections extending inwardly or outwardly and optionally joined to a further annular ring. It is desirable that the aperture be such that air may be passed through it so that air passes around, as well as through the container for the medicament. Further, it is preferred that the container does not fit tightly in the chamber, there being suitably a clearance of 10—50 thou (0.254 to 1.27 mm) between the container and the walls of the chamber. This clearance permits a rapid flow of air past as well as through the container which is perforated at both ends which facilitates the dispersion into the airstream of the finely divided medicament leaving the container. The dispersion may also be enhanced by forming a channel, e.q. of semi-circular cross section, having a diameter of for example about 20 thou (0.508 mm) in the end of the chamber adjacent to the nose-piece, the channel acting to provide a cross-flow of air across the perforation from which the finely divided medicament is leaving.

The orientation of the container for the medicament is not critical, but it is preferred that an axis of symmetry of the container, if such exists, lies substantially along the long axis of the housing. In the case of capsules and like containers having a long axis, this long axis is preferably disposed substantially along the long axis of the housing.

The perforating means includes a retractable piercing member (needle) suitably formed of a stainless spring or carbon steel which may be plated, for example, with nickel or chromium, or coated, for example, with a plastics material to inhibit corrosion or to lubricate passage of the needle through the capsule. It has been found that in order to obtain optimum perforation of a gelatine capsule, the perforating end of the needle should not be sharpened to a conventional conical point but should be sharpened with a plane face at an acute angle. The needle is preferably of sufficient length to pierce both ends of the container though this is not necessary when a container having a perforation is used. The mounting means for the needle may take various forms. Suitably the needle is mounted on a mounting block for sliding movement in a guide sleeve, or on guide rails or the like. Alternatively the mounting block may be provided with a second guide sleeve which co-operates with the first guide sleeve thus permitting of a smaller overall construction. The base of the block is preferably mounted on a grommet at the base of the collapsible bulb, and the grommet is suitably formed integrally with the non-return valve in the bulb. With this arrangement, the needle is actuated by depressing the base of the bulb, and is automatically retracted by the bulb on its return to its normal configuration. The mounting block (or the second guide sleeve) preferably includes an abutment which engages with a projection at the end of the guide sleeve or rails to prevent the needle being withdrawn from the guide sleeve or rails. Suitably the abutment is positioned such that in the withdrawn position, the bulb is held at a slight tension which causes the needle to be biased into the fully withdrawn position after actuation. If a guide sleeve is used, windows may be formed in a portion of it projecting into the bulb to facilitate the passage of air between the bulb and the sleeve.

The needle or the mounting block is also preferably provided with stops to prevent the needle from projecting from the nose-piece during or after the piercing operation. It has also been found desirable to include a perforated disc external to the mounting means, but adjacent to that end of the mounting means remote from the first end of the passageway, e.g. at the end of the guide sleeve adjacent to the chamber for the capsule. The disc has a central perforation to support the tip of the piercing member, and annular perforations preferably placed as far from the centre of the disc as possible. Suitably the annular perforations are 25 to 60 thou (0.635 to 1.524 mm), preferably about 40 thou (1.016 mm) in width (measured in a radial direction). The disc reduces the amount of powder introduced into the bulb on the return of the needle after the piercing action. It appears that much of the powder sucked back lodges around the needle and is then displaced back into the chamber when the bulb is squeezed or otherwise collapsed to insufflate the powder.

The device according to the invention may be used for the administration of medicaments for the alleviation of ailments of the bronchial or nasal tract and of the lungs, e.g. hayfever. The device may also be used for administration of medicaments having systemic action, for example, it may be used for the administration of antidotes to poisonous substances, such as nerve gases,

as it provides a very simple method of carrying medicaments which have to be used rapidly or in emergency. If desired, the device may be provided with clips, cup-like receptacles or the like on or in the housing whereby a number of powder containers may be stored on or in the device for future use. By this means a user is provided with a device whereby a drug may be administered speedily and easily and with a ready supply of capsules or the like for his immediate needs, for example, a day's supply of four to six capsules.

By way of example the device according to the invention will be described with reference to the accompanying drawings in which Figure 1 and Figure 2 represent cross-sections of two embodiments of the device and in which like numerals denote like parts.

In Figures 1 and 2 the device comprises a housing 1, having a detachable nose-piece 2 and a removable protective cap 3 for the nose-piece 2. A chamber 4 in which a capsule (not shown) may be mounted is formed by recessed portions in housing 1 and nose-piece 2. The chamber 4 is proportioned such that the clearance between the walls of the chamber 4 and the capsule is from 10 to 50 thou (0.254 to 1.270 mm). A channel 5 of semi-circular cross section having a diameter of about 20 thou (0.508 mm) is formed in the nose-piece end of the chamber 4 to improve the air flow around the end of the perforated capsule. The other end of the chamber 4 includes an aperture 6 through which a needle 7 may pass to perforate both ends of the capsule. Below the aperture 6 is a guide sleeve 9 secured to, or formed integrally with, the housing 1. At the chamber end of the guide sleeve 9 is a disc 11 formed integrally with the sleeve 9 and having annular apertures 12 and a central aperture which supports the needle 7, which needle is mounted in a block 8. The disc acts to minimise the sucking back of the powder as described above. In the base of the flexible rubber or polymeric bulb 14 is an air inlet non-return valve 15 through which air can enter the bulb. On the outer side the valve 15 are cross-pieces 16 which prevent the valve being blocked by the operator's fingers.

In Figure 1 the block 8 is slideably mounted in the guide sleeve 9, which is formed as an integral unit with finger pieces 10, the guide sleeve 9 includes window portions 13 which allow free passage of air between the interior of the guide sleeve 9 and the interior of the bulb 14 mounted about the guide sleeve 9. The block 8 is fixedly mounted on a grommet formed integrally with the valve 15 and has a shoulder 17 which engages a projection 18 on the guide sleeve 9 to hold the bulb 14 under slight tension when the needle 7 is in the withdrawn position thus biasing the needle into a fully withdrawn position. The engagement of the shoulder 17 and the projection 18 also prevents the needle 7 being withdrawn from the guide sleeve 9.

In Figure 2 a second guide sleeve 20 is mounted on the block 8 and in sliding engagement with guide sleeve 9. The second guide sleeve 20 is provided with slots 21 in which the projections 18 on the guide sleeve 9 run.

In operation of the devices of both Figure 1 and Figure 2 cap 3 is removed, and a capsule inserted into the chamber 4 by removing the nose-piece 2, inserting the capsule, and replacing the nose-piece 2. The capsule is pierced at both ends by depressing the base of the bulb 14 in the direction of the arrow A, and allowing the bulb to return to its original configuration. The nose-piece 2 is then inserted in a nasal passage and the powder in the capsule insufflated by squeezing the bulb 14 in the direction of the arrows B.

WHAT WE CLAIM IS:—

1. A device for dispensing a medicament in finely divided powder form, which comprises a hollow elongate housing having a passageway to permit the passage of air through the device, the passageway having a first end adapted for insertion into a nasal or other bodily passage; means capable of forcing air through the passageway from a second end thereof; mounting means forming part of the passageway and adapted to receive a container for the finely divided medicament; and perforating means, mounted within the means capable of forcing air through the device, for reciprocating movement substantially along the long axis of the housing to perforate the container for the finely divided medicament.

2. A device according to Claim 1, wherein the means capable of forcing air through the passageway is a collapsible bulb made of rubber or a flexible polymer.

3. A device according to Claim 2, wherein the bulb has a non-return air inlet valve.

4. A device according to Claim 3, wherein the exterior of the non-return air inlet valve is provided with spacer members adapted to allow air to pass between them when a finger is placed over the valve.

5. A device according to any one of Claims 2 to 4, wherein the size of the bulb is such that a medicament container mounted in the device may be emptied in less than four squeezes of the bulb.

6. A device according to any one of the preceding Claims, wherein the first end of the passageway is formed as a removable nose-piece.

7. A device according to Claim 6, wherein

as it provides a very simple method of carrying medicaments which have to be used rapidly or in emergency. If desired, the device may be provided with clips, cup-like receptacles or the like on or in the housing whereby a number of powder containers may be stored on or in the device for future use. By this means a user is provided with a device whereby a drug may be administered speedily and easily and with a ready supply of capsules or the like for his immediate needs, for example, a day's supply of four to six capsules.

By way of example the device according to the invention will be described with reference to the accompanying drawings in which Figure 1 and Figure 2 represent cross-sections of two embodiments of the device and in which like numerals denote like parts.

In Figures 1 and 2 the device comprises a housing 1, having a detachable nose-piece 2 and a removable protective cap 3 for the nose-piece 2. A chamber 4 in which a capsule (not shown) may be mounted is formed by recessed portions in housing 1 and nose-piece 2. The chamber 4 is proportioned such that the clearance between the walls of the chamber 4 and the capsule is from 10 to 50 thou (0.254 to 1.270 mm). A channel 5 of semi-circular cross section having a diameter of about 20 thou (0.508 mm) is formed in the nose-piece end of the chamber 4 to improve the air flow around the end of the perforated capsule. The other end of the chamber 4 includes an aperture 6 through which a needle 7 may pass to perforate both ends of the capsule. Below the aperture 6 is a guide sleeve 9 secured to, or formed integrally with, the housing 1. At the chamber end of the guide sleeve 9 is a disc 11 formed integrally with the sleeve 9 and having annular apertures 12 and a central aperture which supports the needle 7, which needle is mounted in a block 8. The disc acts to minimise the sucking back of the powder as described above. In the base of the flexible rubber or polymeric bulb 14 is an air inlet non-return valve 15 through which air can enter the bulb. On the outer side the valve 15 are cross-pieces 16 which prevent the valve being blocked by the operator's fingers.

In Figure 1 the block 8 is slideably mounted in the guide sleeve 9, which is formed as an integral unit with finger pieces 10, the guide sleeve 9 includes window portions 13 which allow free passage of air between the interior of the guide sleeve 9 and the interior of the bulb 14 mounted about the guide sleeve 9. The block 8 is fixedly mounted on a grommet formed integrally with the valve 15 and has a shoulder 17 which engages a projection 18 on the guide sleeve 9 to hold the bulb 14 under slight tension when the needle 7 is in the withdrawn position thus biasing the needle into a fully withdrawn position. The engagement of the shoulder 17 and the projection 18 also prevents the needle 7 being withdrawn from the guide sleeve 9.

In Figure 2 a second guide sleeve 20 is mounted on the block 8 and in sliding engagement with guide sleeve 9. The second guide sleeve 20 is provided with slots 21 in which the projections 18 on the guide sleeve 9 run.

In operation of the devices of both Figure 1 and Figure 2 cap 3 is removed, and a capsule inserted into the chamber 4 by removing the nose-piece 2, inserting the capsule, and replacing the nose-piece 2. The capsule is pierced at both ends by depressing the base of the bulb 14 in the direction of the arrow A, and allowing the bulb to return to its original configuration. The nose-piece 2 is then inserted in a nasal passage and the powder in the capsule insufflated by squeezing the bulb 14 in the direction of the arrows B.

WHAT WE CLAIM IS:—

1. A device for dispensing a medicament in finely divided powder form, which comprises a hollow elongate housing having a passageway to permit the passage of air through the device, the passageway having a first end adapted for insertion into a nasal or other bodily passage; means capable of forcing air through the passageway from a second end thereof; mounting means forming part of the passageway and adapted to receive a container for the finely divided medicament; and perforating means, mounted within the means capable of forcing air through the device, for reciprocating movement substantially along the long axis of the housing to perforate the container for the finely divided medicament.

2. A device according to Claim 1, wherein the means capable of forcing air through the passageway is a collapsible bulb made of rubber or a flexible polymer.

3. A device according to Claim 2, wherein the bulb has a non-return air inlet valve.

4. A device according to Claim 3, wherein the exterior of the non-return air inlet valve is provided with spacer members adapted to allow air to pass between them when a finger is placed over the valve.

5. A device according to any one of Claims 2 to 4, wherein the size of the bulb is such that a medicament container mounted in the device may be emptied in less than four squeezes of the bulb.

6. A device according to any one of the preceding Claims, wherein the first end of the passageway is formed as a removable nose-piece.

7. A device according to Claim 6, wherein

* C L M S *

removal of the nose-piece provides access to the mounting means.

8. A device according to any one of the preceding Claims, wherein the end of the mounting means remote from the first end of the passageway has an aperture through which the perforating means and air may pass.

9. A device according to any one of the preceding Claims, wherein the dimensions of the mounting means and of a container mounted in the mounting means are such that air may pass around as well as through the container.

10. A device according to any one of the preceding Claims, wherein a container is mounted in the mounting means and there is a clearance of between 0.254 and 1.27 mm between the container and the walls of the mounting means.

11. A device according to any one of the preceding Claims, wherein the end of the mounting means adjacent to the nose-piece is provided with a channel adapted to provide a flow of air across a perforation in the end of a container which is mounted in the device adjacent to the first end of the passageway.

12. A device according to any one of the preceding Claims, wherein the perforating means comprises a retractable needle.

13. A device according to Claim 12, wherein the needle is plated or coated to inhibit corrosion or to lubricate the passage of the needle through the capsule.

14. A device according to either Claim 12 or Claim 13, wherein the perforating end of the needle is sharpened with a plane at an acute angle.

15. A device according to any one of the preceding Claims, wherein the perforating means is such as to be able to perforate both ends of the container.

16. A device according to any one of Claims 12 to 15, wherein the needle is mounted on a mounting block slideable in a guide sleeve or on guide rails.

17. A device according to any one of Claims 12 to 15, wherein the needle is mounted on a mounting block provided with a second guide sleeve which is adapted to co-operate slideably with a first guide sleeve.

18. A device according to Claim 16 or Claim 17, wherein the block is mounted on a grommet at the base of the bulb and the grommet is formed integrally with a non-return valve.

19. A device according to any one of Claims 16 to 18, comprising means preventing the needle being withdrawn from the guide sleeve.

20. A device according to any one of Claims 12 to 19, wherein the means for forcing air through the device comprises a collapsible bulb made of rubber or flexible polymer and the bulb is adapted to bias the needle into a fully withdrawn position.

21. A device according to Claim 16, wherein the windows are formed in a portion of the guide sleeve projecting into the bulb.

22. A device according to any one of Claims 12 to 21, wherein the needle does not project from the nose-piece during or after the piercing operation.

23. A device according to any one of Claims 12 to 22, wherein the needle passes through a perforated disc external to the mounting means, but adjacent to that end of the mounting means remote from the first end of the passageway.

24. A device according to Claim 23, wherein the disc has a central perforation to support the needle and annular perforations spaced as far from the centre of the disc as possible.

25. A device according to Claim 1 and substantially as hereinbefore described and shown in either one of Figures 1 or 2 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1973.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

