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INHALER

The present invention relates to an inhaler, more particularly an inhaler for administering dry powder. It
5 also relates to blister packs containing powder for use with the inhaler and to a method of dispensing powder from a blister.

It is known to provide certain medicaments in the form of a dry powder for inhalation for the treatment of
10 respiratory conditions such as asthma.

It is also known to store individual doses separately in a sealed pack commonly known as a blister pack. The blister pack preferably comprises a series of moulded depressions each containing a dose of powder and sealed by
15 a cover such as a foil. Either the user has manually to peel away the foil from an individual blister or a complex mechanism has to be provided to puncture the foil or cup-shaped part of the blister.

The task of finding the edge of a foil and peeling it
20 away from the blister without spilling any of the contained powder can be difficult for some patients, for instance the young, the elderly or those actually experiencing an asthma attack. On the other hand, mechanisms for automatically opening a blister are complicated and therefore costly to
25 produce. Furthermore, the automatic mechanisms do not peel the foil from the blister, but cut the foil or the cup-shaped portion of the blister itself. In some cases, this



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can give rise to the danger of parts of the foil or blister themselves becoming detached and joining the inhalation air stream. Furthermore, it has proved extremely difficult to cut the foil or blister in such a way as to ensure that all
5 of the powder is removed from the blister or at least that a consistent proportion of the powder is removed.

According to the present invention there is provided an inhaler for administering dry powder, the inhaler comprising:

- 10 an inhaler body extending between two ends;
 an outlet at one of said two ends;
 a suction tube at the other of said two ends; and
 an inhalation channel within said body providing
fluid connection between said suction tube and said outlet;
15 wherein

 the suction tube is shaped and dimensioned for insertion into a blister containing powder such that inhalation through the inhaler body will draw powder from the blister through the suction tube and inhalation channel
20 and out of the outlet.

There is also provided a method of transferring powder from a blister to the outlet of a device, the device having an inlet connected to the outlet by means of a channel, the method comprising:

- 25 inserting the inlet into the blister; and
 drawing air out of the outlet so as to form an air stream into the inlet and through the device, the airstream

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picking up powder from the blister and carrying it through the channel to the outlet.

Thus, there may be provided a device which is relatively simple to construct, of relatively low cost to the user, simple to use and yet extremely effective in removing powder from the blister.

Since the inhaler body is separate from the blister pack, it has the additional advantage of being easily cleaned either at regular intervals or when needed. The inhaler body may be cleaned in any way, including total emersion in water, without any danger of contaminating or interfering with the operation of the inhaler. This is in contrast with previous more complicated inhalation devices, where, even if the powder is sealed in blisters, any powder previously retained in other parts of the inhaler may not be fully removed from the more complicated parts of the inhalation device and may interfere with correct operation of the device by being dampened through a washing operation.

According to the present invention there is also provided an inhaler for administering dry powder from a blister sealed by a thin film cover, the inhaler comprising:

a suction tube having an end for insertion into a blister; the end having:

a channel inlet through which powder may be drawn; and

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a cutter around only part of the channel inlet such that, upon insertion into a sealed blister, the cutter cuts the film cover around only part of the channel inlet so as to form a cut film flap.

5 In this way, the cover foil of the blister is assuredly severed as necessary whilst ensuring that the cut portion of the cover remains attached to the rest of the cover. In this way, the cut cover cannot be inhaled by a user.

10 Preferably, the cutter comprises a plurality of axially extending blades divided by axially extending gaps.

In this way, it is assured that an air flow path exists from the blister to the channel inlet within the cutter, since air can always flow through the axially
15 extending gaps. Furthermore, by virtue of the relationship between the blades and the gaps, the cover foil will tear to bridge the gaps between the cutters.

Preferably, the blades extend axially beyond the remainder of the end of the suction tube.

20 In this way, the blades first cut the cover foil, before pushing the cover foil away from the rest of the cover into the blister. The remainder of the end of the suction tube may come into contact with the cut cover foil at the last moments of insertion so as to assist in pushing
25 the flap into the blister.

By using such a cutter, integral with the channel inlet, the blister is only cut when the suction tube is



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being fitted into the blister. In this way, penetration of the cover foil takes place while the suction tube is being fitted on such that fitting and sealing with the blister lasts throughout the period of use and any losses are
5 avoided.

The present invention also provides an inhaler for administering dry powder from a blister sealed by a thin film cover, the inhaler comprising:

a suction tube having:

- 10 an end for insertion into a blister, the end having a channel inlet through which powder may be drawn; and
at least one inlet passage extending between a passage inlet at a position along the length of the suction tube and a passage outlet adjacent said channel inlet, such
15 that, with the end inserted into a blister, the inlet passage provides fluid connection between the blister and a space above the blister.

In this way, powder may be assuredly drawn from a blister, since inlet air channels are provided to the
20 blister. In particular, those inlet air channels may be provided at the outer periphery of the blister so as to assist in ensuring that all of the powder in the blister is removed.

Preferably, the inhaler further comprises a support
25 unit for supporting a blister pack, the support unit including respective guide portions for each blister of a supported blister pack, each guide portion being for

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guiding said suction tube into a respective blister and supporting the inhaler body with said suction tube so guided.

Alternatively, there may be provided a blister pack
5 comprising at least one blister housing a dose of medicament, the blister comprising:

a cup-shaped portion for holding said powder;

a thin film cover for sealing the powder in the blister; and

10 an axially elongate passage extending from said cup-shaped portion for guiding a suction tube of an inhaler into the blister.

In this way, it may be ensured that the inhaler body is correctly inserted into the blister. Since the inhaler
15 body is guided into the blister, consecutive uses of the inhaler body will be more consistent. Furthermore, the user has a feeling of greater confidence in using it.

Where the blister pack is formed as a substantially planar surface with a series of depressions forming
20 respective blisters, the support unit may include a guide wall to be positioned adjacent the substantially planar surface and having a series of apertures for alignment with the series of depressions, the guide wall extending away from the substantially planar surface so as to form the
25 guide portions. The support unit may include a housing within which the blister pack may be contained, with the guide wall being a wall of the housing.

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In this way, the blister pack is securely held in a housing convenient to the user with its blisters in alignment with the guide portions.

Preferably, the support unit includes a support member having a series of depressions for receiving the series of depressions of the blister pack such that in use each depression of the support member is located opposite a respective one of the series of apertures in the guide wall.

10 The support member may be moved in and out of the housing in any way, such as by a hinged mechanism, but, preferably, the support member is slidable in and out of the housing to load and unload blister packs in the support unit.

15 In this way, a blister may conveniently be loaded into or unloaded from the housing.

The support unit may include a holding section, such as a tray with a hinged lid, for holding the inhaler body when not in use.

20 This provides an extremely convenient overall inhaler for the user, enabling the inhaler body to be kept securely with the support unit.

The support member may have one or more projections or recesses with predetermined sizes and positions such that only blister packs with corresponding recesses or
25 projections may be received by the support member.

In this way, it can be ensured that only the correct

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type of blister pack is used in the inhaler. For instance, a particular inhaler may be intended for a particular medicament. In this case, the support member could be shaped so as only to receive blister packs containing that
5 particular medicament.

The shape of the inlet of the inhaler body and the guide portions of the support unit may also be specific to a particular type of inhaler, such that the inhaler body of one inhaler cannot be inserted into the guide portion of
10 another inhaler.

In this regard, the present invention also provides a range of blisters, each comprising a depression sealed with a thin film cover and each housing a dose of respective medicament, the respective size and/or shape of
15 each depression uniquely identifying the type of medicament within the respective depression.

It should be appreciated that the present invention is applicable with blister packs including any number of blisters, including only one.

20 Medicaments suitable for administration by using the present invention are any which may be delivered by inhalation. Suitable inhalable medicaments may include for example β 2-adrenoreceptor agonists for example salbutamol, terbutaline, rimiterol, fenoterol, reproterol, adrenaline,
25 pirbuterol, isoprenaline, orciprenaline, bitolterol, salmeterol, formoterol, clenbuterol, procaterol, broxaterol, picumeterol, TA-2005, mabuterol and the like,



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- and their pharmacologically acceptable esters and salts; anticholinergic bronchodilators for example ipratropium bromide and the like; glucocorticosteroids for example beclomethasone, fluticasone, budesonide, tipredane,
- 5 dexamethasone, betamethasone, fluocinolone, triamcinolone acetonide, mometasone, and the like, and their pharmacologically acceptable esters and salts; anti-allergic medicaments for example sodium cromoglycate and nedocromil sodium; expectorants; mucolytics;
- 10 antihistamines; cyclooxygenase inhibitors; leukotriene synthesis inhibitors; leukotriene antagonists, phospholipase-A2 (PLA2) inhibitors, platelet aggregating factor (PAF) antagonists and prophylactics of asthma; antiarrhythmic medicaments, tranquilisers, cardiac
- 15 glycosides, hormones, antihypertensive medicaments, antidiabetic- antiparasitic- and anticancer-medicaments, sedatives and analgesic medicaments, antibiotics, antirheumatic medicaments, immunotherapies, antifungal and antihypotension medicaments, vaccines, antiviral
- 20 medicaments, proteins, polypeptides and peptides for example peptide hormones and growth factors, polypeptides vaccines, enzymes, endorphines, lipoproteins and polypeptides involved in the blood coagulation cascade, vitamins and others, for example cell surface receptor
- 25 blockers, antioxidants, free radical scavengers and organic salts of N,N'-diacetylcystine.

The present invention will be more clearly understood

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from the following description, given by way of example only, with reference to the accompanying drawings, in which:

Figures 1, 2 and 3 respectively show top, end and
5 side views of an inhaler housing;

Figure 4 illustrates an inhaler body inserted into a guide portion of the inhaler housing;

Figures 5 and 6 respectively show perpendicular side views of the inhaler body;

10 Figure 7 illustrates the cross-section VII-VII indicated in Figure 6;

Figure 8 illustrates the mouthpiece end of the inhaler body;

15 Figure 9 illustrates the inlet end of the inhaler body;

Figure 10 illustrates an enlargement of Figure 9;

Figure 11 illustrates the cross-section of the inhaler body and inhaler housing indicated by XI-XI in Figure 4;

20 Figure 12 illustrates the cross-section of the inhaler body indicated by XII-XII in Figure 6;

Figure 13 illustrates the cross-section of the inhaler body indicated by XIII-XIII in Figure 5;

25 Figure 14 illustrates the inlet of the inhaler body inserted into a blister contained in the inhaler housing;

Figure 15 illustrates a cross-section of the inhaler body inserted into a blister contained in the inhaler

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housing, but with a viewing angle perpendicular to that illustrated in Figures 11 and 14;

Figure 16 illustrates the upper portion of an inhaler housing of another embodiment;

5 Figure 17 illustrates an inhaler body inserted into a support unit according to another embodiment;

Figure 18 illustrates a blister pack for use with an embodiment of the present invention;

10 Figure 19 illustrates the support unit of Figure 17 adjacent the blister pack of Figure 18;

Figure 20 illustrates a cross-section of the support unit on the blister pack indicated by XX-XX in Figure 19;

Figure 21 illustrates a top view of two of the guide portions of the support unit of Figure 19;

15 Figure 22 illustrates a variation of the support unit of Figure 21;

Figure 23 illustrates a cross-section through a guide portion and blister as indicated by XXIII-XXIII in Figure 22;

20 Figure 24 illustrates a blister pack having individualizing features outside the cup-shaped blisters;

Figure 25 illustrates an enlargement of part of the blister pack of Figure 24 illustrating an individualizing feature;

25 Figure 26 illustrates a cross-section through the blister pack of Figures 24 and 25 as indicated by XXVI-XXVI in Figure 25;



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Figure 27 illustrates a blister pack with an alternative form of individualizing feature;

Figure 28 illustrates a cross-section of a variation of the inlet of an inhaler body as indicated by XXVIII-
5 XXVIII in Figure 29; and

Figure 29 illustrates a view of the inlet of the inhaler body of Figure 28.

The basic operation of the preferred inhaler will be described with reference to Figures 1 to 4.

10 The inhaler comprises two main components, a blister pack container V and an inhaler body S. A protective covering may be provided for the container V.

The blister pack container V houses a blister pack, such as illustrated in Figure 18, containing doses of
15 powdered medicament. It has an array of guide portions L corresponding respectively to an array of blisters in the blister pack. It may be of a size similar to a tissue pack or cigarette pack.

The inhaler body S is preferably of a length which
20 corresponds approximately to the small finger of an adult human hand and is normally housed in a chamber 34 to be described later. Having removed the inhaler body S from the chamber 34, its inlet end 19,20 is inserted into one of the guide portions L and pushed down into the container V
25 so as to rupture the sealing foil of the respective blister contained beneath the respective guide portion L.

As will be described below, the inhaler body S

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includes an inhalation channel 31 which extends between the inlet 19,20 and a mouthpiece 17. Thus, with the inlet 19,20 inserted into a blister, a user may inhale from the mouthpiece 17 and through the inhalation channel 31 so as to draw the powder contained in the blister out through the inhaler body S which acts as an inhalation flow bridge. As will be apparent, successive doses are achieved by successively inserting the inhaler body S into a guide portion L corresponding to a previously unused respective blister.

As illustrated, the container V includes a housing 1 in which a blister pack is contained. Furthermore, in the preferred embodiment, it includes a chamber 34 in which the inhaler body S may be stored when not in use. As illustrated, the chamber 34 is closed by a lid 33 which may pivot open and closed by means of a hinge pin 35. The closing joint is obliquely running so that more gripping surface area remains on the closure cap or lid 33 with a corresponding overhang on the top wall side for better grasping. The joint is preferably at 45° with respect to the planar extent of the housing. Other arrangements are, of course, possible. For instance, the inhaler body S could be inserted axially into an opening in the side of the housing 1. In any arrangement, it is also possible to provide an elongate brush onto which the body S is fitted. In this way, whenever the body S is stored, it is not only held in place by the brush extending through its inhalation

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channel 31, but is also cleaned. Indeed, as the body S is pulled off the brush, it is cleaned immediately prior to use.

In order to prevent the body S and container V from
5 being separated and one being lost, it is possible to provide a member, such as a cord for attaching one to the other. Preferably a very fine light cord like member should be used. This can be automatically retracted back into one or other of the body S and container V by means of
10 a sprung mechanism. For example, the cord can be wound around a roller which unwinds against a relatively gentle resilient force.

The blister pack to be used in the inhaler is preferably similar to that illustrated in Figure 18. This
15 blister pack 2 has a generally planar, thin walled sheet body 11 in which depressions 8 are formed to contain powder 9. In particular, the depressions 8 are formed as cup-like portions 10. The sheet body 11 is then covered with a thin sheet 14, such as a foil, preferably aluminium, so as to
20 form unsupported portions 14' which seal the powder 9 in the depressions 8.

As explained above, the blister pack 2 is located in the housing 1 such that individual blisters 8 are positioned directly beneath guide portions L. In
25 particular, the housing 1 is provided with a substantially planar guide wall 6 against which the blister pack 2 is positioned. The guide wall 6 has apertures through its

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thickness so as to form the guide portions L and guide the inlet portion 19,20 of the inhaler body S to the unsupported cover foil 14' and receive the inlet portion such that it does not tilt. The guide portions may take
5 the form of frames surrounding the unsupported portions 14' of the cover foil. However, in one embodiment the underside of the guide wall 6 is provided with elongate walls 6' which, as illustrated in Figure 11, hold the blister pack 2 spaced apart from the lower surface of the
10 guide wall 6. The elongate walls 6' are located between adjacent rows of guide portions L and extend across the width of the container V. They act to hold a blister pack 2 securely with respect to the guide wall 6 and the supporting tray 3 to be described below. However, by
15 providing a space between the blister pack 2 and the guide wall 6 in the regions of guide portions L, the elongate walls 6' allow a good flow of air around and into any particular blister being used.

The blister pack container V preferably allows
20 blister packs 2 to be replaced, such that a single inhaler may be used with successive blister packs 2 as they are emptied. It is possible to provide many different mechanisms for loading and unloading a blister pack 2 to and from the container V, such as by providing a hinged
25 back. However, in the preferred embodiment, a slidable tray 3 is provided. The tray 3 slides in and out of one end of the housing 1 and is itself preferably provided with

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a series of depressions or cup receiving cavities 12 corresponding to the spacing of the cups 10 of the blister pack 2. In this way, the blister pack 2 may be laid onto the withdrawn tray 3 and be securely located such that when the tray 3 is inserted back into the housing 1, the blisters 8,10 and unsupported cover foils 14' are correctly aligned with the guide portions L. The cup receiving cavities 12 correspond, at least in outline, to the cups 10 of the blister pack 2 which, as illustrated are cylindrical in the region of attachment close to the top sheet. The cavities 12 form a crater structure ordered in the form of criss-crossing rows and partition walls 13 support the resting sheet body 11 by their end faces.

In order to facilitate removal of the tray 3, the illustrated embodiment is provided with a tab or handle 4 which protrudes into a recess 5 of the guide wall 6. As is apparent, the recess 5 is formed in the narrow-wall-side border region of the guide wall 6 without any overhang.

Preferably, the tray 3 is provided with some form of catch to secure it in the loaded position. This may be provided merely as a detent in opposing surfaces of the tray 3 and housing 1 or can be provided as part of the handle 4, such that the tray 3 is only released when the user deflects the handle 4 in some way.

As illustrated, in order to enable the tray 3 to be slid in and out of the housing 1, the housing 1 is provided with guides 7 having a generally C-shaped profile.

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Before considering precisely how the inhaler body S interacts with the guide portions L and blister pack 2, we will consider the inhaler body S itself with reference to Figures 5 to 13.

5 As best illustrated by the cross-sections of Figures 12 and 13, the inhaler body S generally comprises an elongate body having an inlet at one end, a mouthpiece 17 with an outlet at the other end and an inhalation channel 31 providing fluid connection between the inlet and the
10 outlet. In the preferred embodiment, the mouthpiece 17 and the outlet end of the inhaler body S are generally oval in shape, whereas the inlet end is generally circular in shape. As will become apparent from the following description, this is not essential, but does give rise to
15 some added advantages. In particular, a flatly oval shaped mouthpiece is more comfortable in the mouth than a circular one. Furthermore, by shaping the inhalation channel 31 as illustrated such that it diverges from the inlet end to the outlet, a higher velocity air flow may be achieved at the
20 inlet so as to improve both the collection of powder from the blister and deagglomeration of that powder.

As illustrated, despite the tapering of the inhalation channel 31, the general outer shape of the inhaler body S remains oval down most of its length, at
25 least up to the shoulder 21. Indeed, its general overall shape only changes at the shoulder 21 for the portion 19 which is to be inserted into the guide portions L of the



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blister pack container V. The flats of the oval provide space for the finger tips of a gripping hand. In order to maintain the oval shape, ribs 18 are provided down the length of the inhaler body S. These are preferable
5 features which provide the user with a convenient and secure means of gripping the inhaler body S. This is particularly useful, since a little force has to be applied to the inhaler body S when it is inserted into a guide portion L in order to rupture an unsupported cover foil
10 14'.

As illustrated, at the bottom of the series of ribs 18, just behind the supporting shoulder 21, inlets 32 are provided into the inhalation channel 31. These transverse air-admitting holes 32 are supplementary air inlets which
15 allow additional air to be drawn into the inhalation channel 31 and mix with the air and powder mixture being drawn up the inhaler body S from its inlet. The provision of such supplementary air inlets 32 allows the user to inhale a less concentrated mixture of powder. Furthermore,
20 the action of the supplementary air mixing with the air flow through the inhalation channel 31 provides some turbulence and assists in the deagglomeration of powder in the air stream. This effect is enhanced by the narrowing of the inhalation channel 31 as described above.
25 Preferably, the cross-section of the two transverse air-admitting holes 32 together correspond approximately to the circularly round cross-section of the suction channel 31 in

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the bottom region.

Provision of the supplementary air inlets 32 adjacent the shoulder 21 is advantageous since, when the inhaler body S is positioned in a guide portion L, the surround of the guide portion L makes it extremely difficult for a user to block the supplementary air inlets 32 with his or her fingers.

The inlet end of the inhaler body S can be considered to comprise two parts, namely a suction tube 19 and an annular cutter 20.

The suction tube 19 is shaped to fit securely in the guide portions L, whilst allowing air to be drawn down around its sides into the ruptured blister below. As illustrated, it is matched cross-sectionally to the shape of hole 15 and may be circular so that an interruption free, well supporting contact with wall 6 is achieved. It forms a plug connection with frictional contact.

As described above, a shoulder 21 is provided separating the suction tube 19 from the upper parts of the inhaler body. This shoulder 21 in use rests in a tilt-preventing manner on the upper side of the guide wall 6 and thus also abuts the guide wall 6 so as to ensure that the suction tube 19 is always inserted into the guide portion L and associated blister 8,10 by the same amount. The suction tube 19 is, of course, chosen to be of a length which positions its end at the location in a blister most suited to withdrawing powder.

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A feature of the suction tube 19 is the provision of air inlet channels 29 formed in its outer thickness and running down along its length. As will become apparent below and, indeed, as illustrated in Figure 14, these channels 29 provide an air path from above the surface of the blister pack down to a position below the ruptured cover foil 14'. In other words, during inhalation through the inhaler body S, air is drawn down through the air inlet channels 29 into the blister 8,10 to pick up the powder 9. The resulting air/powder mixture then continues up into the suction tube 19 and through the inhalation channel 31.

As illustrated, the annular cutter 20 is provided on the end of the suction tube 19. It has a number of cutting blades 28 arranged around a greater part of its outer periphery. The cutting blades are themselves separated from one another by gaps 26. In the illustrated embodiment, four gaps 26 are provided to form three annular cutting blades 28. The remaining fourth segment between the gaps 26 is not provided with a blade. As illustrated in Figures 5 and 15, this segment tapers up towards the top surface of the blister 8,10. Indeed, the annular cutter 20 may generally be angled relative to the axis of the inhaler body S such that the cutting blade 28 opposite the segment without a cutting blade contacts the cover foil 14' of the blister pack 2 before the other cutting blades 28.

As will be apparent from the figures, when the suction tube 19 is inserted into a guide portion L, the

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cutting blades 28 of the annular cutter 20 will come into contact with an unbroken cover foil 14'. Upon pushing the inhaler body S further into the guide portion L, the cutting blades 28 will start to cut the cover foil 14'. Of course, where the gaps 26 occur, the cover foil 14' will not as such be cut by a blade 28. However, the gaps 26 are of a size relative to the blades 28 and blister 8,10, such that the cover foil 14' will easily tear so as to provide a continuous cut in the cover foil 14' between the blades 28.

10 As mentioned above, the blades 28 of the annular cutter 20 do not extend around the entire annulus of the suction tube 19, but leave a segment, preferably of about 90°, which does not cut the cover foil 14'. Indeed, it does not start to come into contact with the cover foil 14' until the

15 cutting blades 28 have cut the cover foil 14' and have been inserted into the volume of the blister 8,10. The cutting blades 28 are merely sharpened edges of the full thickness of the annular cutter 20 and are positioned at the outer edge of the thickness of the annular cutter 20. Therefore,

20 as the suction tube 19 is pushed further into the blister 8,10, the annular cutter 20 pushes with it the cut cover foil 14'. That section of the cover foil 14' which is not cut thus acts as a hinge 27. In other words, there is left a virtually hinge-forming bridge between the valve flap-

25 like punched free tabs of the unsupported portion 14' and the bordering zone of the unsupported portion 14'. With the suction tube 19 fully inserted into the blister 8,10,

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the segment of the annular cutter 20 without blades 28 can come into contact with the foil, but then only to ensure that the cut cover foil 14' is pushed down into the blister 8,10, thereby ensuring that the inhalation channel inlet
5 formed in the centre of the annular cutter 20 is open to the interior of the blister 8,10.

Preferably, the cover foil 14' is cut so as to leave the hinge at an upper side as viewed in Figure 1. This is because, in normal use, the device will be held with a
10 blister pack tilted down from the far end such that powder in individual blisters will collect away from the hinge for easy removal.

It will be appreciated that the cutting and insertion arrangement ensures that reliable and consistent cutting of
15 cover foils 14' always occurs, whilst also ensuring that the cut cover foil 14' cannot, because of the hinge 27, be carried into the inhalation air stream of the user. The interruptions of the radially inwardly undercut blade 28 achieves peripheral longitudinally directed air-inlet
20 channels 29 which cannot be blocked by the cover foil material, as air-inlet cross-sections. The channels 29 in the sides of the suction tube 19 ensure that air is effectively drawn into the blister 8,10 under the cover foil 14. They also direct the inlet air into the outer
25 periphery of the blister 8,10 at a number of positions so as to ensure that powder 9 throughout the blister 8,10 is exposed to the flow of air. The gaps 26 on the other hand



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ensure that the resulting air-powder mixture will always be able to flow past the cut cover foil 14' up into the inhalation channel 31.

Returning to Figures 1 and 4, it will be noted that the guide portions L are not formed merely as simple circular holes, but are formed as holes 15, with radial extensions 16, 16' and 25. Indeed, to use the space available most efficiently, horizontally adjacent holes 15 share extensions, such that they are joined by common extension 16.

Corresponding to those extensions 16, 16' and 25, the suction tube 19 of the inhaler body S is provided with protrusions 23 and 24. Figure 14 illustrates how the protrusions 23 fit into the extensions 16 (or 16'). It is self evident how, similarly, the protrusion 24 fits into the extension 25.

The corresponding extensions 16, 16', 25 and protrusions 23, 24 hold an inserted inhaler body S more securely in a guide portion L and therefore make the inhaler easier and more pleasing to use.

The use of an asymmetric arrangement of extensions and protrusions means that the inhaler body S may only be inserted with one particular predetermined orientation. This provides more consistent and pleasing operation for the user. Furthermore, if the blisters have a non-symmetric cup shape, then this is also advantageous for the reason that it ensures that the suction tube 19 is always

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inserted with the correct orientation.

Irrespective of the nature of the blisters, ensuring that the inhaler body S is always inserted with the same orientation has the following advantage. The user is only
5 able to insert the suction tube 19 of the inhaler body S into a previously used blister with the same orientation as was previously used. If a user accidentally inserts the suction tube 19 of the inhaler body S into a previously
10 used blister and inserts it with the opposite orientation to that used previously, then the cut cover foil 14' can become completely detached, thereby allowing the user to inhale it. However, with the arrangement described above, this is not possible.

As illustrated in Figure 14, the protrusions 23 and
15 24 abut the top surface of the blister pack 2. Indeed, a shoulder 22 is provided to abut the blister pack 2 and the protrusions 23 and 24, where provided, form part of this abutting shoulder. The abutment of the shoulder grips the blister pack against the upper side of the partition wall
20 13, circumscribing the cup receiving cavity 12. In this way, it is ensured that, irrespective of the position of the shoulder 21, variations occurring for instance for tolerance reasons, the annular cutter 20 and suction tube 19 will not be inserted too far into a blister 8,10. This
25 is particularly important, since, if the suction tube 19 were inserted too far, the segment of the annular cutter 20 without blades 28 might tear and detach the cover foil 14'.

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Of course, it is possible to use many other different shapes for the guide portions L. Figure 16 illustrates one possibility, namely the use of holes 15 with flattened sides 37. Such arrangements can replace the protrusions and extensions above in fixing the relative orientation of the inhaler body S and guide portions L. Preferably, the flattening 37 lies on a side diametrically opposite the film hinge 27 parallel thereto. This leads to an even shorter valve-flap-like freeing cut. The opening region at the end face of the suction tube 19 is thus kept even more free. Moreover, due to gravity, the material accumulates in front of the free end of the flap, powder 9 taking up a small proportion of the volume of the cup.

So far, the invention has only be described with relation to a blister pack container V. However, it is also possible to provide an equivalent device G such as illustrated in Figure 17, which does not contain the blister pack 2.

The device G basically comprises a guide wall 6, such as the guide wall of the previous embodiment, with stubs 36 forming the holes 15 of the guide portions L. The stubs 36 receive the suction tube 19 such that it does not tilt. The device G can be produced from a plastics material.

The device G can be embodied in two functionally equivalent but commercially different ways. It can be provided as an integral part of a blister pack as illustrated in Figure 19 or, as with the previous

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embodiment, as a separate device for use with successive blister packs 2.

When the device G is produced as part of the blister pack itself, the guide wall 6 can be fixed to the covering foil 14, for instance by adhesive or heat sealing. However, when the device G is produced as a separate item, it is preferably provided with some means of releasably securing a blister pack to its back surface and holding it in the correct relative position. For example, three of the four edges of the device G could be provided with generally C-shaped lips, such that a blister pack could be slid into position on the device G from the edge without such a lip.

Functionally, the device G is used in the same way as container V. In particular, the suction tube 19 and annular cutter 20 of an inhaler body S are inserted into the opening 15 of the guide portion L so as to rupture all but a hinge 27 of the cover foil 14'.

Rather than have a chamber such as used with the container V, the device G can be provided with one or more clips, for instance resilient claws, for attaching the body S to it.

In the illustrated embodiment, the guide portions L are not provided with extensions. Therefore, the suction tube 19 of the inhaler body S is similarly not provided with protrusions. However, it is of course possible to provide other embodiments with protrusions/extensions or



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shaping of the guide portions L as described previously.
In this respect, the embodiment of Figures 22 and 23
differs slightly from that of Figures 20 and 21 in that,
like the embodiment of Figure 16, a flattened portion 37 is
5 provided on the opening 15 to ensure that the inhaler body
S is always inserted with the same orientation.

Both the embodiment of Figures 20 and 21 and the
embodiment of Figures 22 and 23 illustrate the use of stubs
36 with the same cross-section as the upper portion of the
10 blisters 8,10. In particular, the blister 8,10 of Figure
23 has a flattened portion 38 matching the flattened
portion 37 of the stub 36. However, it is not necessary
for a stub 36 to be the same shape as its blister 8,10. It
is desirable for those parts of the suction tube 19
15 inserted into a blister 8,10 to cover substantially all of
the area of the blister 8,10 so as to lift all of the
powder 9 from that blister 8,10. However, other portions
of the suction tube 19 and inhaler body S may extend beyond
the periphery of the blister 8,10. In this way, the shape
20 and/or size of the stub 36 may be freely varied. Indeed,
if the stubs 36 are at least partially larger than the
blisters 8,10, a shoulder, such as shoulder 22 described
for the previous embodiment may be provided on the inhaler
body S.

25 Before moving on, it should be noted that the
variation in the shape and size of the guide portions L,
whether in the holes 15 or stubs 36, has another



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significant advantage. The shape of the guide portions L may be chosen according to the medicament to be dispensed. In this way, inhaler bodies S can be shaped according to the medicament with which they are intended to be used.

- 5 Although the basic design of the inhaler body S is suitable for use with any medicament, it is preferable that a single inhaler body S is not used with different types of medicament. Thus, for a user who has to administer two or more types of medicament, by shaping the inhaler body S and
10 guide portions L uniquely according to the type of medicament, there will be no possibility of the user inadvertently using the inhaler body S with a different medicament.

Where a device G is adhered to blisters, any shaping
15 of the guide portions L, whether for distinguishing orientation, medicament or both is necessarily fixed relative to the blisters. However, for devices for use with the present invention where blister packs may be interchanged, it then becomes important that the user
20 always positions the blister pack relative to the device with the same orientation and/or only uses the device with blister packs containing the correct medicament. The present application therefore proposes a blister pack which not only includes a number of sealed blisters, but also
25 includes some means of distinguishing the orientation and/or contents of the blister pack.

It is conceivable, in an electronically controlled

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device, to provide a blister pack with some form of electronically readable information, for instance in the form of a magnetic strip or optical bar coding. In order to provide a distinguishing feature with a simple
5 mechanical system, it is proposed to provide the blister pack with portions having particular shapes, sizes and positions to distinguish orientation/medicament type. In particular, to distinguish orientation, the features should be asymmetric with respect to rotation of the blister pack
10 between its otherwise possible insertion orientations.

Figures 24 to 26 illustrate a blister pack where the planar sheet 11, in the intermediate zones 39 of the circularly round, cup-shaped depressions 8, is formed with three openings 40 in a specific distribution which, in the
15 illustrated embodiment, are still covered by the cover foil 14. These areas are placed in terms of their centre point at the corners of a square or rectangle. This embodiment is particularly well suited to the embodiment of Figure 1 where the blister pack is laid on a tray 3 before being
20 inserted into the blister pack container V. As illustrated in Figure 26, in this case, the tray 3 is provided with protrusions 41 corresponding in size, shape and position to the openings 40 of the blister pack 2. In this way, when the blister pack is laid onto the tray, with its blisters
25 8,10 in the corresponding recesses of the tray 3, the protrusions 41 fit into the openings 40. As is apparent from Figure 24, if the blister pack 2 were to be laid on

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the tray 3 with the opposite orientation, the protrusions 41 of the tray 3 would not align with the openings 40 of the blister pack 2, such that the blister pack 2 would stand proud of the tray 3 and prevent insertion into the blister pack container V. In the illustrated embodiment, it will be seen that there are twenty intermediate zone regions 39 in which to form openings, thereby allowing great possibilities for variations in combinations. Covering of the openings 40 with the foil 14 is
10 advantageous since the openings are thus hidden from sight.

The shape, positioning or size of the openings 40 in the blister pack 2 may also be used to distinguish a particular medicament. In this way, if a blister pack is used with a tray 3 having protrusions corresponding to a
15 different medicament, the blister pack 2 will again stand proud and prevent insertion.

The openings 40 and projections 41 described above have a lozenge-shaped or square outline. However, variations are of course possible, such as the provision of
20 slits 40 extending from the border 42 as illustrated in Figure 27. The illustrated slits are aligned such that they run oppositely. They extend parallel to the narrow sides of the long-rectangular basic outline of the packaging sheet 2. The length of the slits is greater than
25 half of the length of the narrow sides. Accordingly, the slits overlap each other in the central region of the packaging sheet 2. The arrangement of the slits is

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paracentral. The male die parts associated with this type of openings 40 are of a correspondingly web-like shape or blade like form and extend from the base 3 of the device. Also, as with other embodiments, the cover foil 14 can be
5 broken to correspond with the openings 40.

The blister pack could be provided with the protrusions, for instance as small redundant appropriately positioned blisters. Indeed, the protrusions could be provided as thermoformed projections like the cups 10.
10 Alternatively, the shape and positioning of the blisters themselves could distinguish orientations and/or medicament types.

For devices G for use with successive blister packs, the protrusions/recesses can be provided on the cover foil
15 14 face of the blister pack 2 and the opposing face of the device G. For the embodiment mentioned with C-shaped lips on opposing edges, it would also be possible to taper the width of the device G and blister pack 2 from one end to the other, such that it would only be possible to insert
20 the blister pack 2 into the device G narrow end first.

Figures 28 and 29 illustrate a variation to the suction tube 19 of the inhaler body S which is applicable to any of the previously described embodiments. In this variation, the air inlets 29 are not channels down the side
25 of the suction tube 19 terminating at the gaps 26 of the annular cutter 20, but are enclosed channels in the walls of the suction tube 19 having broad outlets adjacent the



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cutting blades 28 between the gaps 26, air being drawn in through openings 29' in the side of the suction tube 19. The outlets are ring-sector portions, denoted by a, b and c. This variation has the advantage of providing a flow of
5 air into the blister 8,10 around a greater periphery of the blister.

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CLAIMS

1. An inhaler for administering dry powder, the inhaler comprising:

- 5 an inhaler body (S) extending between two ends;
an outlet (17) at one of said two ends;
a suction tube (19,20) at the other of said two ends;
and

an inhalation channel (31) within said body (S)
10 providing fluid connection between said suction tube
(19,20) and said outlet (17); wherein

the suction tube (19,20) is shaped and dimensioned
for insertion into a blister containing powder such that
inhalation through the inhaler body (S) will draw powder
15 from the blister through the suction tube (19,20) and
inhalation channel (31) and out of the outlet (17).

2. An inhaler according to claim 1 further comprising:

a support unit (V,G) for supporting a blister pack
20 (2), the support unit (V,G) including respective guide
portions (L) for each blister of a supported blister pack
(2), each guide portion (L) being for guiding said suction
tube (19,20) into a respective blister and supporting the
inhaler body (S) with said suction tube (19,20) so guided.

25 3. An inhaler according to claim 2 for use with a
blister pack (2) comprising a substantially planar surface
having a series of depressions (10) forming respective

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blisters, the support unit (V,G) including a guide wall (6) to be positioned adjacent said substantially planar surface opposite said depressions and having a series of apertures (15,16) for alignment with the series of depressions, the
5 guide wall (6,36) extending away from said substantially planar surface so as to form said guide portions (L,36).

4. An inhaler according to claim 3 wherein the support unit (V) includes a housing (1) within which a blister pack (2) may be contained, the guide wall (6) being
10 a wall of said housing (1).

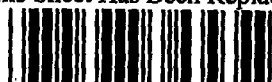
5. An inhaler according to claim 4 wherein the support unit (V) includes a support member (3) having a series of depressions (12) for receiving the series of depressions of the blister pack, in use, each depression
15 (12) of the support member (3) being located opposite a respective one of said series of apertures (15) in said guide wall (6).

6. An inhaler according to claim 5 wherein the support member (3) is slidable in and out of the housing
20 (1) to load and unload blister packs (2) in the support unit (V).

7. An inhaler according to claim 5 or 6 wherein the support member (3) has one or more projections (41) or recesses with predetermined sizes and positions such that
25 only blister packs (2) with corresponding recesses (40) or projections may be received by the support member (3).

8. An inhaler according to claim 7 wherein said

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one or more projections (41) or recesses (40) are positioned and/or sized such that said blister packs may only be received with a predetermined relative orientation.

9. An inhaler according to any one of claims 2 to 5 8 wherein said suction tube (19,20) and each of said series of apertures (15,16) are shaped such that said suction tube (19,20) can only be inserted through any one of said series of apertures (15,16) with a predetermined relative orientation.

10 10. An inhaler according to claim 9 wherein each of said series of apertures (15,16) is generally circular in shape with at least one radial extension (16,16').

11. An inhaler according to claim 10 wherein at least some of said series of apertures (15,16) are joined 15 together by way of the at least one radial extension (16,16').

12. An inhaler according to any one of claims 2 to 11 wherein the support unit (V) includes a holding section for holding said inhaler body (S) when not in use.

20 13. An inhaler according to claim 12 wherein the holding section comprises a tray with a hinged lid.

14. An inhaler according to any preceding claim wherein a channel inlet is formed in the end of the suction tube (19) and the end of the suction tube (19) has a cutter 25 (20) formed around only a part of the channel inlet such that, upon insertion into a sealed blister (8), the cutter (20) cuts a film cover (14') of the blister (8) around only

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part of the channel inlet so as to form a cut film flap (14').

15. An inhaler for administering dry powder from a blister (8) sealed by a thin film cover (14'), the inhaler
5 comprising:

a suction tube (19) having an end for insertion into a blister (8); the end having:

a channel inlet through which powder may be drawn;
and

10 a cutter (20) around only part of the channel inlet such that, upon insertion into a sealed blister, the cutter (20) cuts the film cover (14') around only part of the channel inlet so as to form a cut film flap (14').

16. An inhaler according to claim 14 or 15 wherein
15 the cutter (20) comprises a plurality of axially extending blades (28) divided by axially extending gaps (26).

17. An inhaler according to claim 16 wherein the blades (28) extend axially beyond the remainder of the end of the suction tube (19).

20 18. An inhaler according to any one of claims 14 to 17 wherein the cutter (20) is formed around the outer periphery of the suction tube (19) such that, when the suction tube (19) is inserted into a blister (8), the inner periphery of the suction tube (19) pushes the cut film flap
25 (14') into the blister (8).

19. An inhaler for administering dry powder from a blister (8) sealed by a thin film cover (14'), the inhaler



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comprising:

a suction tube (19) having:

an end for insertion into a blister (8), the end
having a channel inlet through which powder may be drawn;

5 and

at least one inlet passage (29) extending between a
passage inlet (29') at a position along the length of the
suction tube (19) and a passage outlet adjacent said
channel inlet, such that, with the end inserted into a
10 blister (8), the inlet passage (29) provides fluid
connection between the blister (8) and a space above the
blister (8).

20. An inhaler according to any one of claims 1 to
13 wherein a channel inlet is formed in the end of the
15 suction tube (19) and the suction tube (19) has at least
one inlet passage (29) extending between a passage inlet
(29') at a position along the length of the suction tube
(19) and a passage outlet adjacent said channel inlet, such
that, with the end inserted into a blister (8), the inlet
20 passage (29) provides fluid connection between the blister
(8) and a space above the blister (8).

21. An inhaler according to any one of claims 14 to
18 wherein the suction tube (19) has at least one inlet
passage (29) extending between a passage inlet (29') at a
25 position along the length of the suction tube (19) and a
passage outlet adjacent said channel inlet, such that, with
the end inserted into a blister (8), the inlet passage (29)

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provides fluid connection between the blister (8) and a space above the blister (8).

22. An inhaler according to claim 21 wherein the passage outlet is located adjacent the cutter (20).

5 23. An inhaler according to claim 21 or 22 when appendant to claim 16 wherein the passage outlet is located at one of said gaps (26).

24. An inhaler according to claim 21 or 22 when appendant to claim 16 wherein the passage outlet is located
10 between two of said gaps (26).

25. An inhaler according to any one of claims 19 to 24 wherein said inlet passage (29) comprises an open channel extending axially along an outer surface of the suction tube (19).

15 26. An inhaler according to any one of claims 19 to 24 wherein said inlet passage (29) extends within a peripheral wall of the suction tube.

27. An inhaler according to any preceding claim wherein, at a predetermined distance from said channel
20 inlet, the suction tube (19) includes a radial extension for use as a shoulder (22) against the periphery of a blister (8) to prevent the end of the suction tube (19) from being inserted too far into the blister (8).

28. An inhaler according to any preceding claim in
25 combination with the blister.

29. A blister pack comprising at least one blister housing a dose of medicament, the blister comprising:





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a cup-shaped portion (8) for holding said powder;
a thin film cover (14') for sealing the powder in the
blister (8); and

an axially elongate passage (36) extending from said
5 cup-shaped portion (8) for guiding a suction tube of an
inhaler into the blister (8).

30. A blister pack according to claim 29 wherein
the thin film cover (14') separates the cup-shaped portion
(8) and the elongate passage (36).

10 31. A blister pack according to claim 29 or 30
wherein the elongate passage (36) extends axially further
than the width of said cup-shaped portion (8).

32. A blister pack according to any one of claims
29 to 31 in combination with an inhaler having a suction
15 tube (19) for insertion into the elongate passage (36),
wherein

the cross-section of the elongate passage (36)
corresponds to the cross-section of at least part of the
suction tube (19), such that the elongate passage (36)
20 securely guides the suction tube (19) into the blister (8).

33. A blister pack according to claim 32 wherein
said cross-section is rotationally asymmetric so that the
elongate passage (36) guides the suction tube with a
predetermined orientation.

25 34. A blister pack according to claim 32 or 33
wherein said cross-section is of a predetermined size and
shape according to the type of medicament contained in said

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blister.

35. A blister pack comprising:

a series of blisters (8) housing respective doses of medicament, the blister pack (2) being shaped such that the orientation of the blister pack (2) may be uniquely determined.

36. A blister pack according to claim 35 comprising one or more of shaped blisters (8), recesses (40) and protrusions by which to uniquely determine the orientation.

10 37. A range of blisters, each comprising a depression (8) sealed with a thin film cover (14') and each housing a dose of respective medicament, the respective size and/or shape of each depression (8) uniquely identifying the type of medicament within the respective depression.

38. A method of constructing an inhaler for dispensing powder stored in the blister of a blister pack from an outlet of the inhaler, the method comprising:

providing an inhalation channel through the inhaler in fluid communication with the outlet; and

providing an inlet in the inhaler in fluid communication with the inhalation channel and for insertion into a blister such that inhalation through the inhaler will draw powder from the blister through the inlet and inhalation channel and out of the outlet.

39. A method according to claim 38 further comprising:

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providing a support unit (V,G) for supporting the blister pack (2);

providing in the support unit (V,G) respective guide portions (L) for each blister of a supported blister pack
5 for guiding said inlet (19,20) into a respective blister.

40. A method of transferring powder from a blister to the outlet of a device, the device having an inlet (19) connected to the outlet by means of a channel (31), the method comprising:

10 inserting the inlet (19) into the blister (8); and drawing air out of the outlet so as to form an air stream into the inlet (19) and through the device, the airstream picking up powder from the blister (8) and carrying it through the channel (31) to the outlet.

15 41. A method of constructing an inhaler for dispensing powder from a blister pack, in which doses of powder are individually stored in blisters (8) sealed by a thin film cover (14'), through a channel (31) of the inhaler, the method comprising:

20 providing a suction tube (19) for insertion into a blister (8);

providing a channel inlet in an end of the suction tube (19); and

25 providing a cutter (20) around only part of the channel inlet such that upon insertion of the suction tube (19) into a blister (8), the cutter (20) cuts the film cover (14') around only part of the channel inlet so as to



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form a cut film flap (14').

42. A method of transferring powder from a blister (8) sealed by a thin film cover (14') through a channel of a device having a suction tube (19), a channel inlet being
5 provided in an end of the suction tube (19) and a cutter (20) being provided around only part of the channel inlet, the method comprising:

inserting the suction tube (19) into the blister (8) such that the cutter (20) cuts the film cover (14') around
10 only part of the channel inlet so as to form a cut film flap (14'); and

drawing air through the channel so as to form an air stream to pick up powder from the blister (8).

43. A method of constructing an inhaler for
15 dispensing powder from the blister of a blister pack, through a channel of the inhaler, the method comprising:

providing a suction tube (19) for insertion into a blister (8);

providing a channel inlet in an end of the suction
20 tube (19); and

providing at least one inlet passage (29) extending between a passage inlet (29') at a position along the length of the suction tube (19) and a passage outlet adjacent the channel inlet, such that, with the end
25 inserted into the blister (8), the inlet passage (29) provides fluid connection between the blister (8) and a space above the blister (8).





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44. A method of transferring powder from a blister through a channel of a device having a suction tube (19), and end of the suction tube (19) being provided with a channel inlet, the suction tube (19) being provided with at least one inlet passage (29) extending between a passage inlet (29') at a position along the length of the suction tube (19) and a passage outlet adjacent the channel inlet, the method comprising:

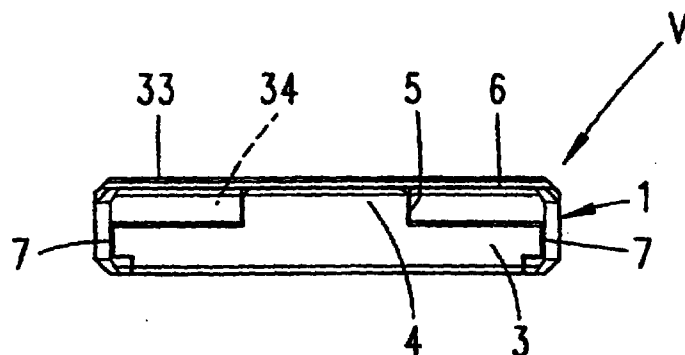
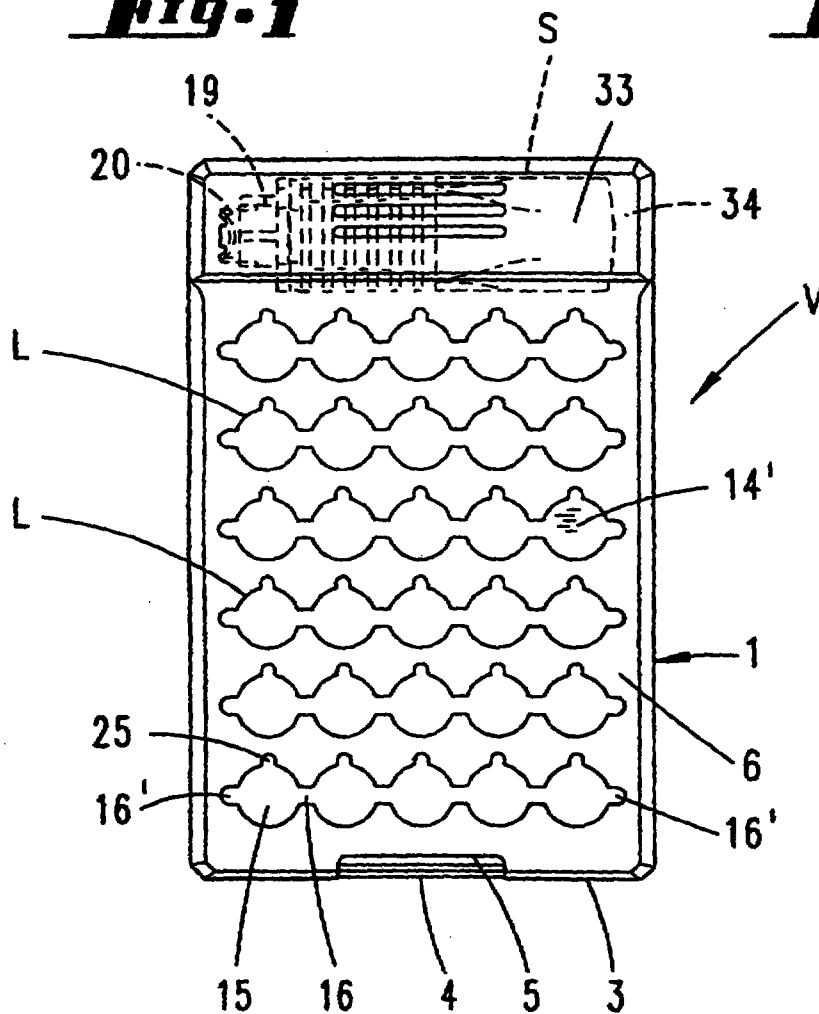
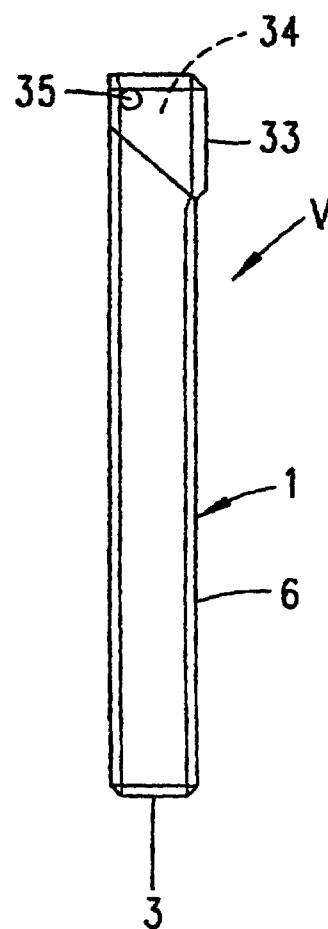
inserting the suction tube (19) into the blister (8) such that, with the end in the blister (8), the inlet passage (29) provides fluid connection between the blister (8) and a space above the blister; and

drawing air through the channel so as to draw air in the passage inlet (29'), through the inlet passage (29) and out of the passage outlet into the blister (8) and form an air stream picking up powder from the blister (8).

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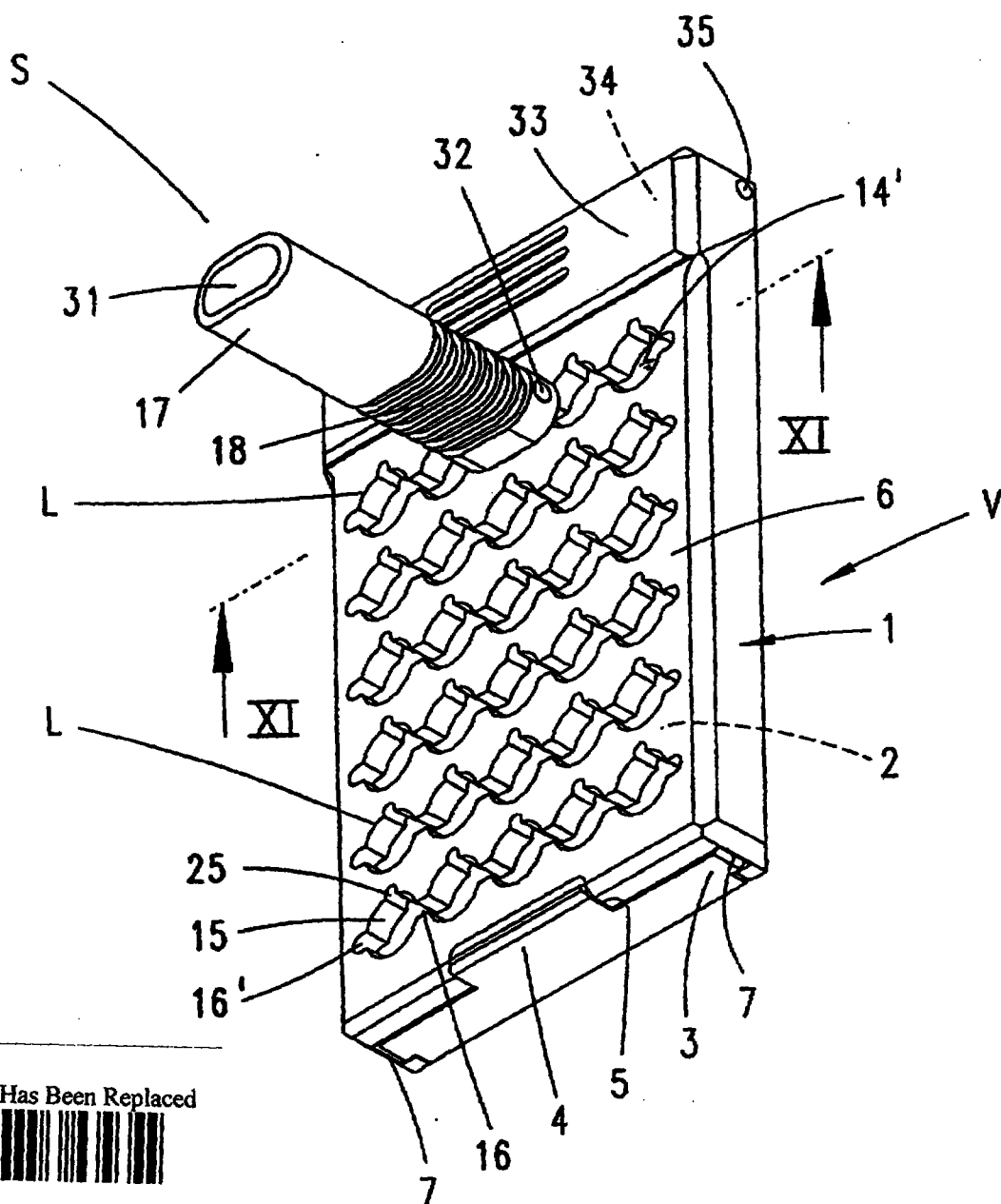


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Fig. 2**Fig. 1****Fig. 3**

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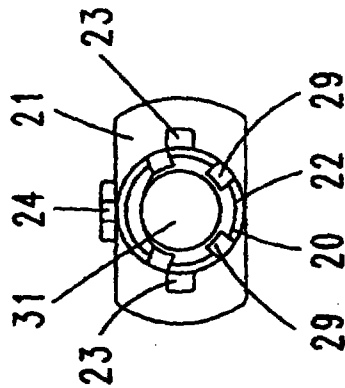


Fig. 4

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Fig. 9



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Fig. 5

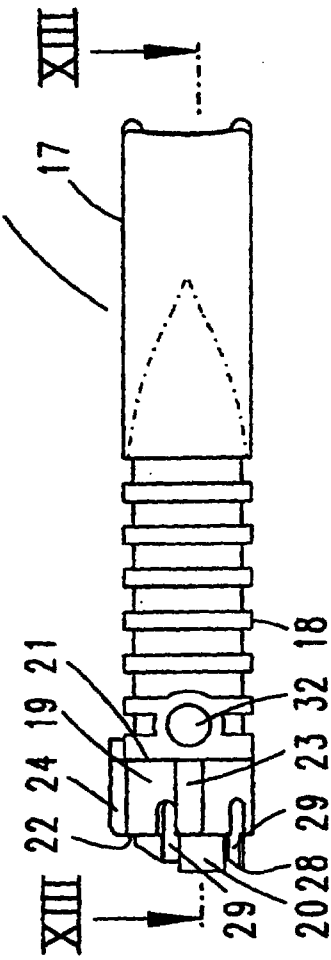


Fig. 8

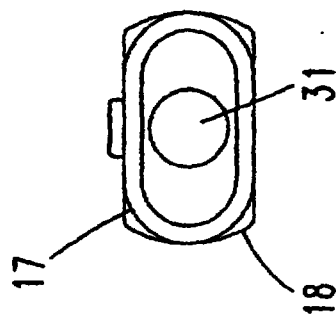


Fig. 7

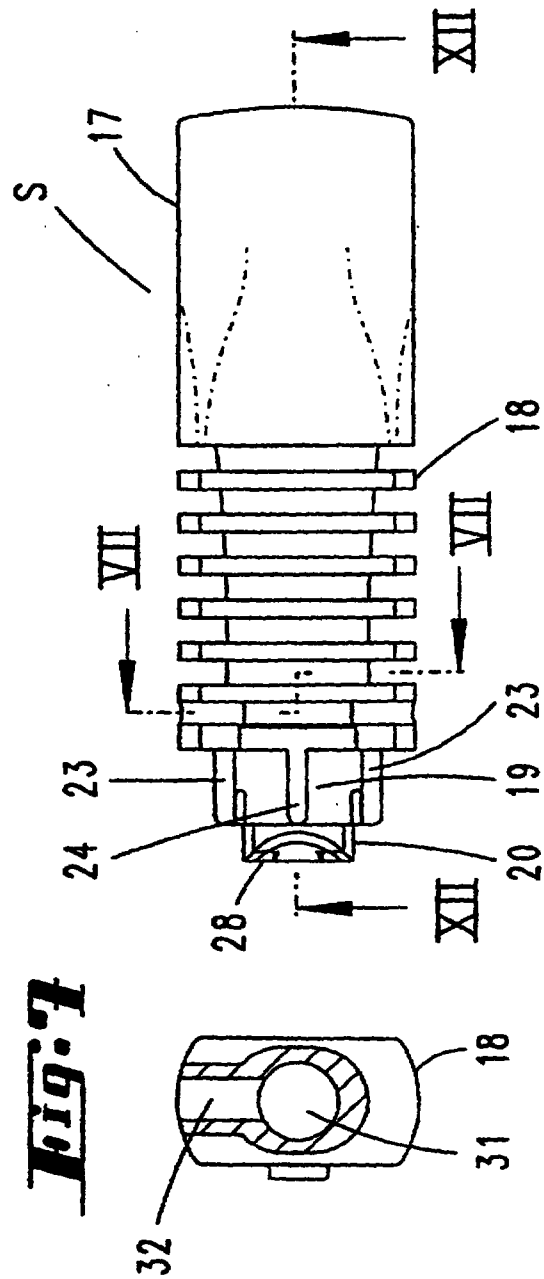
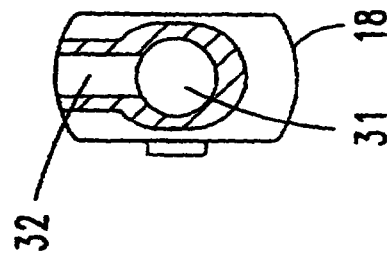
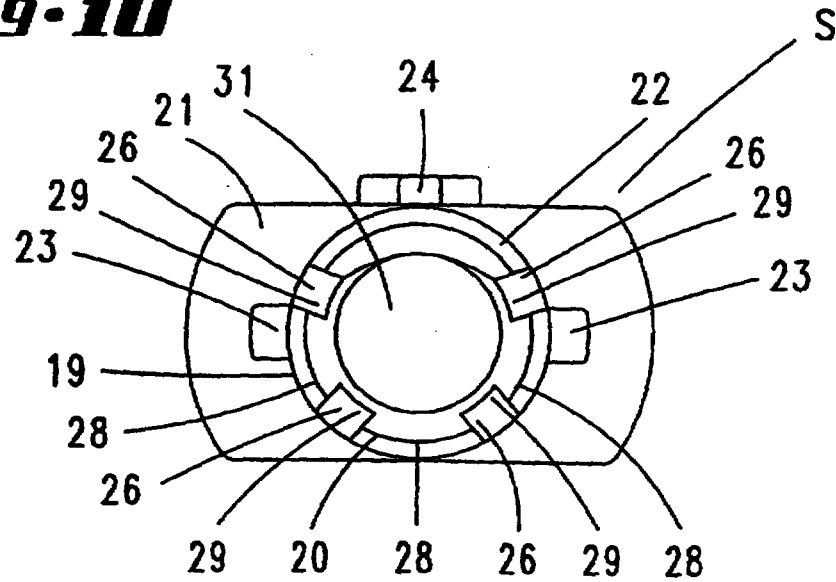


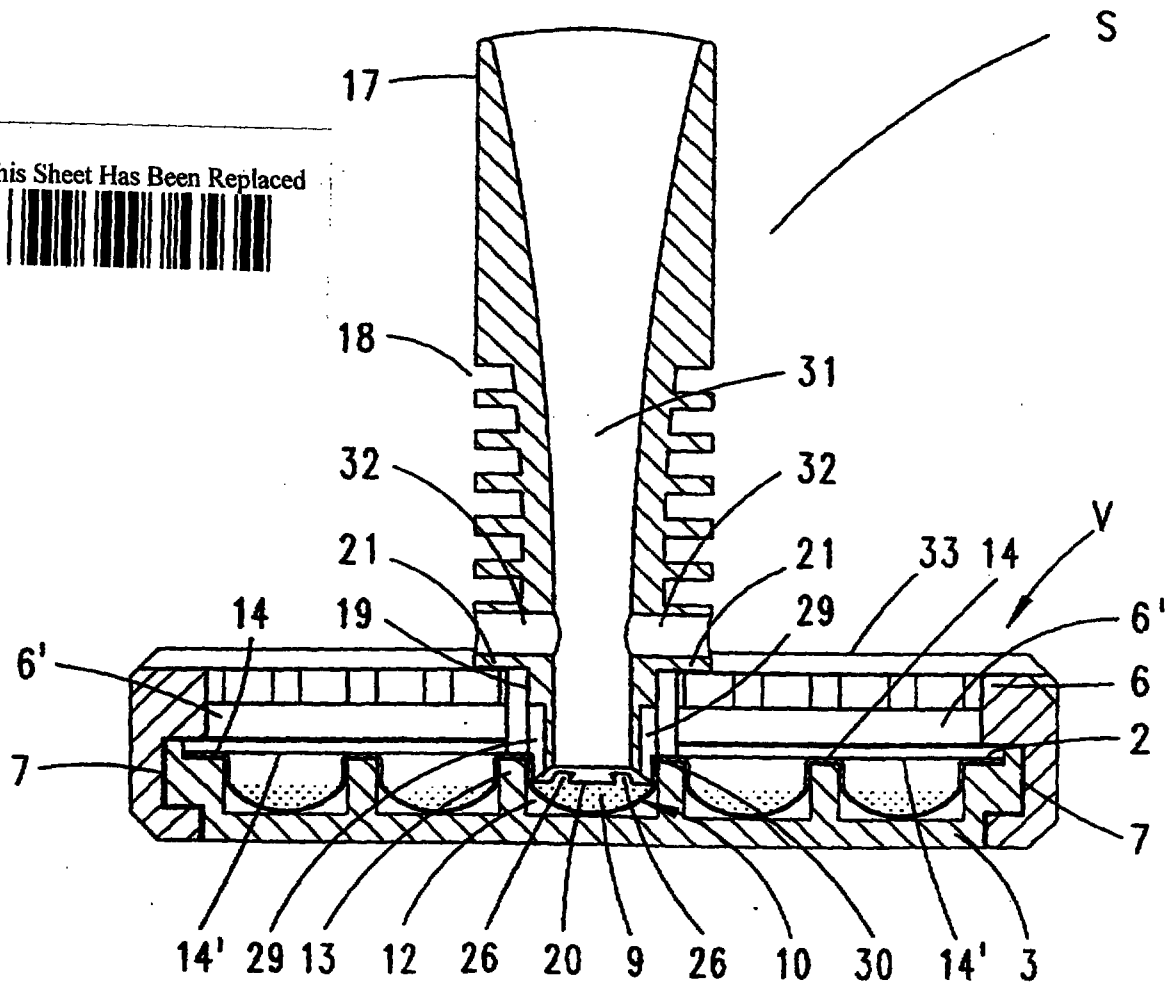
Fig. 6



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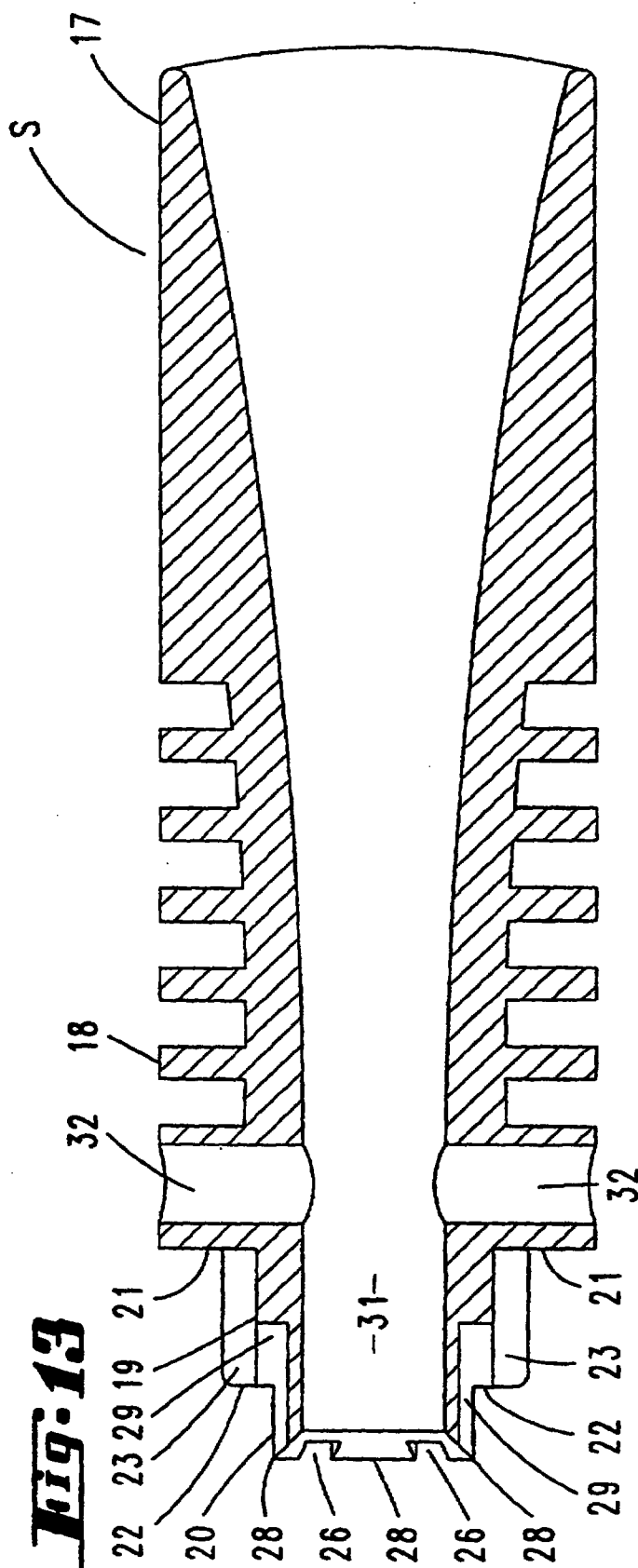
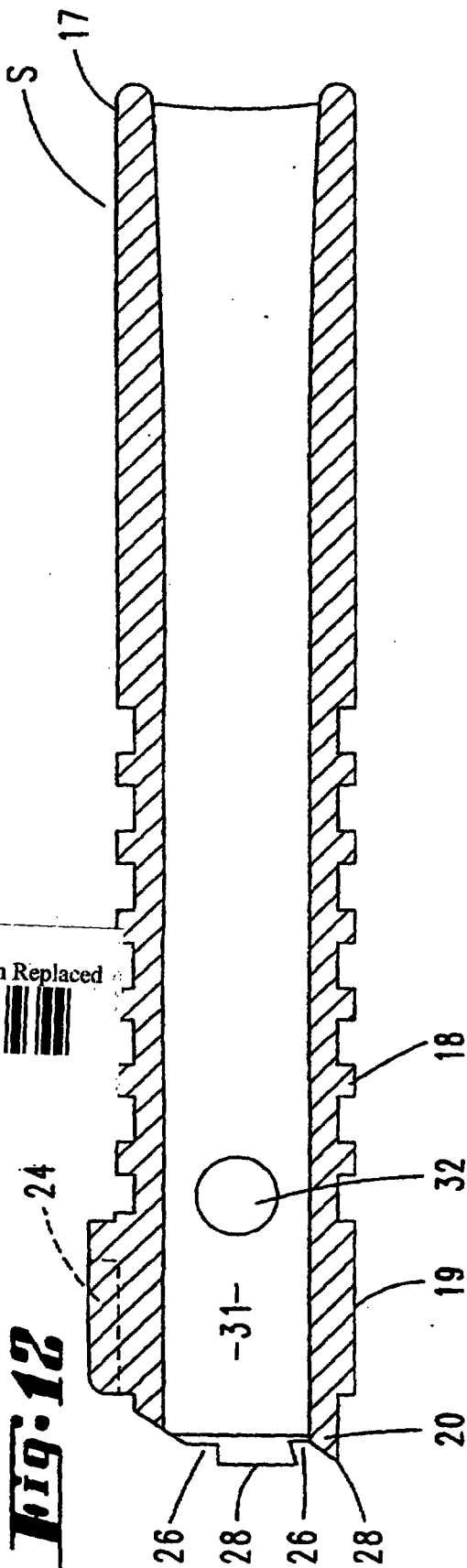
Fig. 10**Fig. 11**

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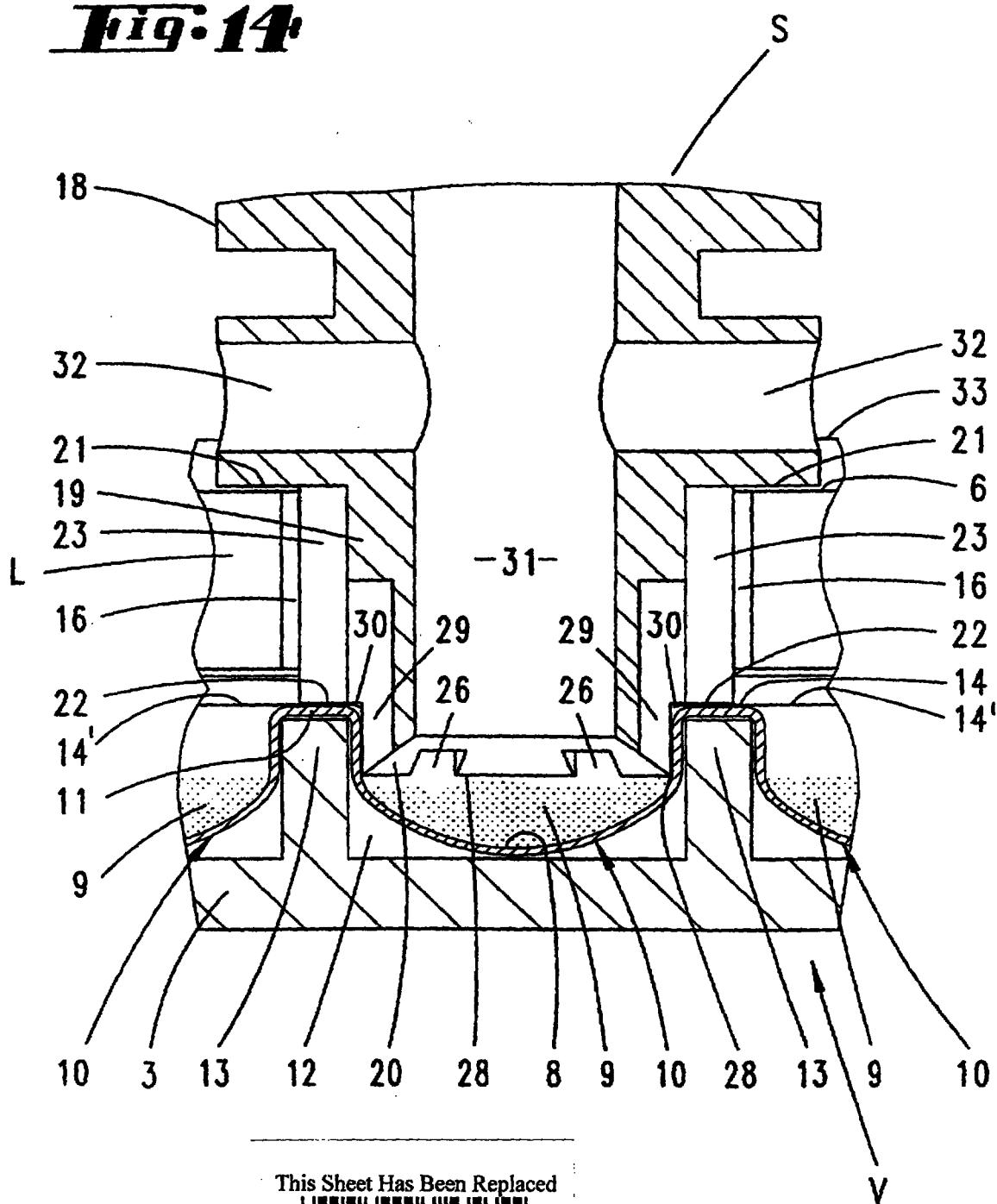


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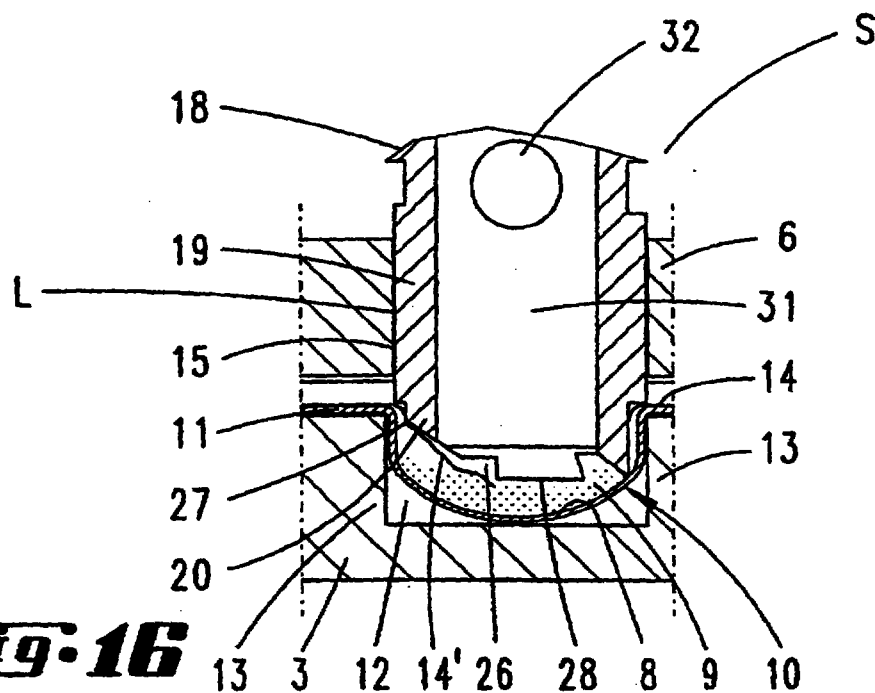
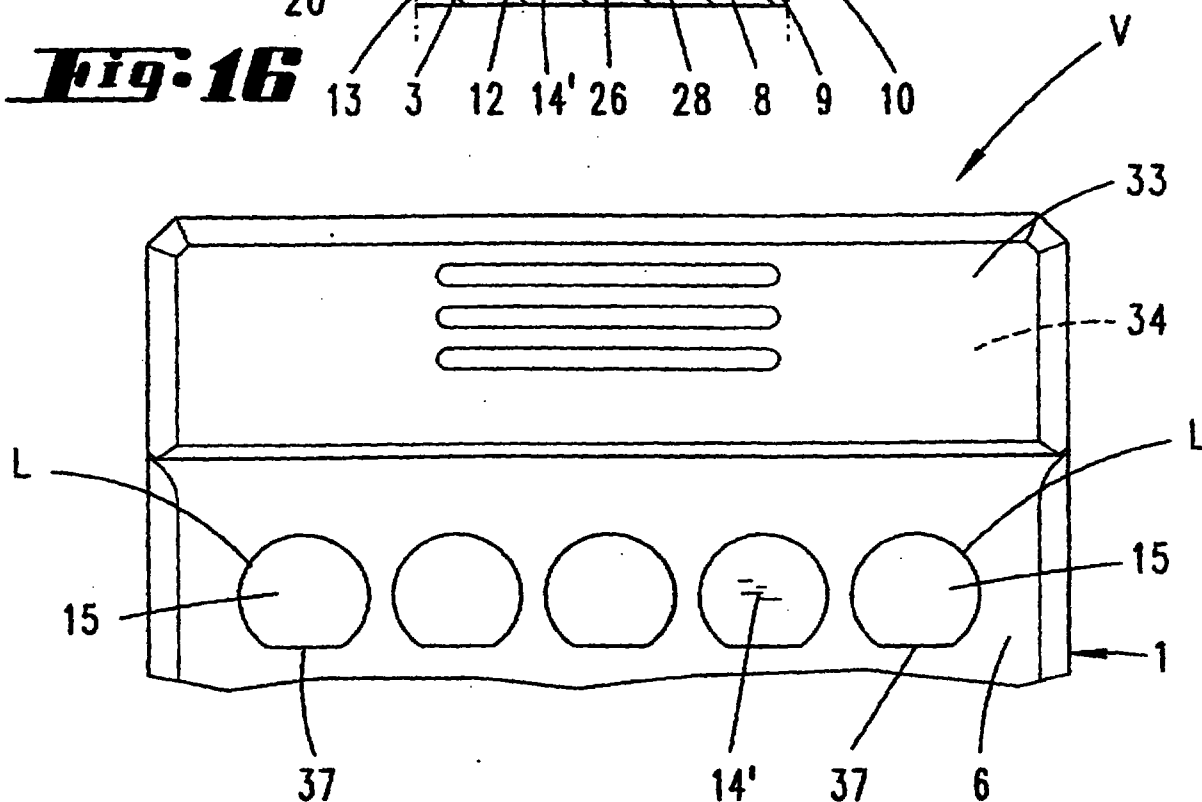
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Fig. 14

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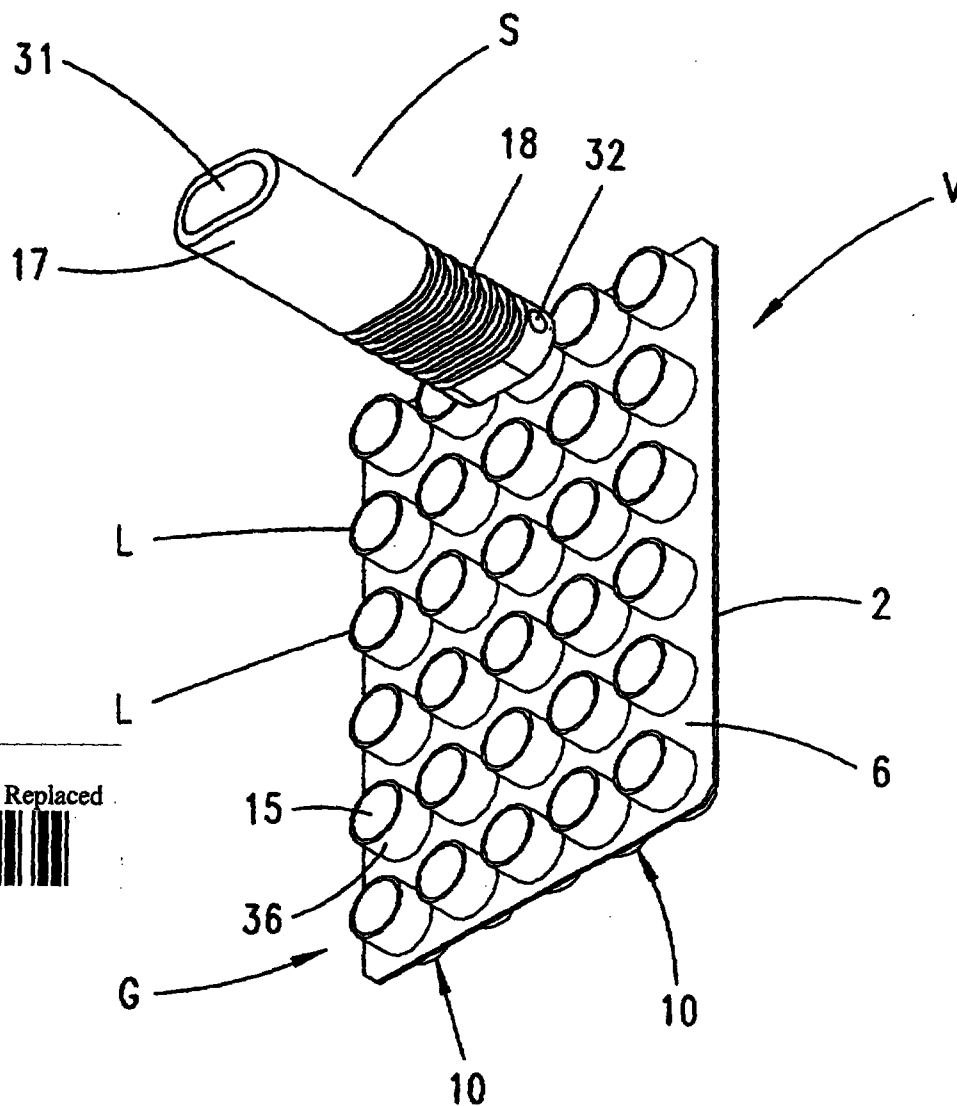


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Fig. 15**Fig. 16**

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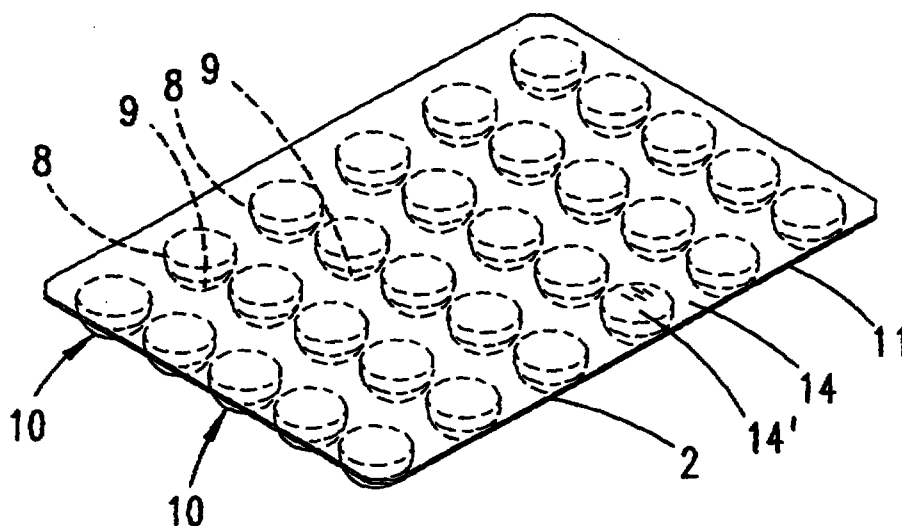
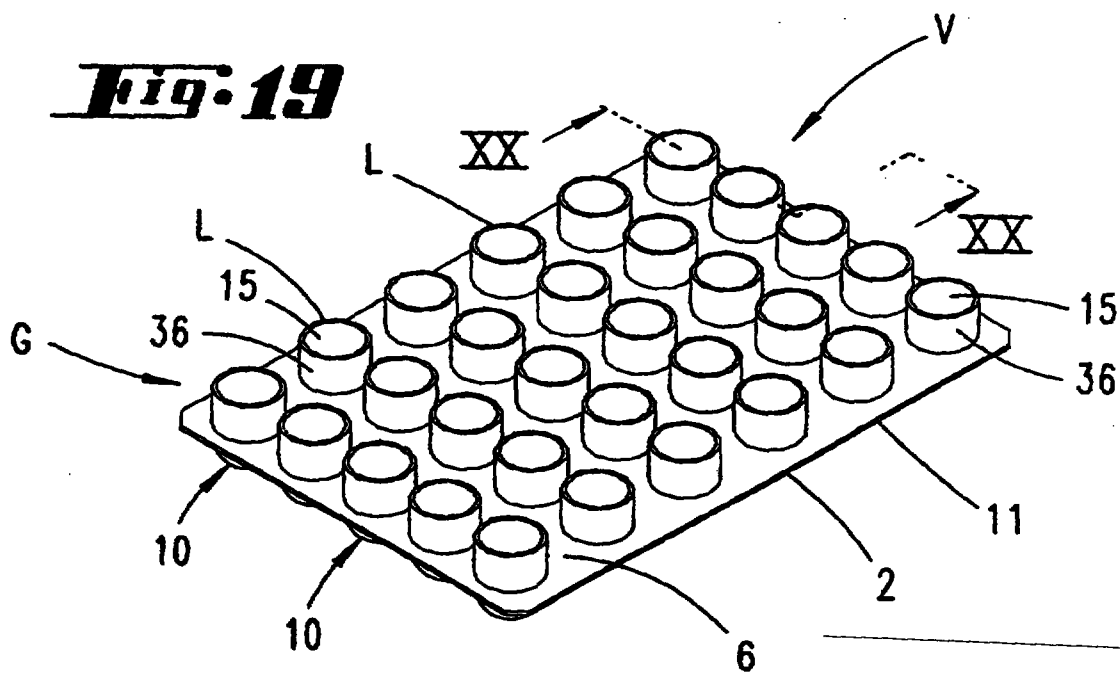


Fig. 17

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Fig. 18**Fig. 19**

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Fig. 20

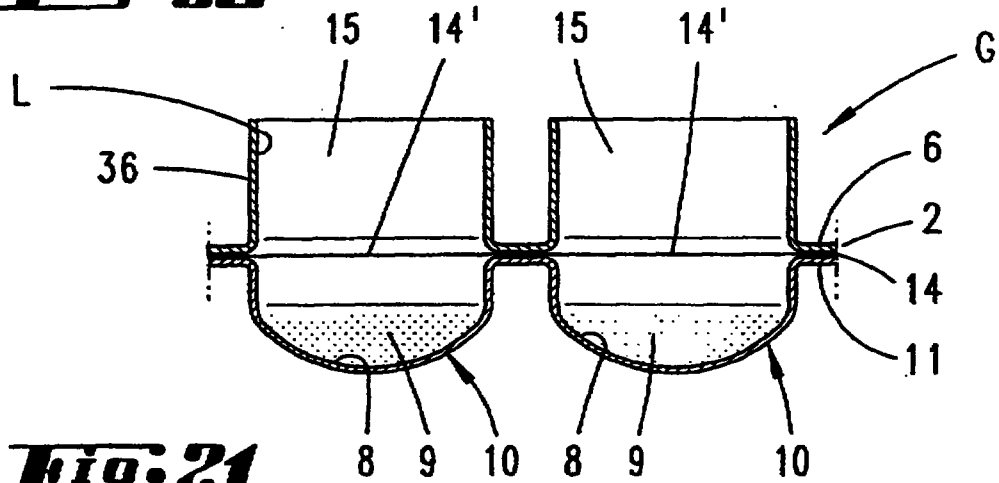


Fig. 21

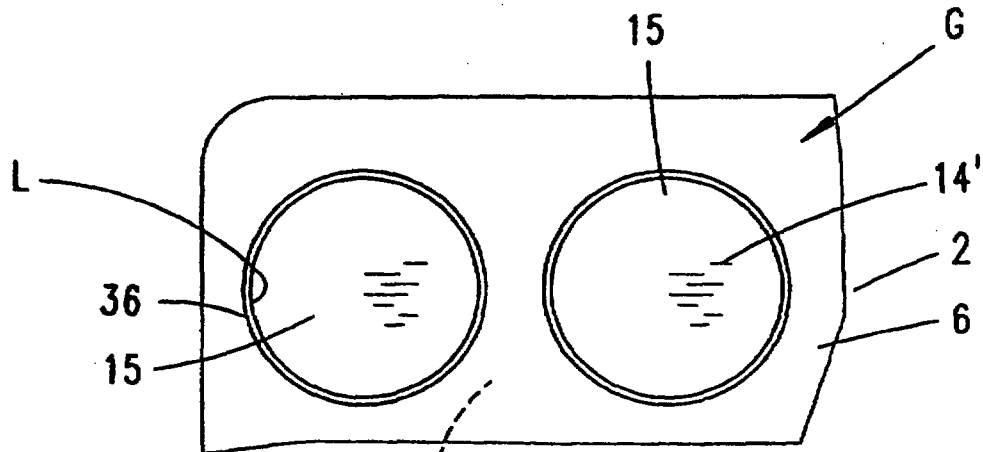


Fig. 22

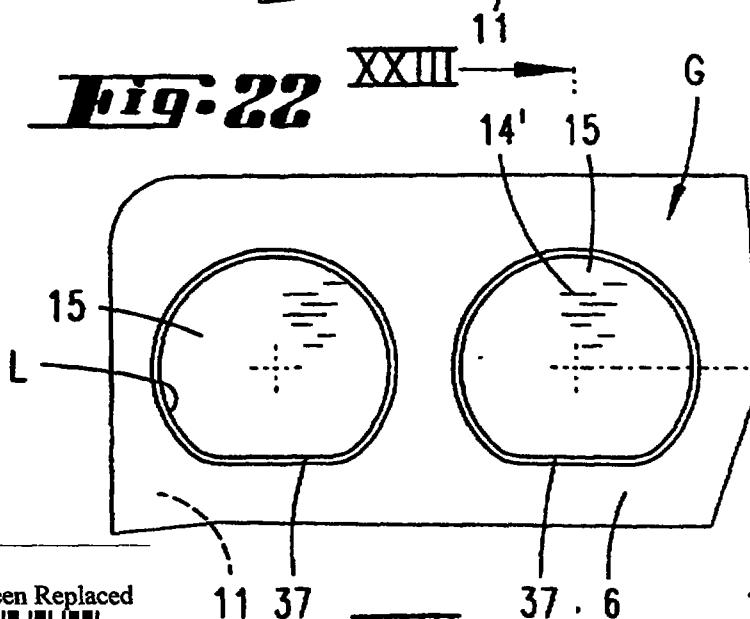


Fig. 23

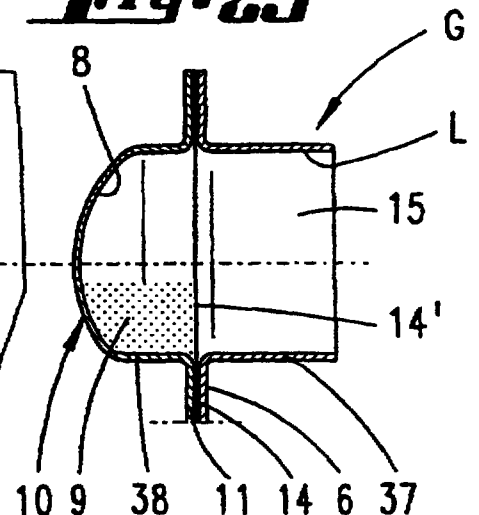


Fig. 24

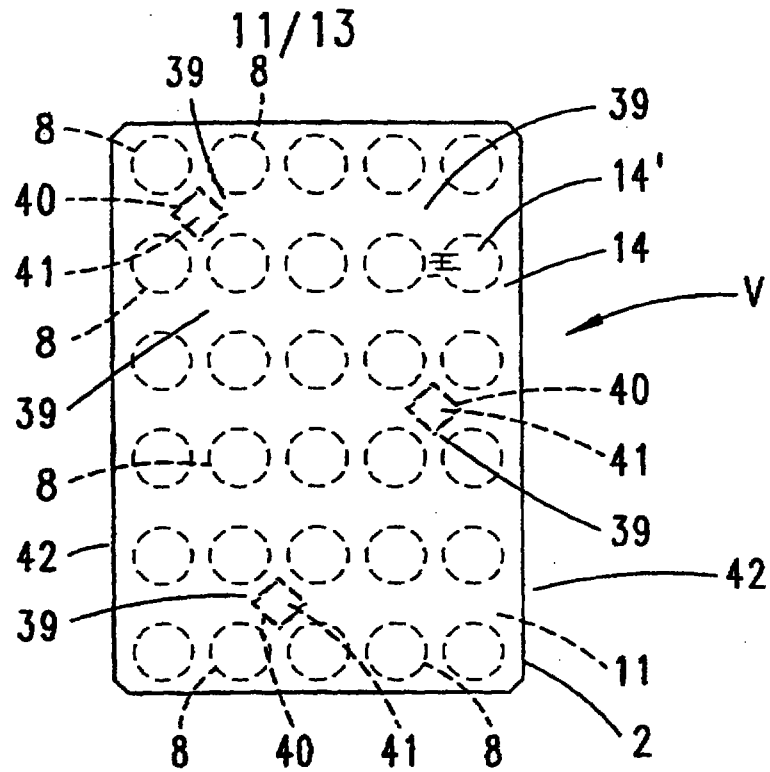
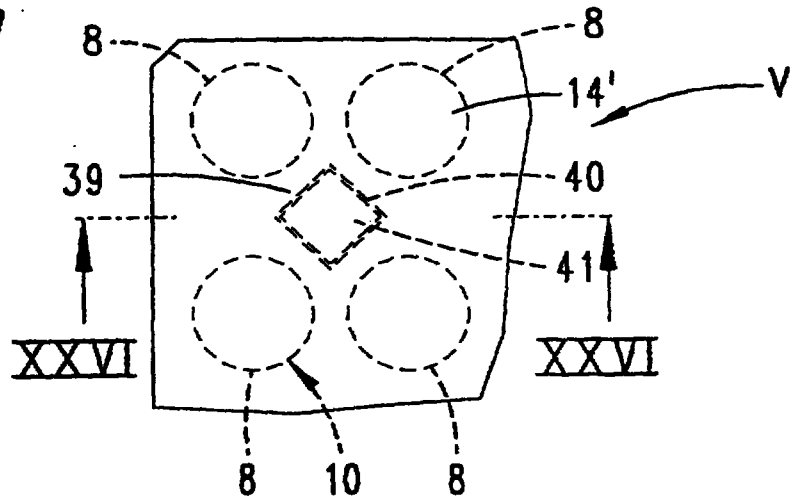


Fig. 25



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Fig. 26

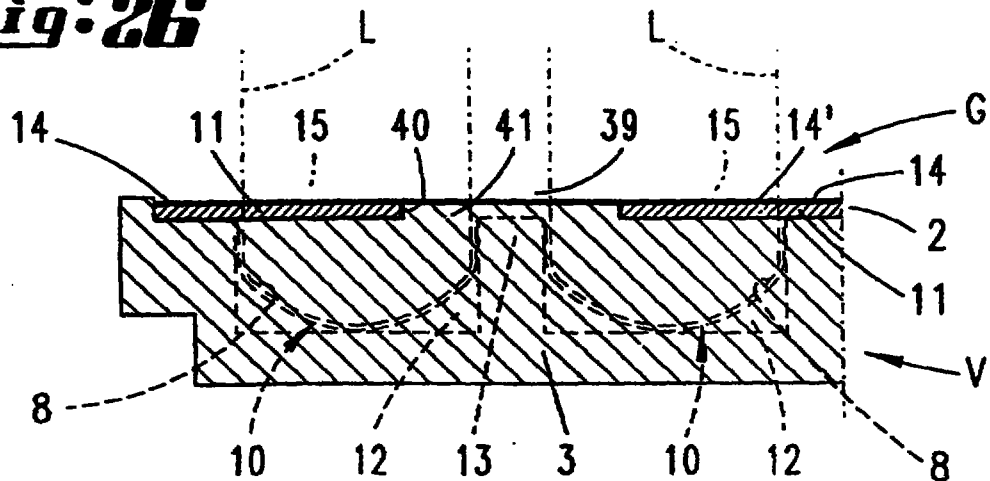
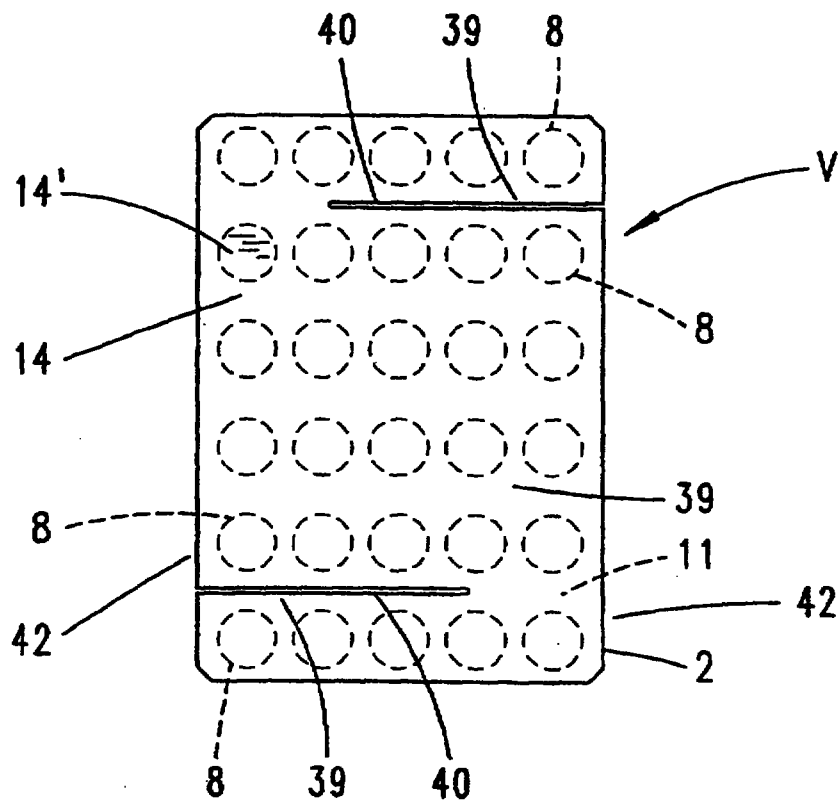


Fig. 27

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INHALER

The present invention relates to an inhaler, more particularly an inhaler for administering dry powder, a support unit for an inhaler and a suction tube for an inhaler.

It is known in the treatment of respiratory conditions such as asthma to provide certain medicaments in the form of dry powder for inhalation.

It is also known to provide individual doses of such powders in the blisters of a blister pack. With such blister packs, however, either the user has manually to peel away the covering film from an individual blister to access the dose of powder or a complex device is required for rupturing the covering film or the cup-shaped portion of an individual blister. Where the user has manually to peel away the covering film, the task of finding the edge of the covering film and peeling the same away without spilling any of the powder contained therein can be difficult for some patients, particularly the young, the elderly or those actually experiencing an asthma attack. On the other hand, known devices for automatically rupturing a blister are complex and therefore costly to produce. Indeed, such known devices for rupturing the covering film or the cup-shaped portion of an individual blister can lead to parts of the covering film or the cup-shaped portion becoming detached, with the associated

risk of those parts being inhaled. Furthermore, it has proved extremely difficult to rupture the covering film or the cup-shaped portion of a blister in such a way as to ensure that all of the powder is removed from the blister or at least that a consistent proportion of the powder is removed.

US-A-2549303 discloses an inhaler for administering dry powder containing medicament. The inhaler comprises a cartridge which includes a compartment which has a rupturable wall and contains dry powder containing medicament and a suction tube one end of which includes a frusto-conical extension for rupturing the rupturable wall of the cartridge and the other end of which is adapted for insertion into a respiratory orifice through which a user inhales.

WO-A-96/09085 discloses a device for aerosolizing dry powder containing medicament contained in a blister. The device comprises a dispersion chamber from which dry powder when dispersed is inhaled by a user, a feed tube assembly one end of which is in fluid communication with the dispersion chamber and the other end of which includes a piercing mechanism for rupturing the covering film of a blister, a feed tube through which powder is drawn from the blister and at least one air flow channel through which fluidizing air is drawn into the blister, and a pressurized gas source for delivering a high pressure gas to the feed tube assembly by means of which the powder in the blister is drawn into the

dispersion chamber. The feed tube assembly is configured such that the high pressure gas draws fluidizing air through the at least one air flow channel into the blister where the powder contained therein is entrained and then through the feed tube into the dispersion chamber.

It is an aim of the present invention to provide an improved inhaler.

The present invention provides an inhaler for administering dry powder, comprising: a suction tube having an inlet at one end and an outlet at the other end, the suction tube including at the one end an inlet section configured for insertion into a blister containing a dose of powder containing medicament and an inhalation channel providing fluid communication between the inlet and the outlet through which powder is in use drawn on inhalation by a user; and a support unit for supporting a blister pack having a substantially planar surface with a plurality of blisters formed therein, the support unit including a guide wall adjacent which the substantially planar surface of the blister pack is in use disposed, the guide wall including a plurality of apertures acting as guide portions in alignment with respective blisters of the blister pack, each aperture being for guiding the inlet section of the suction tube into a respective blister of the blister pack and supporting the suction tube when so guided.

Thus, the present invention provides an inhaler which is relatively simple to construct, of relatively low cost to the user and simple to use, but yet extremely effective in removing powder from a blister.

Furthermore, since the suction tube is a component separate from the blister pack, advantageously the suction tube can be easily cleaned as and when required. Indeed, the suction tube can be cleaned in any way, including total immersion in water, without there being any risk of contaminating or interfering with the operation of the inhaler. This is in contrast with known devices for automatically rupturing the covering film of a blister, where, even if the powder for administration is sealed in blisters, residual powder which has accumulated in other, particularly more complicated, parts of the device may not be fully removed and may interfere with the correct operation of the device after being dampened through a washing operation.

In one embodiment the support unit is a container within which the blister pack is in use housed.

Preferably, the support unit includes a support member including a plurality of cavities for receiving respective blisters of the blister pack, the cavities having the same arrangement as the apertures in the guide wall such that in use the blisters of the blister pack oppose the respective apertures.

More preferably, the support member is adapted to be slideable relative to the guide wall so as to allow loading and unloading of blister packs.

In another embodiment the support unit includes holding means for holding the substantially planar surface of the blister pack adjacent the guide wall.

Preferably, the holding means comprises C-shaped lips for slideably receiving the blister pack.

Preferably, the apertures are defined by elongate sections.

More preferably, the length of the elongate sections is greater than the width of the blisters of the blister pack.

Preferably, the support unit includes one or more projections or recesses of predetermined size and position such that the support unit can only receive blister packs with corresponding recesses or projections.

More preferably, the one or more projections or recesses are sized and positioned such that the support unit can only receive blister packs in one relative orientation.

Preferably, the inlet section of the suction tube and each of the apertures are configured such that the inlet section of

the suction tube can only be inserted through the apertures in one relative orientation.

More preferably, the cross-section of the inlet section of the suction tube and the cross-section of each of the apertures is rotationally asymmetric.

Yet more preferably, each of the apertures is generally circular in shape with at least one radial extension.

Still more preferably, a plurality of the apertures are linked by at least one radial extension.

Preferably, the support unit includes a holder for holding the suction tube when not in use.

More preferably, the holder comprises a chamber with a hinged lid.

Preferably, the inlet section of the suction tube includes a cutter having a cutting edge for cutting a covering film of a blister of the blister pack.

By providing the suction tube with a cutter the covering film of a blister is only cut when the suction tube is inserted into the blister. In this way, spillage as may occur when handling a blister pack with an open blister containing powder can be avoided.

More preferably, the cutter is located around only a part of the inlet of the suction tube such that upon insertion of the inlet section of the suction tube into a blister of the blister pack the cutter cuts the covering film of the blister such as to leave a single cut film flap.

In this way, the covering film of a blister is never cut free and thus cannot be inhaled by a user.

Yet more preferably, the cutting edge of the cutter is disposed at the outer peripheral surface of the inlet section of the suction tube such that when the inlet section of the suction tube is inserted into a blister of the blister pack the cutter first cuts the covering film of the blister and then the inner peripheral surface of the inlet section of the suction tube pushes the cut film flap into the blister.

Preferably, the cutter comprises a plurality of axially-extending blades, each having cutting edges, separated by axially-extending gaps.

Such a cutter arrangement ensures that an air flow path exists between a blister and the inlet of the suction tube since air can always flow through the axially-extending gaps. Furthermore, by virtue of the relationship between the blades and the gaps, the covering film will tear to bridge the gaps between the blades.

Preferably, the inlet section of the suction tube includes at least one passageway for providing fluid communication between a blister of the blister pack and a space above the blister when the inlet section of the suction tube is inserted in the blister.

In this way, powder may be assuredly drawn from a blister since an air flow path is provided to the blister. In particular, by providing air flow paths at the outer periphery of a blister powder is more completely removed from the blister.

In one embodiment the at least one passageway comprises an open channel in the outer peripheral surface of the inlet section of the suction tube, the at least one passageway having one end located at a position along the length of the inlet section of the suction tube and the other end located adjacent the inlet of the suction tube.

Preferably, the other end of the at least one passageway is located adjacent the cutter.

In one preferred embodiment the other end of the at least one passageway is located at one of the gaps.

In another preferred embodiment the other end of the at least one passageway is located between adjacent gaps.

In another embodiment the at least one passageway comprises a conduit in the inlet section of the suction tube, the at least one passageway having an inlet located at a position along the length of the inlet section of the suction tube and an outlet located adjacent the inlet of the suction tube.

Preferably, the outlet of the at least one passageway is located adjacent the cutter.

In one preferred embodiment the outlet of the at least one passageway is located at one of the gaps.

In another preferred embodiment the outlet of the at least one passageway is located between adjacent gaps.

Preferably, the suction tube includes at least one passageway providing fluid communication between the inhalation channel and the atmosphere through which supplementary air is in use drawn into the inhalation channel on inhalation by the user.

Preferably, the inlet section of the suction tube includes a radially-extending member defining a shoulder at a predetermined axial distance from the distal end thereof, the shoulder being configured so as in use to abut the blister pack and prevent the inlet section of the suction tube from being inserted too far into a blister of the blister pack.

Preferably, the inhaler further comprises a member connecting the suction tube to the support unit in order to prevent the suction tube and the support unit from being separated from one another.

The present invention also extends to the above-described inhaler in combination with a blister pack.

The present invention also provides a support unit for supporting a blister pack having a substantially planar surface with a plurality of blisters formed therein, the support unit including a guide wall adjacent which the substantially planar surface of the blister pack is in use disposed, the guide wall including a plurality of apertures acting as guide portions in alignment with respective blisters of the blister pack, each aperture being for guiding the inlet section of a suction tube into a respective blister of the blister pack and supporting the suction tube when so guided.

In one embodiment the support unit is a container within which the blister pack is in use housed.

Preferably, the support unit includes a support member including a plurality of cavities for receiving respective blisters of the blister pack, the cavities having the same arrangement as the apertures in the guide wall such that in

use the blisters of the blister pack oppose the respective apertures.

More preferably, the support member is adapted to be slideable relative to the guide wall to allow loading and unloading of blister packs.

In another embodiment the support unit includes holding means for holding the substantially planar surface of the blister pack adjacent the guide wall.

Preferably, the holding means comprises C-shaped lips for slideably receiving the blister pack.

Preferably, the apertures are defined by elongate sections.

More preferably, the length of the elongate sections is greater than the width of the blisters of the blister pack.

Preferably, the support unit includes one or more projections or recesses of predetermined size and position so as to be able to receive only blister packs with corresponding recesses or projections.

More preferably, the one or more projections or recesses are sized and positioned such that blister packs can only be received in one relative orientation.

Preferably, each of the apertures is configured such that the inlet section of a suction tube can only be inserted through the apertures in one relative orientation.

More preferably, the cross-section of each of the apertures is rotationally asymmetric.

Yet more preferably, each of the apertures is generally circular in shape with at least one radial extension.

Still more preferably, a plurality of the apertures are linked by at least one radial extension.

Preferably, the support unit includes a holder for holding a suction tube.

More preferably, the holder comprises a chamber with a hinged lid.

The present invention also extends to the above-described support unit in combination with a blister pack.

The present invention further provides an inhaler for administering dry powder, comprising: a suction tube having an inlet at one end and an outlet at the other end, the suction tube including at the one end an inlet section configured for insertion into a blister containing a dose of powder containing medicament and an inhalation channel

providing fluid communication between the inlet and the outlet through which powder is in use drawn on inhalation by a user; and a support unit for supporting a blister pack having a substantially planar surface with a plurality of blisters formed therein, the support unit including a guide wall adjacent which the substantially planar surface of the blister pack is in use disposed, the guide wall including a plurality of apertures acting as guide portions in alignment with respective blisters of the blister pack, each aperture being for guiding the inlet section of the suction tube into a respective blister of the blister pack and supporting the suction tube when so guided; wherein the inlet section of the suction tube and each of the apertures are configured such that the inlet section of the suction tube can only be inserted through the apertures in one relative orientation.

In one embodiment the support unit is a container within which the blister pack is in use housed.

Preferably, the support unit includes a support member including a plurality of cavities for receiving respective blisters of the blister pack, the cavities having the same arrangement as the apertures in the guide wall such that in use the blisters of the blister pack oppose the respective apertures.

More preferably, the support member is adapted to be slideable relative to the guide wall so as to allow loading and unloading of blister packs.

In another embodiment the support unit includes holding means for holding the substantially planar surface of the blister pack adjacent the guide wall.

Preferably, the holding means comprises C-shaped lips for slideably receiving the blister pack.

Preferably, the apertures are defined by elongate sections.

More preferably, the length of the elongate sections is greater than the width of the blisters of the blister pack.

Preferably, the support unit includes one or more projections or recesses of predetermined size and position such that the support unit can only receive blister packs with corresponding recesses or projections.

More preferably, the one or more projections or recesses are sized and positioned such that the support unit can only receive blister packs in one relative orientation.

Preferably, the cross-section of the inlet section of the suction tube and the cross-section of each of the apertures is rotationally asymmetric.

More preferably, each of the apertures is generally circular in shape with at least one radial extension.

Yet more preferably, a plurality of the apertures are linked by at least one radial extension.

Preferably, the support unit includes a holder for holding the suction tube when not in use.

More preferably, the holder comprises a chamber with a hinged lid.

Preferably, the inlet section of the suction tube includes a cutter having a cutting edge for cutting a covering film of a blister of the blister pack.

More preferably, the cutter is located around only a part of the inlet of the suction tube such that upon insertion of the inlet section of the suction tube into a blister of the blister pack the cutter cuts the covering film of the blister such as to leave a single cut film flap.

Yet more preferably, the cutting edge of the cutter is disposed at the outer peripheral surface of the inlet section of the suction tube such that when the inlet section of the suction tube is inserted into a blister of the blister pack the cutter first cuts the covering film of the blister and

then the inner peripheral surface of the inlet section of the suction tube pushes the cut film flap into the blister.

Preferably, the cutter comprises a plurality of axially-extending blades, each having cutting edges, separated by axially-extending gaps.

Preferably, the inlet section of the suction tube includes at least one passageway for providing fluid communication between a blister of the blister pack and a space above the blister when the inlet section of the suction tube is inserted in the blister.

In one embodiment the at least one passageway comprises an open channel in the outer peripheral surface of the inlet section of the suction tube, the at least one passageway having one end located at a position along the length of the inlet section of the suction tube and the other end located adjacent the inlet of the suction tube.

Preferably, the other end of the at least one passageway is located adjacent the cutter.

In one preferred embodiment the other end of the at least one passageway is located at one of the gaps.

In another preferred embodiment the other end of the at least one passageway is located between adjacent gaps.

In another embodiment the at least one passageway comprises a conduit in the inlet section of the suction tube, the at least one passageway having an inlet located at a position along the length of the inlet section of the suction tube and an outlet located adjacent the inlet of the suction tube.

Preferably, the outlet of the at least one passageway is located adjacent the cutter.

In one preferred embodiment the outlet of the at least one passageway is located at one of the gaps.

In another preferred embodiment the outlet of the at least one passageway is located between adjacent gaps.

Preferably, the suction tube includes at least one passageway providing fluid communication between the inhalation channel and the atmosphere through which supplementary air is in use drawn into the inhalation channel on inhalation by the user.

Preferably, the inlet section of the suction tube includes a radially-extending member defining a shoulder at a predetermined axial distance from the distal end thereof, the shoulder being configured so as in use to abut the blister pack and prevent the inlet section of the suction tube from being inserted too far into a blister of the blister pack.

Preferably, the inhaler further comprises a member connecting the suction tube to the support unit in order to prevent the suction tube and the support unit from being separated from one another.

The present invention also extends to the above-described inhaler in combination with a blister pack.

The present invention yet further provides a suction tube for administering dry powder from a blister sealed by a covering film, the suction tube having an inlet at one end and an outlet at the other end, and including at the one end an inlet section configured for insertion into a blister containing a dose of powder containing medicament and an inhalation channel providing fluid communication between the inlet and the outlet through which powder is in use drawn on inhalation by a user, wherein the inlet section includes a cutter located around only a part of the inlet such that upon insertion of the inlet section into a blister the cutter cuts the covering film of the blister such as to leave a single cut film flap.

Preferably, the cutting edge of the cutter is disposed at the outer peripheral surface of the inlet section such that when the inlet section is inserted into a blister the cutter first cuts the covering film of the blister and then the inner peripheral surface of the inlet section pushes the cut film flap into the blister.

Preferably, the cutter comprises a plurality of axially-extending blades, each having cutting edges, separated by axially-extending gaps.

Preferably, the inlet section includes at least one passageway for providing fluid communication between a blister and a space above the blister when the inlet section is inserted in the blister.

In one embodiment the at least one passageway comprises an open channel in the outer peripheral surface of the inlet section, the at least one passageway having one end located at a position along the length of the inlet section and the other end located adjacent the inlet of the suction tube.

Preferably, the other end of the at least one passageway is located adjacent the cutter.

In one preferred embodiment the other end of the at least one passageway is located at one of the gaps.

In another preferred embodiment the other end of the at least one passageway is located between adjacent gaps.

In another embodiment the at least one passageway comprises a conduit in the inlet section, the at least one passageway having an inlet located at a position along the length of the

inlet section and an outlet located adjacent the inlet of the suction tube.

Preferably, the outlet of the at least one passageway is located adjacent the cutter.

In one preferred embodiment the outlet of the at least one passageway is located at one of the gaps.

In another preferred embodiment the outlet of the at least one passageway is located between adjacent gaps.

Preferably, the inhaler includes at least one passageway providing fluid communication between the inhalation channel and the atmosphere through which supplementary air is in use drawn into the inhalation channel on inhalation by the user.

Preferably, the inlet section includes a radially-extending member defining a shoulder at a predetermined axial distance from the distal end thereof, the shoulder being configured so as in use to abut a blister pack which includes at least one blister and prevent the inlet section from being inserted too far into the at least one blister.

The present invention still further provides a suction tube for administering dry powder from a blister sealed by a covering film, the suction tube having an inlet at one end and an outlet at the other end, and including an inlet

section at the one end, the inlet section being configured for insertion into a blister containing a dose of powder containing medicament and including at least one first passageway for providing fluid communication between the blister and a space above the blister when the inlet section is inserted in the blister, an inhalation channel providing fluid communication between the inlet and the outlet through which powder is in use drawn on inhalation by a user and at least one second passageway providing fluid communication between the inhalation channel and the atmosphere through which supplementary air is in use drawn into the inhalation channel on inhalation by the user.

Preferably, the inlet section includes a cutter having a cutting edge for cutting the covering film of a blister.

More preferably, the cutter is located around only a part of the inlet of the suction tube such that upon insertion of the inlet section into a blister the cutter cuts the covering film of the blister such as to leave a single cut film flap.

Yet more preferably, the cutting edge of the cutter is disposed at the outer peripheral surface of the inlet section such that when the inlet section is inserted into a blister the cutter first cuts the covering film of the blister and then the inner peripheral surface of the inlet section pushes the cut film flap into the blister.

Preferably, the cutter comprises a plurality of axially-extending blades, each having cutting edges, separated by axially-extending gaps.

In one embodiment the at least one first passageway comprises an open channel in the outer peripheral surface of the inlet section, the at least one first passageway having one end located at a position along the length of the inlet section and the other end located adjacent the inlet of the suction tube.

Preferably, the other end of the at least one first passageway is located adjacent the cutter.

In one preferred embodiment the other end of the at least one first passageway is located at one of the gaps.

In another preferred embodiment the other end of the at least one first passageway is located between adjacent gaps.

In another embodiment the at least one first passageway comprises a conduit in the inlet section, the at least one first passageway having an inlet located at a position along the length of the inlet section and an outlet located adjacent the inlet of the suction tube.

Preferably, the outlet of the at least one first passageway is located adjacent the cutter.

In one preferred embodiment the outlet of the at least one first passageway is located at one of the gaps.

In another preferred embodiment the outlet of the at least one first passageway is located between adjacent gaps.

Preferably, the inlet section includes a radially-extending member defining a shoulder at a predetermined axial distance from the distal end thereof, the shoulder being configured so as in use to abut a blister pack which includes at least one blister and prevent the inlet section from being inserted too far into the at least one blister.

The present invention also further provides an inhaler for administering dry powder, comprising: a blister pack including a plurality of blisters each containing a dose of powder containing medicament, each blister comprising a cup-shaped portion containing a dose of powder containing medicament, an elongate section extending axially from the cup-shaped portion for guiding the inlet section of a suction tube thereinto and a covering film sealing the dose of powder containing medicament in the cup-shaped portion and separating the cup-shaped portion from the elongate section; and a suction tube having an inlet at one end and an outlet at the other end, the suction tube including an inlet section at the one end and an inhalation channel providing fluid communication between the inlet and the outlet through which

powder is in use drawn on inhalation by a user, wherein the inlet section is configured for insertion into the elongate section and corresponding cup-shaped portion of a respective one of the blisters of the blister pack, the cross-section of the elongate sections corresponding to the cross-section of at least a part of the inlet section of the suction tube such that on insertion of the inlet section of the suction tube into the elongate sections the inlet section of the suction tube is guided into the corresponding cup-shaped portion.

By providing each blister with an elongate section the suction tube is always correctly inserted into the blisters. Furthermore, since the suction tube is positively guided into each blister, the user has a feeling of confidence when using the inhaler.

Preferably, the length of the elongate sections is greater than the width of the blisters of the blister pack.

Preferably, the inlet section of the suction tube and the elongate sections are configured such that the inlet section of the suction tube can only be inserted into the elongate sections in one relative orientation.

More preferably, the cross-section of the inlet section of the suction tube and the cross-section of the elongate sections is rotationally asymmetric.

Preferably, the inlet section of the suction tube includes a cutter having a cutting edge for cutting the covering film sealing the cup-shaped portion of a blister of the blister pack.

More preferably, the cutter is located around only a part of the inlet of the suction tube such that upon insertion of the inlet section of the suction tube into the cup-shaped portion of a blister of the blister pack the cutter cuts the covering film sealing the cup-shaped portion such as to leave a single cut film flap.

Yet more preferably, the cutting edge of the cutter is disposed at the outer peripheral surface of the inlet section of the suction tube such that when the inlet section of the suction tube is inserted into the cup-shaped portion of a blister of the blister pack the cutter first cuts the covering film sealing the cup-shaped portion and then the inner peripheral surface of the inlet section of the suction tube pushes the cut film flap into the cup-shaped portion.

Preferably, the cutter comprises a plurality of axially-extending blades, each having cutting edges, separated by axially-extending gaps.

Preferably, the inlet section of the suction tube includes at least one passageway for providing fluid communication between the cup-shaped portion of a blister of the blister

pack and a space above the cup-shaped portion of the blister when the inlet section of the suction tube is inserted in the cup-shaped portion of the blister.

In one embodiment the at least one passageway comprises an open channel in the outer peripheral surface of the inlet section of the suction tube, the at least one passageway having one end located at a position along the length of the inlet section of the suction tube and the other end located adjacent the inlet of the suction tube.

Preferably, the other end of the at least one passageway is located adjacent the cutter.

In one preferred embodiment the other end of the at least one passageway is located at one of the gaps.

In another preferred embodiment the other end of the at least one passageway is located between adjacent gaps.

In another embodiment the at least one passageway comprises a conduit in the inlet section of the suction tube, the at least one passageway having an inlet located at a position along the length of the inlet section of the suction tube and an outlet located adjacent the inlet of the suction tube.

Preferably, the outlet of the at least one passageway is located adjacent the cutter.

In one preferred embodiment the outlet of the at least one passageway is located at one of the gaps.

In another preferred embodiment the outlet of the at least one passageway is located between adjacent gaps.

Preferably, the suction tube includes at least one passageway providing fluid communication between the inhalation channel and the atmosphere through which supplementary air is in use drawn into the inhalation channel on inhalation by a user.

Preferably, the inlet section of the suction tube includes a radially-extending member defining a shoulder at a predetermined axial distance from the distal end thereof, the shoulder being configured so as in use to abut the blister pack and prevent the inlet section of the suction tube from being inserted too far into the cup-shaped portion of a blister of the blister pack.

Preferably, the inhaler further comprises a member connecting the suction tube to the blister pack in order to prevent the suction tube and the blister pack from being separated from one another.

The present invention still yet further provides a blister pack including a plurality of blisters each containing a dose of powder containing medicament, each blister comprising a

cup-shaped portion containing a dose of powder containing medicament, an elongate section extending axially from the cup-shaped portion for guiding the inlet section of a suction tube thereinto and a covering film sealing the dose of powder containing medicament in the cup-shaped portion and separating the cup-shaped portion from the elongate section.

Preferably, the length of the elongate sections is greater than the width of the blisters.

Preferably, the elongate sections are configured such that an inlet section of a suction tube can only be inserted thereinto in one relative orientation.

More preferably, the cross-section of the elongate sections is rotationally asymmetric.

Medicaments suitable for administration by the present invention are any which may be delivered by inhalation and include for example β 2-adrenoreceptor agonists, for example, salbutamol, terbutaline, rimiterol, fenoterol, reproterol, adrenaline, pirbuterol, isoprenaline, orciprenaline, bitolterol, salmeterol, formoterol, clenbuterol, procaterol, broxaterol, picumeterol, TA-2005, mabuterol and the like, and their pharmacologically acceptable esters and salts; anticholinergic bronchodilators, for example, ipratropium bromide and the

like; glucocorticosteroids, for example, beclomethasone, fluticasone, budesonide, tipredane, dexamethasone, betamethasone, fluocinolone, triamcinolone acetonide, mometasone and the like, and their pharmacologically acceptable esters and salts; antiallergic medicaments, for example, sodium cromoglycate and nedocromil sodium; expectorants; mucolytics; antihistamines; cyclooxygenase inhibitors; leukotriene synthesis inhibitors; leukotriene antagonists; phospholipase-A2 (PLA2) inhibitors; platelet aggregating factor (PAF) antagonists and prophylactics of asthma; antiarrhythmic medicaments; tranquilisers; cardiac glycosides; hormones; antihypertensive medicaments; antidiabetic medicaments; antiparasitic medicaments; anticancer medicaments; sedatives; analgesic medicaments; antibiotics; antirheumatic medicaments; immunotherapies; antifungal medicaments; antihypotension medicaments; vaccines; antiviral medicaments; proteins; polypeptides and peptides, for example, peptide hormones and growth factors; polypeptide vaccines; enzymes; endorphines; lipoproteins and polypeptides involved in the blood coagulation cascade; vitamins; and others, for example, cell surface receptor blockers, antioxidants, free radical scavengers and organic salts of N,N'-diacetylcystine.

Preferred embodiments of the present invention will now be described hereinbelow by way of example only with reference to the accompanying drawings, in which:

Figure 1 illustrates a perspective view of an inhaler in accordance with a first embodiment of the present invention;

Figures 2 to 4 illustrate respectively top, end and side views of the support unit of the inhaler of Figure 1;

Figures 5 and 6 illustrate in enlarged scale orthogonal side views of the suction tube of the inhaler of Figure 1;

Figure 7 illustrates in enlarged scale a horizontal sectional view (along section I-I in Figure 6) of the suction tube of the inhaler of Figure 1;

Figure 8 illustrates in enlarged scale a top view of the upper, mouthpiece end of the suction tube of the inhaler of Figure 1;

Figure 9 illustrates in enlarged scale a bottom view of the lower end of the suction tube of the inhaler of Figure 1;

Figure 10 illustrates in enlarged scale the view of Figure 9;

Figure 11 illustrates in enlarged scale a vertical sectional view (along section II-II in Figure 6) of the suction tube of the inhaler of Figure 1;

Figure 12 illustrates in enlarged scale a vertical sectional view (along section III-III in Figure 5) of the suction tube of the inhaler of Figure 1;

Figure 13 illustrates in enlarged scale a vertical sectional view (along section IV-IV in Figure 1) of the inhaler of Figure 1, illustrated in use with a blister pack contained in the support unit;

Figure 14 illustrates in enlarged scale a fragmentary vertical sectional view (along section IV-IV in Figure 1) of the inhaler of Figure 1, illustrated in use with a blister pack contained in the support unit;

Figure 15 illustrates in enlarged scale a fragmentary vertical sectional view (along section V-V in Figure 1) of the inhaler of Figure 1, illustrated in use with a blister pack contained in the support unit;

Figure 16 illustrates a fragmentary top view of a modified support unit for the inhaler of Figure 1;

Figure 17 illustrates in enlarged scale a bottom view of the lower end of a modified suction tube for the inhaler of Figure 1;

Figure 18 illustrates in enlarged scale a fragmentary vertical sectional view (along section VI-VI in Figure 17 and corresponding to section IV-IV in Figure 1) of the suction tube of Figure 17 and the support unit of the inhaler of Figure 1, illustrated in use with a blister pack contained in the support unit;

Figure 19 illustrates a blister pack for the inhaler of Figure 1;

Figure 20 illustrates a perspective view of an inhaler in accordance with a second embodiment of the present invention;

Figure 21 illustrates a perspective view of a support unit for the inhaler of Figure 20;

Figure 22 illustrates in enlarged scale a fragmentary vertical sectional view (along section VII-VII in Figure 21) of the support unit of Figure 21;

Figure 23 illustrates in enlarged scale a fragmentary top view of the support unit of Figure 21;

Figure 24 illustrates in enlarged scale a fragmentary top view of a modified support unit for the inhaler of Figure 20;

Figure 25 illustrates in enlarged scale a fragmentary vertical sectional view (along section VIII-VIII in Figure 24) of the support unit of Figure 24;

Figure 26 illustrates a top view of a further modified blister pack for the inhaler of Figure 1;

Figure 27 illustrates in enlarged scale a fragmentary top view of the blister pack of Figure 26;

Figure 28 illustrates in enlarged scale a fragmentary vertical sectional view (along section IX-IX in Figure 27) of a modified tray for the support unit of the inhaler of Figure 1, illustrated with the blister pack of Figure 26 located thereon; and

Figure 29 illustrates a top view of a yet further modified blister pack for the inhaler of Figure 1.

Figures 1 to 16 illustrate an inhaler or components thereof in accordance with a first embodiment of the present invention.

The inhaler comprises a support unit V for supporting a blister pack B and a suction tube S. In a preferred

embodiment a protective cover may be provided for the support unit V.

The support unit V, in this embodiment a container, houses a blister pack B, such as illustrated in Figure 19, the respective blisters 8 of which each contain a dose of powder containing medicament 9. The support unit V includes an array of apertures 15 which provide guide portions corresponding respectively to the array of blisters 8 in the blister pack B. The support unit V is typically of a size similar to a tissue or cigarette pack.

The suction tube S is preferably of a length which corresponds approximately to the small finger of an adult human hand. In use, one end section 19 providing an inlet, an inlet section, of the suction tube S is inserted into one of the apertures 15 and pushed down so as to rupture the covering film 14' of the blister 8 therebeneath.

As will be described hereinbelow, the suction tube S includes an inhalation channel 31 which extends between the inlet section 19 providing an inlet and an outlet section 17 providing an outlet and acting as a mouthpiece. Thus, with the inlet section 19 inserted into a blister 8, when a user inhales through the outlet section 17 the dose of powder containing medicament 9 in the blister 8 is drawn through the inhalation channel 31. As will be apparent, successive doses of powder containing medicament 9 are obtained by

successively inserting the suction tube S into an aperture 15 corresponding to a previously unused blister 8.

In this embodiment the support unit V includes a chamber 34 in which the suction tube S is stored when not in use. The chamber 34 is closed by a lid 33 which is hinged about a pair of opposing hinge pins 35. The closing joint of the lid 33 is obliquely directed so as to maximise the surface area of the gripping portion on the lid 33. The closing joint is preferably at an angle of 45° with respect to the planar extent of the support unit V. Other arrangements are, of course, possible. For instance, the suction tube S could be inserted axially into an opening in the side of the support unit V. In any arrangement an elongate brush could be provided onto which the suction tube S is fitted. In this way, whenever the suction tube S is stored, the suction tube S is not only held in place by virtue of the brush extending through the inhalation channel 31, but is also cleaned. Indeed, as the suction tube S is pulled off the brush, the suction tube S is cleaned immediately prior to use.

In a preferred embodiment, in order to prevent the suction tube S and the support unit V from being separated and one being lost, the suction tube S can be attached to the support unit V by a member, such as a cord, particularly a very fine light cord-like member. In a particularly preferred embodiment the inhaler can include a sprung mechanism by means of which the member can be automatically retracted back

into one or other of the suction tube S and the support unit V. For example, the member could be wound around a roller which unwinds against a relatively gentle resilient force.

The blister pack B to be used in the inhaler of this embodiment is preferably of the kind as illustrated in Figure 19. The blister pack B comprises a generally planar thin sheet 11 having a plurality of cup-shaped portions or depressions 10 formed therein each containing a dose of powder containing medicament 9. The blister pack B further comprises a thin film 14, such as a foil, preferably of aluminium, which covers the openings to the cup-shaped portions 10 and thereby seals the doses of powder containing medicament 9 in the cup-shaped portions 10 to provide blisters 8.

As described hereinabove, a blister pack B is located in the support unit V such that individual blisters 8 are positioned directly beneath respective apertures 15. In this embodiment the support unit V includes a substantially planar guide wall 6 against which the substantially planar surface of the blister pack B is disposed. The guide wall 6 includes the plurality of apertures 15 which provide the guide portions that guide the inlet section 19 of the suction tube S into respective blisters 8 in such a manner that the suction tube S cannot tilt relative to the support unit V. The apertures 15 may take the form of frames surrounding the blisters 8. In this embodiment, however, the under surface of the guide

wall 6 is provided with elongate ribs 6', which, as illustrated in Figure 13, space the blister pack B from the under surface of the guide wall 6. The elongate ribs 6' are located between adjacent rows of apertures 15 and extend across the width of the support unit V. The elongate ribs 6' act to hold a blister pack B securely with respect to the guide wall 6 and a supporting tray 3 as will be described hereinbelow. By providing a space between the substantially planar surface of the blister pack B and the guide wall 6 a good flow of air around and into the cup-shaped portion 10 of any particular blister 8 is ensured.

As in this embodiment, the support unit V is preferably configured to allow the blister pack B to be replaced, such that one support unit V may be used with successive blister packs B as each is exhausted. It is possible to provide many different mechanisms for loading and unloading a blister pack B to and from the support unit V, such as by providing a hinged back part. In this embodiment the support unit V includes a slideable tray 3. The tray 3 is slideable in and out of one end of the support unit V and is preferably provided with a plurality of depressions or cavities 12 having the same arrangement as the blisters 8 in the blister pack B. In this way, the blister pack B may be laid onto the tray 3 when withdrawn and securely located thereto such that when the tray 3 is inserted back into the support unit V the blisters 8 are correctly aligned with the apertures 15 in the guide wall 6 of the support unit V. The cavities 12

correspond, at least in outline, to the cup-shaped portions 10 of the blisters 8 in the blister pack B, which, as illustrated, are cylindrical in the region adjacent the covering film 14'. The cavities 12 define a crater-like structure ordered in the form of criss-crossing rows, with partition walls 13 supporting the blister pack B. In this embodiment, in order to facilitate removal of the tray 3, the tray 3 is provided with a tab or handle 4 which protrudes into a recess 5 in the guide wall 6. As illustrated, the recess 5 is formed in one short side of the guide wall 6 without any overhang. In a preferred embodiment the tray 3 is provided with a catch to secure the same in the loaded position. The catch may be provided merely as a detent on the tray 3 or as part of the handle 4, such that the tray 3 is only released when the user deflects the handle 4 in some way. As illustrated, in order to enable the tray 3 to be slid in and out of the support unit V, the support unit V includes guides 7 having a generally C-shaped profile.

As described hereinabove and best illustrated by the cross-sections of Figures 11 and 12, the suction tube S generally comprises an elongate body having an inlet section 19 providing an inlet at one end, an outlet section 17 providing an outlet and acting as a mouthpiece at the other end and an inhalation channel 31 providing fluid communication between the inlet and the outlet. In this embodiment the outlet section 17 of the suction tube S is generally oval in shape, whereas the inlet section 19 is generally circular in shape.

As will become apparent, this configuration is not essential, but is advantageous. In particular, a flattened oval section is more comfortable in the mouth than a circular section. Furthermore, by shaping the inhalation channel 31 so as to flare outwardly from the inlet to the outlet, a higher velocity air flow is achieved at the inlet, thereby improving both the removal of the dose of powder containing medicament 9 from the blister 8 and the deagglomeration of that powder.

As illustrated, despite the inhalation channel 31 being tapered, the outer shape of the suction tube S is generally oval along most of the length thereof, at least up to a shoulder 21 which in use abuts the upper surface of the guide wall 6. The flats of the oval provide surfaces which can be gripped by the fingers of a user. In this embodiment, in order to maintain the oval shape, ribs 18 are provided down the length of the suction tube S. The provision of the ribs 18 is preferred in allowing for the suction tube S to be gripped securely by a user. A secure grip is necessary since some force has to be applied to the suction tube S on insertion into an aperture 15 in order to rupture the covering film 14' sealing the opening to the cup-shaped portion 10 of the respective blister 8.

In this embodiment, as illustrated, axially at the bottom of the plurality of ribs 18, and just axially above the shoulder 21, the suction tube S includes passageways 32 in fluid communication with the inhalation channel 31. The

passageways 32, in this embodiment transversely directed to the longitudinal axis of the suction tube S, provide supplementary air flow paths which allow supplementary air to be drawn into the inhalation channel 31 and mix with the air and powder mixture drawn through the inhalation channel 31 from the blister 8. The provision of such supplementary passageways 32 provides that for each unit volume of air inhaled the user inhales a reduced amount powder containing medicament. Furthermore, the action of the supplementary air mixing with the air and powder mixture flowing through the inhalation channel 31 induces turbulence and assists in the deagglomeration of that powder. This effect is enhanced by the inhalation channel 31 being tapered as described hereinabove. Preferably, the cross-section of the passageways 32 together correspond approximately to the circular cross-section of the inhalation channel 31 in the inlet section 19 of the suction tube S.

As described hereinabove, the passageways 32 are located adjacent the shoulder 21. The location of the passageways 32 in this position is advantageous since, when the inlet section 19 of the suction tube S is inserted into an aperture 15, the presence of the adjacent guide wall 6 ensures that it is almost impossible for a user accidentally to block the supplementary passageways 32 with his or her fingers.

In this embodiment, as best illustrated in Figures 11 and 12, the inlet section 19 of the suction tube S includes a

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generally annular cutter 20. The inlet section 19 of the suction tube S is shaped to fit securely in the apertures 15, whilst allowing air to be drawn down around the outer peripheral surface thereof into the ruptured blister 8 below. In this embodiment the inlet section 19 of the suction tube S is matched cross-sectionally to the shape of the apertures 15 which are preferably circular such that an interruption free, well supporting contact is achieved with the guide wall 6. In this embodiment the inlet section 19 of the suction tube S is a plug connection having frictional contact with the apertures 15.

As described hereinabove, the suction tube S includes a shoulder 21 which, in use, rests in a tilt-preventing manner on the upper surface of the guide wall 6 so as to ensure that the inlet section 19 of the suction tube S is always inserted into each aperture 15 and associated blister 8 to the same extent. It will, of course, be appreciated that the inlet section 19 of the suction tube S is of such a length as to position the inlet of the suction tube S in that position in the cup-shaped portion 10 of a blister 8 most suited to withdrawing therefrom the dose of powder containing medicament 9.

In this embodiment the inlet section 19 of the suction tube S includes passageways 29 formed as axially-directed channels in the outer peripheral surface thereof. As will become apparent hereinbelow and, indeed, as illustrated in Figure

14, the passageways 29 provide an air flow path from above the surface of the blister pack B to a position below the ruptured covering film 14' of a blister 8. In this way, during inhalation through the suction tube S, air is drawn down through the passageways 29 and into the cup-shaped portion 10 of the blister 8 so as to pick up the dose of powder containing medicament 9 contained therein. The resulting air and powder mixture containing medicament is then drawn through the inhalation channel 31 and into the lungs of a user.

As illustrated, the cutter 20 includes a plurality of cutting blades 28 arranged around a greater part of the outer peripheral surface thereof. In this embodiment, where the cutter 20 is considered to comprise four sectors, the cutter 20 includes part-annular cutting blades 28 in three of the four sectors, with one sector not including a cutting blade 28. The sectors and hence cutting blades 28 are separated from one another by gaps 26. In this embodiment, as illustrated in Figures 5 and 15, the non-cutting sector of the cutter 20 tapers inwardly to the distal end of the cutter 20. Indeed, the cutter 20 may generally be angled relative to the longitudinal axis of the suction tube S such that the cutting blade 28 opposite the non-cutting sector contacts the covering film 14' of the respective blister 8 before the other cutting blades 28.

In use, when the suction tube S is inserted into one of the apertures 15, the cutting blades 28 of the cutter 20 come into contact with an unbroken covering film 14'. Upon inserting the suction tube S further into the aperture 15, the cutting blades 28 begin to cut the covering film 14'. It will, of course, be appreciated that the covering film 14' opposing the gaps 26 is not cut directly by one of the cutting blades 28, but rather, the gaps 26 are of such a size relative to the cutting blades 28 and the blister 8 that the covering film 14' tears so as to provide a continuous cut in the covering film 14' between the cutting blades 28. As mentioned hereinabove, the cutting blades 28 of the cutter 20 do not extend around the entire annulus of the inlet section 19 of the suction tube S, but the cutter 20 includes a sector, preferably of about 90°, which does not cut the covering film 14'. In this embodiment the non-cutting sector of the cutter 20 does not contact the covering film 14' until the cutting blades 28 have cut the covering film 14' and are located in the cup-shaped portion 10 of the blister 8. The cutting blades 28 are sharpened cutting edges provided by the full radial thickness of the cutter 20, with the cutting edges being disposed at the outer radial surface of the radial thickness of the cutter 20. Therefore, as the inlet section 19 of the suction tube S is pushed further into the blister 8, the cut covering film 14' is pushed downwards by the cutter 20. That single section of the covering film 14' which is not cut thus acts as a hinge 27. With the inlet section 19 of the suction tube S fully inserted into the

blister 8 the non-cutting sector of the cutter 20 contacts the covering film 14', but only to ensure that the cut covering film 14' is pushed down into the cup-shaped portion 10 of the blister 8, thereby ensuring that the inlet of the suction tube S defined by the cutter 20 is open to the interior of the blister 8.

In a preferred embodiment the covering film 14' is cut so as to leave the hinge 27 at an upper side as viewed in Figure 1. In normal use, the support unit V will be held as illustrated in Figure 1, whereby the doses of powder containing medicament 9 in the individual blisters 8 will collect away from the hinge 27 allowing unimpeded withdrawal.

It will be appreciated that the above-described cutting and insertion arrangement ensures not only reliable and consistent cutting of the covering films 14', but also that a cut covering film 14' is retained by the hinge 27 and cannot be inhaled by a user. In addition, the passageways 29 in the outer radial surface of the inlet section 19 of the suction tube S cannot be blocked by the covering film 14' and ensure that air is effectively drawn into the blister 8 under the covering film 14'. The passageways 29 also direct air into the outer periphery of the cup-shaped portion 10 of the blister 8 at a plurality of positions so as to ensure that all of the dose of powder containing medicament 9 in the blister 8 is exposed to a flow of air. Furthermore, the gaps 26 between the cutting blades 28 ensure that the resulting

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air and powder mixture is always able to flow past the cut covering film 14' and into the inhalation channel 31.

Referring to Figure 2, it will be noted that the apertures 15 in the guide wall 6 of the support unit V include radial extensions 16, 16', 16''. Indeed, in order to use the space available most efficiently, horizontally adjacent apertures 15 are linked by a common extension 16. Corresponding to the extensions 16, 16', 16'' the inlet section 19 of the suction tube S is provided with protrusions 23, 24. The corresponding extensions 16, 16', 16'' and protrusions 23, 24 fix the suction tube S more securely in the apertures 15 and therefore make the inhaler easier and more pleasing to use. The use of an asymmetric arrangement of extensions 16, 16', 16'' and protrusions 23, 24 means that the suction tube S may only be inserted in one particular predetermined orientation. This provides more consistent and pleasing operation for the user. Furthermore, if the cup-shaped portions 10 of the blisters 8 have an asymmetric shape, the suction tube S is advantageously always inserted with the correct orientation.

Irrespective of the nature of the blisters 8, ensuring that the suction tube S can only be inserted into each aperture 15 with one orientation has the advantage that the user is only able to insert the suction tube S into a previously used blister with the same orientation as was previously used. If a user were accidentally to be able to insert the suction tube S into a previously used blister with another

orientation to that used previously, then the cut covering film 14' could be cut free, with the risk that the user could inhale the same. However, with the preferred arrangement described above, this is not possible.

As illustrated in Figure 14, the protrusions 23, 24 abut the top surface of the blister pack B. Indeed, where provided, the protrusions 23, 24 define a shoulder 22 that in use abuts the blister pack B. The abutment of the shoulder 22 fixes the blister pack B against the upper side of the partition walls 13 circumscribing the respective cavity 12. In this way, it is ensured that, irrespective of the position of the shoulder 22 because of variations occurring for instance for tolerance reasons, the cutter 20 is not inserted too far into a blister 8. This is particularly important, since, if the inlet section 19 of the suction tube S were inserted too far, the non-cutting sector of the cutter 20 could tear the covering film 14', causing the covering film 14' to be cut free.

Of course, it will be appreciated that it is possible to use many other different shapes for fixing the orientation of the suction tube S relative to the support unit V. Figure 16 illustrates one possibility, namely the use of apertures 15 with flattened sides 37. Preferably, the flattened sides 37 lie diametrically opposite the non-cutting sector of the cutter 20. This configuration requires an even shorter length of cut and the opening at the end face of the inlet

section 19 of the suction tube S is thus kept even more free. Moreover, due to gravity, the dose of powder containing medicament 9 accumulates in front of the free end of the covering film 14'.

Figures 17 and 18 illustrate a modified suction tube S for the inhaler of the first embodiment. In this suction tube S the passageways 29 are not channels in the outer peripheral surface of the inlet section 19 of the suction tube S, but are conduits within the tubular member defining the inlet section 19 of the suction tube S having broad sector-shaped outlets 29'' adjacent the cutting blades 28 and between the gaps 26 and inlets 29' in the outer peripheral surface of the inlet section 19. This modified suction tube S advantageously provides a flow of air into the blister 8 around a greater length of the periphery thereof.

Figures 20 to 25 illustrate an inhaler or components thereof in accordance with a second embodiment of the present invention.

The inhaler comprises a support unit G and a suction tube S. The suction tube S is of the same kind as described hereinabove in relation to the inhaler of the first embodiment. The support unit G comprises a guide wall 6 of essentially the same kind as described hereinabove in relation to the inhaler of the first embodiment, with stubs 36 defining the apertures 15 that act as guide portions. The

stubs 36 receive the inlet section 19 of the suction tube S such that the suction tube S is not able to tilt. In a preferred embodiment the support unit G is formed of a plastics material.

In a first variant, as illustrated in Figure 21, the support unit G is an integral part of a blister pack. The guide wall 6 of the support unit G is fixed, for instance, by adhesive or heat sealing to the covering film 14 of a blister pack B of the same kind as described hereinabove in relation to the inhaler of the first embodiment.

In a second variant the support unit G is adapted for use with successive blister packs B of the same kind as described hereinabove in relation to the inhaler of the first embodiment. This variant of the support unit G includes means for releasably securing a blister pack B to the under surface of the guide wall 6 thereof and holding the same in the correct relative position. In a preferred embodiment three of the four edges of the guide wall 6 could be provided with generally C-shaped lips, such that a blister pack B could be slid into position from that edge without such a lip.

Functionally, the support unit G of this embodiment is used in the same way as the support unit V described hereinabove in relation to the inhaler of the first embodiment. In particular, the inlet section 19 of the suction tube S which

includes the cutter 20 is inserted into a respective aperture 15 so as to rupture the respective covering film 14'.

In a preferred embodiment the support unit G includes means for attaching the suction tube S thereto, for example, one or more clips such as resilient claws.

In the variant of the support unit G as illustrated in Figures 21 to 23 neither the stubs 36 of the guide wall 6 nor the inlet section 19 of the suction tube S are configured so as to ensure that the suction tube S can only be inserted in one relative orientation into a respective stub 36. However, it will, of course, be appreciated that the stubs 36 and the inlet section 19 of the suction tube S can be so configured. In a preferred embodiment, as illustrated in Figures 24 and 25 and similarly to the modified support unit V as illustrated in Figure 16, the apertures 15 of the stubs 36 may each be provided with a flattened portion 37 to ensure that the suction tube S is always inserted into an aperture 15 with the same relative orientation.

In the support units G of Figures 22 and 23 and Figures 24 and 25 the stubs 36 have the same cross-section as the upper sections of the cup-shaped portions 10 of the blisters 8. In particular, the blisters 8 of the support unit G of Figures 24 and 25 each have a flattened portion 38 which matches the flattened portion 37 of each stub 36. However, it is not necessary for the stubs 36 to be of the same shape as the

cup-shaped portions 10 of the blisters 8. Desirably, that part of inlet section 19 of the suction tube S which is inserted into a blister 8 should encompass substantially all of the area of the opening of the blister 8 so as to promote the withdrawal of the dose of powder containing medicament 9 from the blister 8. However, other portions of the suction tube S may extend radially beyond the opening of the blister 8. In this way, the stubs 36 can be of any shape or size. Indeed, if at least part of the stubs 36 has a radial dimension greater than that of the blisters 8, the suction tube S may include a shoulder such as shoulder 22 described hereinabove in relation to the inhaler of the first embodiment.

In the preferred inhalers of the above-described first and second embodiments the inlet sections 19 of the suction tubes S and the apertures 15 in the guide walls 6 of the support units V, G are configured so as to ensure that the suction tubes S can only be inserted through respective apertures 15 in one relative orientation. It is, however, further preferred that the inlet sections 19 of the suction tubes S and the apertures 15 in the support units V, G be shaped and/or sized according to the medicament of use so as to avoid the possibility of cross-contamination of medicaments. It is envisaged that cross-contamination of medicaments could possibly occur where a user has to take two or more different medicaments, but by shaping and/or sizing the suction tubes S and the apertures 15 in the support units V, G uniquely

according to the medicament the possibility of the user inadvertently using the wrong suction tube S is obviated.

Furthermore, where the support units V, G are reusable, it is important that blister packs B are loaded into support units V, G with the same orientation and that any loaded blister pack B contains the correct medicament. It is, therefore, preferred that the blister packs B include a physical feature representative of the orientation and/or the contained medicament. In an electronically-controlled inhaler the blister packs B could be provided with electronically-readable information, such as a magnetic strip or optically-readable bar coding. However, in relatively simple inhalers of the kind as described hereinabove it is proposed to provide the blister packs B with features having particular shapes, sizes and positions representative of the orientation and/or the contained medicament. In particular, in order to ensure that blister packs B are loaded into support units V, G with the correct orientation, the features are asymmetrically disposed with respect to the possible orientations for insertion.

A blister pack B modified to include features representative of the orientation and/or the contained medicament is illustrated in Figures 26 and 27. This modified blister pack B includes first, second and third openings 40 in the sheet 11 in which the cup-shaped portions 10 of the blisters 8 are formed. The openings 40 are located in the intermediate

zones 39 between the cup-shaped portions 10 defining the blisters 8. In the illustrated embodiment the openings 40 are hidden by the covering film 14. In a preferred embodiment the openings 40 are located at the corners of a square or rectangle. This modified blister pack B is particularly suited to the inhaler of the first embodiment where the blister pack B is laid onto a tray 3 which is then slid into a support unit V. A tray 3 modified to receive such a blister pack B is illustrated in Figure 28. The tray 3 includes protrusions 41 corresponding in size, shape and position to the openings 40 in the blister pack B. In this way, when the blister pack B is laid onto the tray 3 in the correct orientation the protrusions 41 fit into the openings 40. As will be apparent from Figure 26, if the blister pack B were to be laid onto the tray 3 with the opposite orientation, the protrusions 41 on the tray 3 would not align with the openings 40 in the blister pack B, such that the blister pack B would stand proud of the tray 3 and prevent the tray 3 from being slid into the support unit V. The asymmetric arrangement of the openings 40 and the protrusions 41 ensures that the blister pack B cannot be loaded into the support unit V with the incorrect orientation. It will further be appreciated that by selecting a different asymmetric arrangement of openings 40 and protrusions 41 for each different medicament, then blister packs B containing only the correct medicament can be loaded into the support unit V. In the illustrated embodiment the blister pack B includes twenty intermediate zones 39 in which openings 40

could be formed, thus giving scope for many possible combinations.

In the above-described modified blister pack B the openings 40 and the projections 41 have a lozenge-shaped or square outline. Other configurations are, of course, possible. One such further blister pack B is illustrated in Figure 29. This further modified blister pack B includes first and second slits 40 that extend inwardly from the peripheral edge 42. In this modified blister pack B the first and second slits 40 are paracentral and extend oppositely in a direction parallel to the narrow sides and over a length greater than half of the length of the narrow sides. In this way, the slits 40 overlap each other in the central region of the blister pack B. For such a modified blister pack B the tray 3 of the support unit V would, for example, include web or blade like protrusions.

In a yet further modified blister pack B the blisters 8 could be shaped and/or positioned to identify the orientation and/or the contained medicament. Alternatively, the blister pack B could include small appropriately-positioned protrusions which could be formed in the same thermoforming step as the cup-shaped portions 10 of the blisters 8.

For the above-described variant of the support unit G of the inhaler of the second embodiment which is reusable, protrusions and/or recesses can be provided on the upper

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substantially planar surface of the blister pack B and the under surface of the guide wall 6 of the support unit G which opposes the same. Specifically, in the preferred embodiment of the support unit G which includes C-shaped lips on opposing edges for receiving a blister pack B, the support unit G could be tapered such that only correspondingly-tapered blister packs B could be received in the one orientation.

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CLAIMS

1. An inhaler for administering dry powder, comprising:
a suction tube (S) having an inlet at one end and an outlet at the other end, the suction tube (S) including at the one end an inlet section (19) configured for insertion into a blister (8) containing a dose of powder containing medicament (9) and an inhalation channel (31) providing fluid communication between the inlet and the outlet through which powder is in use drawn on inhalation by a user; and
a support unit (V, G) for supporting a blister pack (B) having a substantially planar surface with a plurality of blisters (8) formed therein, the support unit (V, G) including a guide wall (6) adjacent which the substantially planar surface of the blister pack (B) is in use disposed, the guide wall (6) including a plurality of apertures (15) acting as guide portions in alignment with respective blisters (8) of the blister pack (B), each aperture (15) being for guiding the inlet section (19) of the suction tube (S) into a respective blister (8) of the blister pack (B) and supporting the suction tube (S) when so guided.
2. The inhaler according to claim 1, wherein the support unit (V) is a container within which the blister pack (B) is in use housed.



3. The inhaler according to claim 2, wherein the support unit (V) includes a support member (3) including a plurality of cavities (12) for receiving respective blisters (8) of the blister pack (B), the cavities (12) having the same arrangement as the apertures (15) in the guide wall (6) such that in use the blisters (8) of the blister pack (B) oppose the respective apertures (15).
4. The inhaler according to claim 3, wherein the support member (3) is adapted to be slideable relative to the guide wall (6) so as to allow loading and unloading of blister packs (B).
5. The inhaler according to claim 1, wherein the support unit (G) includes holding means for holding the substantially planar surface of the blister pack (B) adjacent the guide wall (6).
6. The inhaler according to claim 5, wherein the holding means comprises C-shaped lips for slideably receiving the blister pack (B).
7. The inhaler according to claim 5 or 6, wherein the apertures (15) are defined by elongate sections (36).
8. The inhaler according to claim 7, wherein the length of the elongate sections (36) is greater than the width of the blisters (8) of the blister pack (B).



9. The inhaler according to any of claims 1 to 8, wherein the support unit (V, G) includes one or more projections or recesses (41) of predetermined size and position such that the support unit (V, G) can only receive blister packs (B) with corresponding recesses or projections (40).
10. The inhaler according to claim 9, wherein the one or more projections or recesses (41) are sized and positioned such that the support unit (V, G) can only receive blister packs (B) in one relative orientation.
11. The inhaler according to any of claims 1 to 10, wherein the inlet section (19) of the suction tube (S) and each of the apertures (15) are configured such that the inlet section (19) of the suction tube (S) can only be inserted through the apertures (15) in one relative orientation.
12. The inhaler according to claim 11, wherein the cross-section of the inlet section (19) of the suction tube (S) and the cross-section of each of the apertures (15) is rotationally asymmetric.
13. The inhaler according to claim 12, wherein each of the apertures (15) is generally circular in shape with at least one radial extension (16, 16', 16'').



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14. The inhaler according to claim 13, wherein a plurality of the apertures (15) are linked by at least one radial extension (16).
15. The inhaler according to any of claims 1 to 14, wherein the support unit (V, G) includes a holder for holding the suction tube (S) when not in use.
16. The inhaler according to claim 15, wherein the holder comprises a chamber (34) with a hinged lid (33).
17. The inhaler according to any of claims 1 to 16, wherein the inlet section (19) of the suction tube (S) includes a cutter (20) having a cutting edge for cutting a covering film (14') of a blister (8) of the blister pack (B).
18. The inhaler according to claim 17, wherein the cutter (20) is located around only a part of the inlet of the suction tube (S) such that upon insertion of the inlet section (19) of the suction tube (S) into a blister (8) of the blister pack (B) the cutter (20) cuts the covering film (14') of the blister (8) such as to leave a single cut film flap.
19. The inhaler according to claim 18, wherein the cutting edge of the cutter (20) is disposed at the outer

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peripheral surface of the inlet section (19) of the suction tube (S) such that when the inlet section (19) of the suction tube (S) is inserted into a blister (8) of the blister pack (B) the cutter (20) first cuts the covering film (14') of the blister (8) and then the inner peripheral surface of the inlet section (19) of the suction tube (S) pushes the cut film flap into the blister (8).

20. The inhaler according to any of claims 17 to 19, wherein the cutter (20) comprises a plurality of axially-extending blades (28), each having cutting edges, separated by axially-extending gaps (26).
21. The inhaler according to any of claims 1 to 20, wherein the inlet section (19) of the suction tube (S) includes at least one passageway (29) for providing fluid communication between a blister (8) of the blister pack (B) and a space above the blister (8) when the inlet section (19) of the suction tube (S) is inserted in the blister (8).
22. The inhaler according to claim 21, wherein the at least one passageway (29) comprises an open channel in the outer peripheral surface of the inlet section (19) of the suction tube (S), the at least one passageway (29) having one end located at a position along the length of the inlet section (19) of the suction tube (S) and the



other end located adjacent the inlet of the suction tube (S).

23. The inhaler according to claim 22 when appendant upon any of claims 17 to 20, wherein the other end of the at least one passageway (29) is located adjacent the cutter (20).
24. The inhaler according to claim 22 or 23 when appendant upon claim 20, wherein the other end of the at least one passageway (29) is located at one of the gaps (26).
25. The inhaler according to claim 22 or 23 when appendant upon claim 20, wherein the other end of the at least one passageway (29) is located between adjacent gaps (26).
26. The inhaler according to claim 21, wherein the at least one passageway (29) comprises a conduit in the inlet section (19) of the suction tube (S), the at least one passageway (29) having an inlet (29') located at a position along the length of the inlet section (19) of the suction tube (S) and an outlet (29'') located adjacent the inlet of the suction tube (S).
27. The inhaler according to claim 26 when appendant upon any of claims 17 to 20, wherein the outlet (29'') of the at least one passageway (29) is located adjacent the cutter (20).

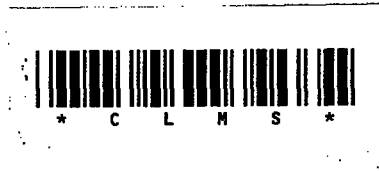


28. The inhaler according to claim 26 or 27 when appendant upon claim 20, wherein the outlet (29'') of the at least one passageway (29) is located at one of the gaps (26).
29. The inhaler according to claim 26 or 27 when appendant upon claim 20, wherein the outlet (29'') of the at least one passageway (29) is located between adjacent gaps (26).
30. The inhaler according to any of claims 1 to 29, wherein the suction tube (S) includes at least one passageway (32) providing fluid communication between the inhalation channel (31) and the atmosphere through which supplementary air is in use drawn into the inhalation channel (31) on inhalation by the user.
31. The inhaler according to any of claims 1 to 30, wherein the inlet section (19) of the suction tube (S) includes a radially-extending member defining a shoulder (22) at a predetermined axial distance from the distal end thereof, the shoulder (22) being configured so as in use to abut the blister pack (B) and prevent the inlet section (19) of the suction tube (S) from being inserted too far into a blister (8) of the blister pack (B).
32. The inhaler according to any of claims 1 to 31, further comprising a member connecting the suction tube (S) to



the support unit (V, G) in order to prevent the suction tube (S) and the support unit (V, G) from being separated from one another.

33. The inhaler according to any of claims 1 to 32, in combination with a blister pack (B).
34. A support unit for supporting a blister pack (B) having a substantially planar surface with a plurality of blisters (8) formed therein, the support unit (V, G) including a guide wall (6) adjacent which the substantially planar surface of the blister pack (B) is in use disposed, the guide wall (6) including a plurality of apertures (15) acting as guide portions in alignment with respective blisters (8) of the blister pack (B), each aperture (15) being for guiding the inlet section (19) of a suction tube (S) into a respective blister (8) of the blister pack (B) and supporting the suction tube (S) when so guided.
35. The support unit according to claim 34, wherein the support unit (V) is a container within which the blister pack (B) is in use housed.
36. The support unit according to claim 35, including a support member (3) including a plurality of cavities (12) for receiving respective blisters (8) of the blister pack (B), the cavities (12) having the same



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arrangement as the apertures (15) in the guide wall (6) such that in use the blisters (8) of the blister pack (B) oppose the respective apertures (15).

37. The support unit according to claim 36, wherein the support member (3) is adapted to be slideable relative to the guide wall (6) to allow loading and unloading of blister packs (B).
38. The support unit according to claim 34, including holding means for holding the substantially planar surface of the blister pack (B) adjacent the guide wall (6).
39. The support unit according to claim 38, wherein the holding means comprises C-shaped lips for slideably receiving the blister pack (B).
40. The support unit according to claim 38 or 39, wherein the apertures (15) are defined by elongate sections (36).
41. The support unit according to claim 40, wherein the length of the elongate sections (36) is greater than the width of the blisters (8) of the blister pack (B).
42. The support unit according to any of claims 34 to 41, including one or more projections or recesses (41) of

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predetermined size and position so as to be able to receive only blister packs (B) with corresponding recesses or projections (40).

43. The support unit according to claim 42, wherein the one or more projections or recesses (41) are sized and positioned such that blister packs (B) can only be received in one relative orientation.
44. The support unit according to any of claims 34 to 43, wherein each of the apertures (15) is configured such that the inlet section (19) of a suction tube (S) can only be inserted through the apertures (15) in one relative orientation.
45. The support unit according to claim 44, wherein the cross-section of each of the apertures (15) is rotationally asymmetric.
46. The support unit according to claim 45, wherein each of the apertures (15) is generally circular in shape with at least one radial extension (16, 16', 16'').
47. The support unit according to claim 46, wherein a plurality of the apertures (15) are linked by at least one radial extension (16).



48. The support unit according to any of claims 34 to 47, including a holder for holding a suction tube (S).
49. The support unit according to claim 48, wherein the holder comprises a chamber (34) with a hinged lid (33).
50. The support unit according to any of claims 34 to 49, in combination with a blister pack (B).
51. An inhaler for administering dry powder, comprising:
a suction tube (S) having an inlet at one end and an outlet at the other end, the suction tube (S) including at the one end an inlet section (19) configured for insertion into a blister (8) containing a dose of powder containing medicament (9) and an inhalation channel (31) providing fluid communication between the inlet and the outlet through which powder is in use drawn on inhalation by a user; and
a support unit (V, G) for supporting a blister pack (B) having a substantially planar surface with a plurality of blisters (8) formed therein, the support unit (V, G) including a guide wall (6) adjacent which the substantially planar surface of the blister pack (B) is in use disposed, the guide wall (6) including a plurality of apertures (15) acting as guide portions in alignment with respective blisters (8) of the blister pack (B), each aperture (15) being for guiding the inlet section (19) of the suction tube (S) into a respective



blister (8) of the blister pack (B) and supporting the suction tube (S) when so guided;

wherein the inlet section (19) of the suction tube (S) and each of the apertures (15) are configured such that the inlet section (19) of the suction tube (S) can only be inserted through the apertures (15) in one relative orientation.

52. The inhaler according to claim 51, wherein the support unit (V) is a container within which the blister pack (B) is in use housed.
53. The inhaler according to claim 52, wherein the support unit (V) includes a support member (3) including a plurality of cavities (12) for receiving respective blisters (8) of the blister pack (B), the cavities (12) having the same arrangement as the apertures (15) in the guide wall (6) such that in use the blisters (8) of the blister pack (B) oppose the respective apertures (15).
54. The inhaler according to claim 53, wherein the support member (3) is adapted to be slideable relative to the guide wall (6) so as to allow loading and unloading of blister packs (B).
55. The inhaler according to claim 51, wherein the support unit (G) includes holding means for holding the



substantially planar surface of the blister pack (B) adjacent the guide wall (6).

56. The inhaler according to claim 55, wherein the holding means comprises C-shaped lips for slideably receiving the blister pack (B).
57. The inhaler according to claim 55 or 56, wherein the apertures (15) are defined by elongate sections (36).
58. The inhaler according to claim 57, wherein the length of the elongate sections (36) is greater than the width of the blisters (8) of the blister pack (B).
59. The inhaler according to any of claims 51 to 58, wherein the support unit (V, G) includes one or more projections or recesses (41) of predetermined size and position such that the support unit (V, G) can only receive blister packs (B) with corresponding recesses or projections (40).
60. The inhaler according to claim 59, wherein the one or more projections or recesses (41) are sized and positioned such that the support unit (V, G) can only receive blister packs (B) in one relative orientation.
61. The inhaler according to any of claims 51 to 60, wherein the cross-section of the inlet section (19) of the

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suction tube (S) and the cross-section of each of the apertures (15) is rotationally asymmetric.

62. The inhaler according to claim 61, wherein each of the apertures (15) is generally circular in shape with at least one radial extension (16, 16', 16'').
63. The inhaler according to claim 62, wherein a plurality of the apertures (15) are linked by at least one radial extension (16).
64. The inhaler according to any of claims 51 to 63, wherein the support unit (V, G) includes a holder for holding the suction tube (S) when not in use.
65. The inhaler according to claim 64, wherein the holder comprises a chamber (34) with a hinged lid (33).
66. The inhaler according to any of claims 51 to 65, wherein the inlet section (19) of the suction tube (S) includes a cutter (20) having a cutting edge for cutting a covering film (14') of a blister (8) of the blister pack (B).
67. The inhaler according to claim 66, wherein the cutter (20) is located around only a part of the inlet of the suction tube (S) such that upon insertion of the inlet section (19) of the suction tube (S) into a blister (8)

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of the blister pack (B) the cutter (20) cuts the covering film (14') of the blister (8) such as to leave a single cut film flap.

68. The inhaler according to claim 67, wherein the cutting edge of the cutter (20) is disposed at the outer peripheral surface of the inlet section (19) of the suction tube (S) such that when the inlet section (19) of the suction tube (S) is inserted into a blister (8) of the blister pack (B) the cutter (20) first cuts the covering film (14') of the blister (8) and then the inner peripheral surface of the inlet section (19) of the suction tube (S) pushes the cut film flap into the blister (8).
69. The inhaler according to any of claims 66 to 68, wherein the cutter (20) comprises a plurality of axially-extending blades (28), each having cutting edges, separated by axially-extending gaps (26).
70. The inhaler according to any of claims 51 to 69, wherein the inlet section (19) of the suction tube (S) includes at least one passageway (29) for providing fluid communication between a blister (8) of the blister pack (B) and a space above the blister (8) when the inlet section (19) of the suction tube (S) is inserted in the blister (8).



71. The inhaler according to claim 70, wherein the at least one passageway (29) comprises an open channel in the outer peripheral surface of the inlet section (19) of the suction tube (S), the at least one passageway (29) having one end located at a position along the length of the inlet section (19) of the suction tube (S) and the other end located adjacent the inlet of the suction tube (S).
72. The inhaler according to claim 71 when appendant upon any of claims 66 to 69, wherein the other end of the at least one passageway (29) is located adjacent the cutter (20).
73. The inhaler according to claim 71 or 72 when appendant upon claim 69, wherein the other end of the at least one passageway (29) is located at one of the gaps (26).
74. The inhaler according to claim 71 or 72 when appendant upon claim 69, wherein the other end of the at least one passageway (29) is located between adjacent gaps (26).
75. The inhaler according to claim 70, wherein the at least one passageway (29) comprises a conduit in the inlet section (19) of the suction tube (S), the at least one passageway (29) having an inlet (29') located at a position along the length of the inlet section (19) of



the suction tube (S) and an outlet (29'') located adjacent the inlet of the suction tube (S).

76. The inhaler according to claim 75 when appendant upon any of claims 66 to 69, wherein the outlet (29'') of the at least one passageway (29) is located adjacent the cutter (20).
77. The inhaler according to claim 75 or 76 when appendant upon claim 69, wherein the outlet (29'') of the at least one passageway (29) is located at one of the gaps (26).
78. The inhaler according to claim 75 or 76 when appendant upon claim 69, wherein the outlet (29'') of the at least one passageway (29) is located between adjacent gaps (26).
79. The inhaler according to any of claims 51 to 78, wherein the suction tube (S) includes at least one passageway (32) providing fluid communication between the inhalation channel (31) and the atmosphere through which supplementary air is in use drawn into the inhalation channel (31) on inhalation by the user.
80. The inhaler according to any of claims 51 to 79, wherein the inlet section (19) of the suction tube (S) includes a radially-extending member defining a shoulder (22) at a predetermined axial distance form the distal end



thereof, the shoulder (22) being configured so as in use to abut the blister pack (B) and prevent the inlet section (19) of the suction tube (S) from being inserted too far into a blister (8) of the blister pack (B).

81. The inhaler according to any of claims 51 to 80, further comprising a member connecting the suction tube (S) to the support unit (V, G) in order to prevent the suction tube (S) and the support unit (V, G) from being separated from one another.
82. The inhaler according to any of claims 51 to 81, in combination with a blister pack (B).
83. A suction tube for administering dry powder from a blister (8) sealed by a covering film (14'), the suction tube (S) having an inlet at one end and an outlet at the other end, and including at the one end an inlet section (19) configured for insertion into a blister (8) containing a dose of powder containing medicament (9) and an inhalation channel (31) providing fluid communication between the inlet and the outlet through which powder is in use drawn on inhalation by a user, wherein the inlet section (19) includes a cutter (20) located around only a part of the inlet such that upon insertion of the inlet section (19) into a blister (8) the cutter (20) cuts the covering film (14') of the blister (8) such as to leave a single cut film flap.



84. The suction tube according to claim 83, wherein the cutting edge of the cutter (20) is disposed at the outer peripheral surface of the inlet section (19) such that when the inlet section (19) is inserted into a blister (8) the cutter (20) first cuts the covering film (14') of the blister (8) and then the inner peripheral surface of the inlet section (19) pushes the cut film flap into the blister (8).
85. The suction tube according to claim 83 or 84, wherein the cutter (20) comprises a plurality of axially-extending blades (28), each having cutting edges, separated by axially-extending gaps (26).
86. The suction tube according to any of claims 83 to 85, wherein the inlet section (19) includes at least one passageway (29) for providing fluid communication between a blister (8) and a space above the blister (8) when the inlet section (19) is inserted in the blister (8).
87. The suction tube according to claim 86, wherein the at least one passageway (29) comprises an open channel in the outer peripheral surface of the inlet section (19), the at least one passageway (29) having one end located at a position along the length of the inlet section (19)



and the other end located adjacent the inlet of the suction tube (S).

88. The suction tube according to claim 87, wherein the other end of the at least one passageway (29) is located adjacent the cutter (20).
89. The suction tube according to claim 87 or 88 when appendant upon claim 85, wherein the other end of the at least one passageway (29) is located at one of the gaps (26).
90. The suction tube according to claim 87 or 88 when appendant upon claim 85, wherein the other end of the at least one passageway (29) is located between adjacent gaps (26).
91. The suction tube according to claim 86, wherein the at least one passageway (29) comprises a conduit in the inlet section (19), the at least one passageway (29) having an inlet (29') located at a position along the length of the inlet section (19) and an outlet (29'') located adjacent the inlet of the suction tube (S).
92. The suction tube according to claim 91, wherein the outlet (29'') of the at least one passageway (29) is located adjacent the cutter (20).



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93. The suction tube according to claim 91 or 92 when appendant upon claim 85, wherein the outlet (29'') of the at least one passageway (29) is located at one of the gaps (26).
94. The suction tube according to claim 91 or 92 when appendant upon claim 85, wherein the outlet (29'') of the at least one passageway (29) is located between adjacent gaps (26).
95. The suction tube according to any of claims 83 to 94, including at least one passageway (32) providing fluid communication between the inhalation channel (31) and the atmosphere through which supplementary air is in use drawn into the inhalation channel (31) on inhalation by the user.
96. The suction tube according to any of claims 83 to 95, wherein the inlet section (19) includes a radially-extending member defining a shoulder (22) at a predetermined axial distance from the distal end thereof, the shoulder (22) being configured so as in use to abut a blister pack (B) which includes at least one blister (8) and prevent the inlet section (19) from being inserted too far into the at least one blister (8).

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97. A suction tube for administering dry powder from a blister (8) sealed by a covering film (14'), the suction tube (S) having an inlet at one end and an outlet at the other end, and including an inlet section (19) at the one end, the inlet section (19) being configured for insertion into a blister (8) containing a dose of powder containing medicament (9) and including at least one first passageway (29) for providing fluid communication between the blister (8) and a space above the blister (8) when the inlet section (19) is inserted in the blister (8), an inhalation channel (31) providing fluid communication between the inlet and the outlet through which powder is in use drawn on inhalation by a user and at least one second passageway (32) providing fluid communication between the inhalation channel (31) and the atmosphere through which supplementary air is in use drawn into the inhalation channel (31) on inhalation by the user.
98. The suction tube according to claim 97, wherein the inlet section (19) includes a cutter (20) having a cutting edge for cutting the covering film (14') of a blister (8).
99. The suction tube according to claim 98, wherein the cutter (20) is located around only a part of the inlet of the suction tube (S) such that upon insertion of the inlet section (19) into a blister (8) the cutter (20)



cuts the covering film (14') of the blister (8) such as to leave a single cut film flap.

100. The suction tube according to claim 99, wherein the cutting edge of the cutter (20) is disposed at the outer peripheral surface of the inlet section (19) such that when the inlet section (19) is inserted into a blister (8) the cutter (20) first cuts the covering film (14') of the blister (8) and then the inner peripheral surface of the inlet section (19) pushes the cut film flap into the blister (8).
101. The suction tube according to any of claims 98 to 100, wherein the cutter (20) comprises a plurality of axially-extending blades (28), each having cutting edges, separated by axially-extending gaps (26).
102. The suction tube according to any of claims 97 to 101, wherein the at least one first passageway (29) comprises an open channel in the outer peripheral surface of the inlet section (19), the at least one first passageway (29) having one end located at a position along the length of the inlet section (19) and the other end located adjacent the inlet of the suction tube (S).
103. The suction tube according to claim 102 when appendant upon any of claims 98 to 101, wherein the other end of



the at least one first passageway (29) is located adjacent the cutter (20).

104. The suction tube according to claim 102 or 103 when appendant upon claim 101, wherein the other end of the at least one first passageway (29) is located at one of the gaps (26).
105. The suction tube according to claim 102 or 103 when appendant upon claim 101, wherein the other end of the at least one first passageway (29) is located between adjacent gaps (26).
106. The suction tube according to any of claims 97 to 101, wherein the at least one first passageway (29) comprises a conduit in the inlet section (19), the at least one first passageway (29) having an inlet (29') located at a position along the length of the inlet section (19) and an outlet (29'') located adjacent the inlet of the suction tube (S).
107. The suction tube according to claim 106 when appendant upon any of claims 98 to 101, wherein the outlet (29'') of the at least one first passageway (29) is located adjacent the cutter (20).
108. The suction tube according to claim 106 or 107 when appendant upon claim 101, wherein the outlet (29'') of

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the at least one first passageway (29) is located at one of the gaps (26).

109. The suction tube according to claim 106 or 107 when appendant upon claim 101, wherein the outlet (29'') of the at least one first passageway (29) is located between adjacent gaps (26).
110. The suction tube according to any of claims 97 to 109, wherein the inlet section (19) includes a radially-extending member defining a shoulder (22) at a predetermined axial distance from the distal end thereof, the shoulder (22) being configured so as in use to abut a blister pack (B) which includes at least one blister (8) and prevent the inlet section (19) from being inserted too far into the at least one blister (8).
111. An inhaler for administering dry powder, comprising:
a blister pack (G) including a plurality of blisters (8) each containing a dose of powder containing medicament (9), each blister (8) comprising a cup-shaped portion (10) containing a dose of powder containing medicament (9), an elongate section (36) extending axially from the cup-shaped portion (10) for guiding the inlet section (19) of a suction tube (S) thereinto and a covering film (14') sealing the dose of powder containing medicament (9) in the cup-shaped portion (10) and separating the

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cup-shaped portion (10) from the elongate section (36); and
a suction tube (S) having an inlet at one end and an outlet at the other end, the suction tube (S) including an inlet section (19) at the one end and an inhalation channel (31) providing fluid communication between the inlet and the outlet through which powder is in use drawn on inhalation by a user, wherein the inlet section (19) is configured for insertion into the elongate section (36) and corresponding cup-shaped portion (10) of a respective one of the blisters (8) of the blister pack (G), the cross-section of the elongate sections (36) corresponding to the cross-section of at least a part of the inlet section (19) of the suction tube (S) such that on insertion of the inlet section (19) of the suction tube (S) into the elongate sections (36) the inlet section (19) of the suction tube (S) is guided into the corresponding cup-shaped portion (10).

112. The inhaler according to claim 111, wherein the length of the elongate sections (36) is greater than the width of the blisters (8) of the blister pack (G).

113. The inhaler according to claim 111 or 112, wherein the inlet section (19) of the suction tube (S) and the elongate sections (36) are configured such that the inlet section (19) of the suction tube (S) can only be



inserted into the elongate sections (36) in one relative orientation.

114. The inhaler according to claim 113, wherein the cross-section of the inlet section (19) of the suction tube (S) and the cross-section of the elongate sections (36) is rotationally asymmetric.
115. The inhaler according to any of claims 111 to 114, wherein the inlet section (19) of the suction tube (S) includes a cutter (20) having a cutting edge for cutting the covering film (14') sealing the cup-shaped portion (10) of a blister (8) of the blister pack (G).
116. The inhaler according to claim 115, wherein the cutter (20) is located around only a part of the inlet of the suction tube (S) such that upon insertion of the inlet section (19) of the suction tube (S) into the cup-shaped portion (10) of a blister (8) of the blister pack (G) the cutter (20) cuts the covering film (14') sealing the cup-shaped portion (10) such as to leave a single cut film flap.
117. The inhaler according to claim 116, wherein the cutting edge of the cutter (20) is disposed at the outer peripheral surface of the inlet section (19) of the suction tube (S) such that when the inlet section (19) of the suction tube (S) is inserted into the cup-shaped



portion (10) of a blister (8) of the blister pack (G) the cutter (20) first cuts the covering film (14') sealing the cup-shaped portion (10) and then the inner peripheral surface of the inlet section (19) of the suction tube (S) pushes the cut film flap into the cup-shaped portion (10).

118. The inhaler according to any of claims 115 to 117, wherein the cutter (20) comprises a plurality of axially-extending blades (28), each having cutting edges, separated by axially-extending gaps (26).
119. The inhaler according to any of claims 111 to 118, wherein the inlet section (19) of the suction tube (S) includes at least one passageway (29) for providing fluid communication between the cup-shaped portion (10) of a blister (8) of the blister pack (G) and a space above the cup-shaped portion (10) of the blister (8) when the inlet section (19) of the suction tube (S) is inserted in the cup-shaped portion (10) of the blister (8).
120. The inhaler according to claim 119, wherein the at least one passageway (29) comprises an open channel in the outer peripheral surface of the inlet section (19) of the suction tube (S), the at least one passageway (29) having one end located at a position along the length of the inlet section (19) of the suction tube (S) and the



other end located adjacent the inlet of the suction tube (S).

121. The inhaler according to claim 120 when appendant upon any of claims 115 to 118, wherein the other end of the at least one passageway (29) is located adjacent the cutter (20).
122. The inhaler according to claim 120 or 121 when appendant upon claim 118, wherein the other end of the at least one passageway (29) is located at one of the gaps (26).
123. The inhaler according to claim 120 or 121 when appendant upon claim 118, wherein the other end of the at least one passageway (29) is located between adjacent gaps (26).
124. The inhaler according to claim 119, wherein the at least one passageway (29) comprises a conduit in the inlet section (19) of the suction tube (S), the at least one passageway (29) having an inlet (29') located at a position along the length of the inlet section (19) of the suction tube (S) and an outlet (29'') located adjacent the inlet of the suction tube (S).
125. The inhaler according to claim 124 when appendant upon any of claims 115 to 118, wherein the outlet (29'') of



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the at least one passageway (29) is located adjacent the cutter (20).

126. The inhaler according to claim 124 or 125 when appendant upon claim 118, wherein the outlet (29'') of the at least one passageway (29) is located at one of the gaps (26).
127. The inhaler according to claim 124 or 125 when appendant upon claim 118, wherein the outlet (29'') of the at least one passageway (29) is located between adjacent gaps (26).
128. The inhaler according to any of claims 111 to 127, wherein the suction tube (S) includes at least one passageway (32) providing fluid communication between the inhalation channel (31) and the atmosphere through which supplementary air is in use drawn into the inhalation channel (31) on inhalation by a user.
129. The inhaler according to any of claims 111 to 128, wherein the inlet section (19) of the suction tube (S) includes a radially-extending member defining a shoulder (22) at a predetermined axial distance from the distal end thereof, the shoulder (22) being configured so as in use to abut the blister pack (G) and prevent the inlet section (19) of the suction tube (S) from being inserted

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too far into the cup-shaped portion (10) of a blister (8) of the blister pack (G).

130. The inhaler according to any of claims 111 to 129, further comprising a member connecting the suction tube (S) to the blister pack (G) in order to prevent the suction tube (S) and the blister pack (G) from being separated from one another.
131. A blister pack including a plurality of blisters (8) each containing a dose of powder containing medicament (9), each blister (8) comprising a cup-shaped portion (10) containing a dose of powder containing medicament (9), an elongate section (36) extending axially from the cup-shaped portion (10) for guiding the inlet section (19) of a suction tube (S) thereinto and a covering film (14') sealing the dose of powder containing medicament (9) in the cup-shaped portion (10) and separating the cup-shaped portion (10) from the elongate section (36).
132. The blister pack according to claim 131, wherein the length of the elongate sections (36) is greater than the width of the blisters (8).
133. The blister pack according to claim 131 or 132, wherein the elongate sections (36) are configured such that an inlet section (19) of a suction tube (S) can only be inserted thereinto in one relative orientation.



134. The blister pack according to claim 133, wherein the cross-section of the elongate sections (36) is rotationally asymmetric.

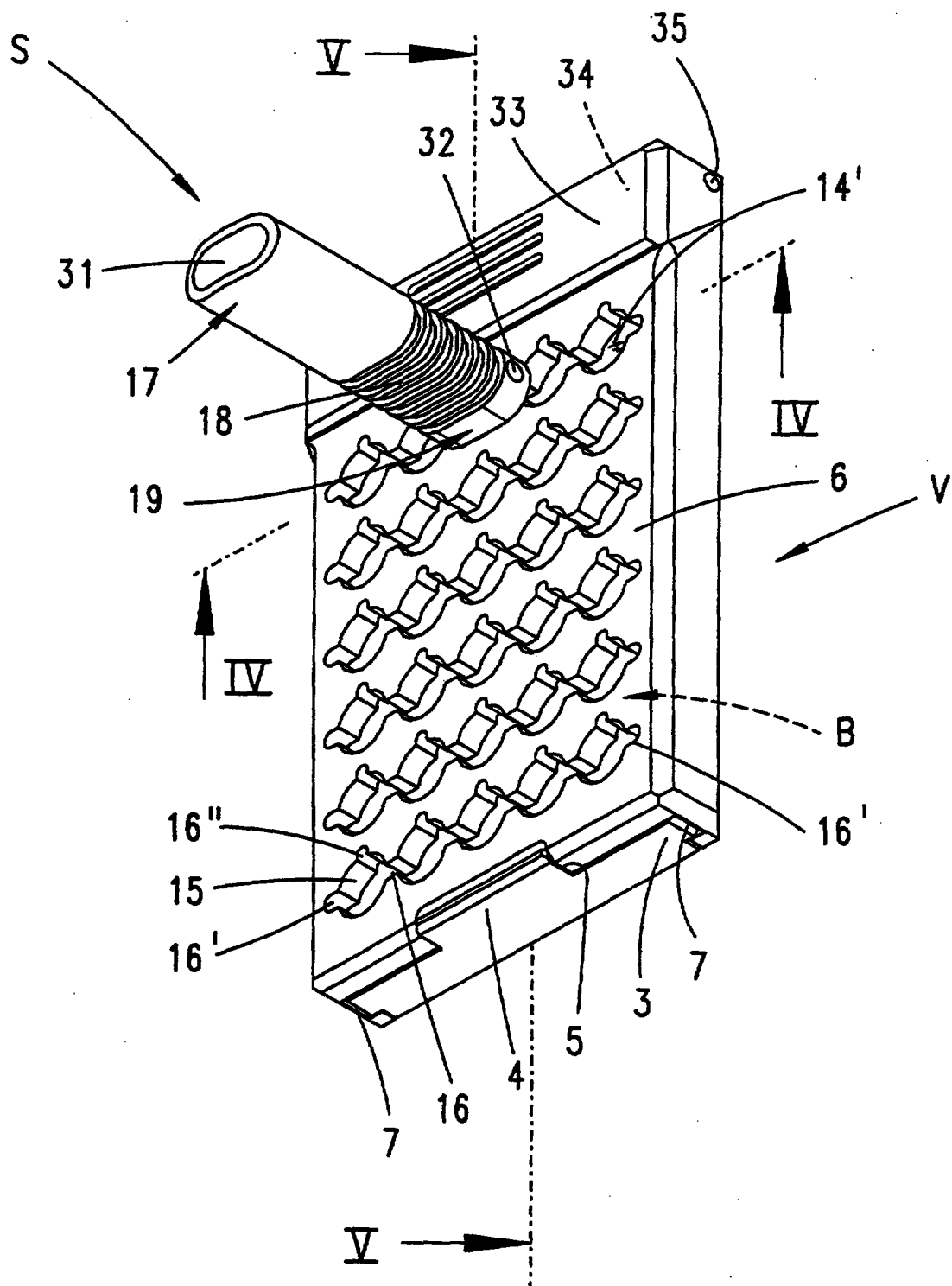
Fig. 1

Fig. 3

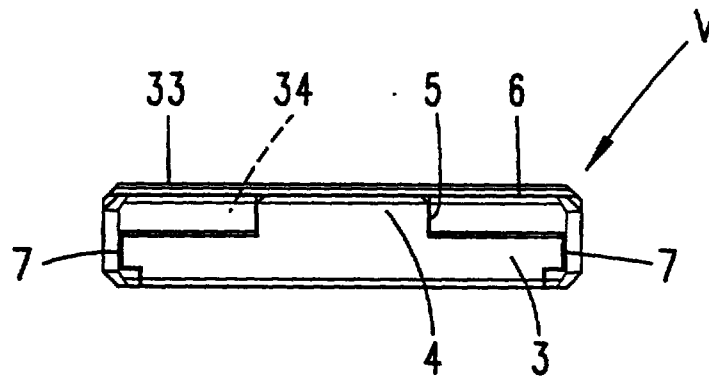


Fig. 2

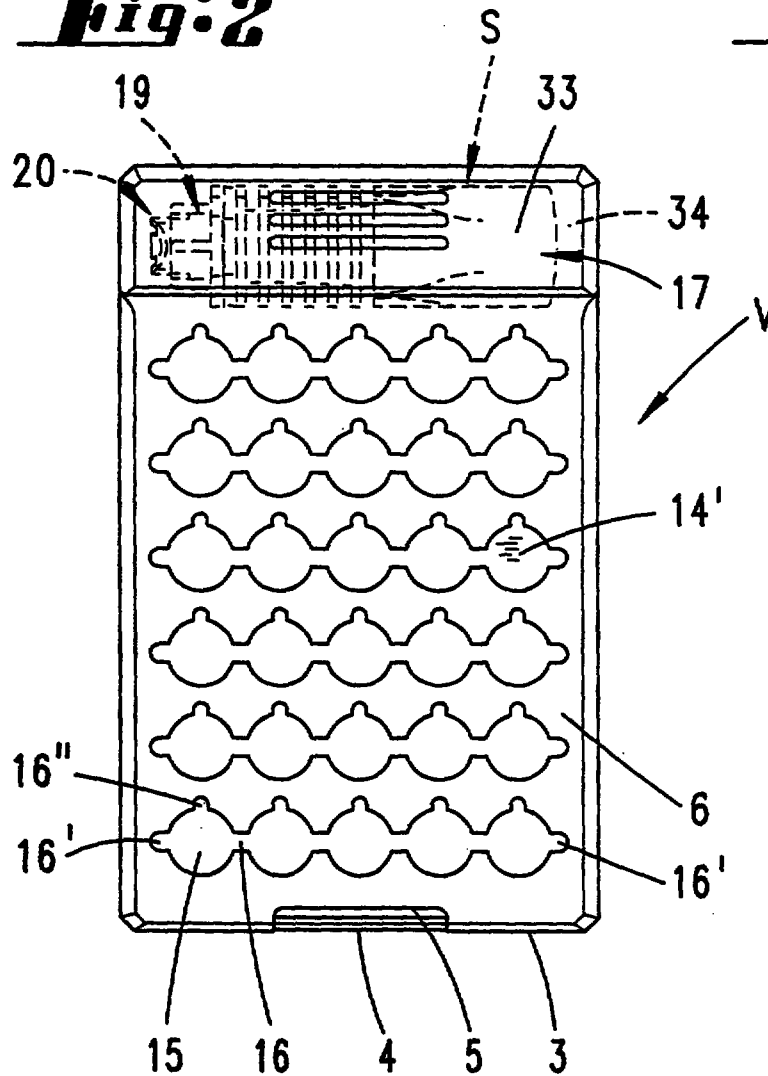


Fig. 4

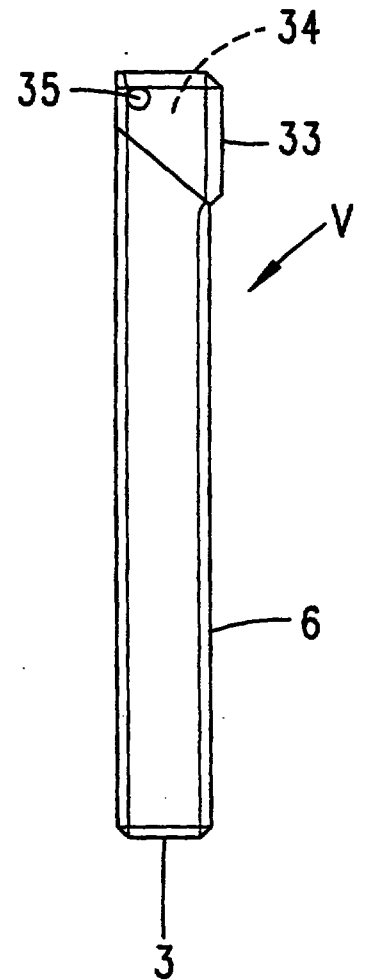


Fig. 8

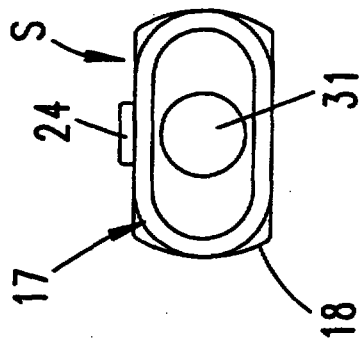


Fig. 5

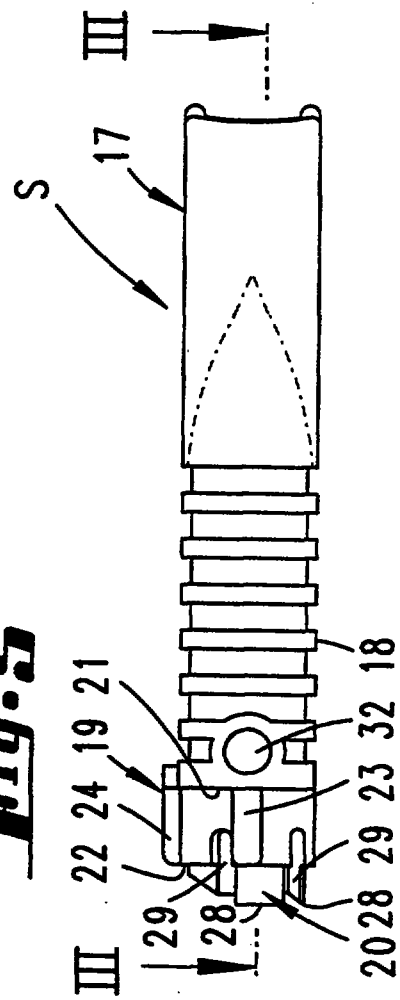


Fig. 7

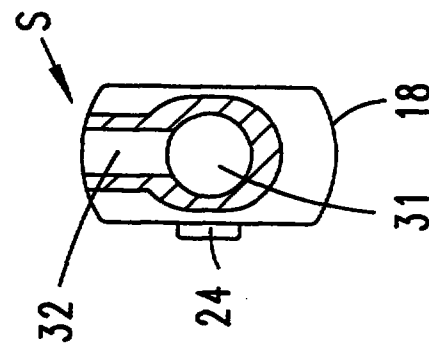


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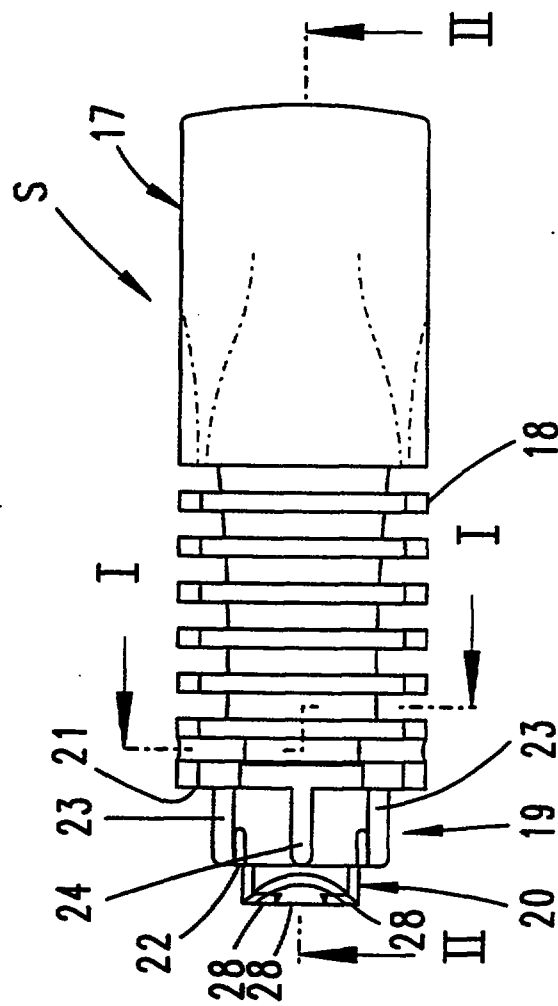


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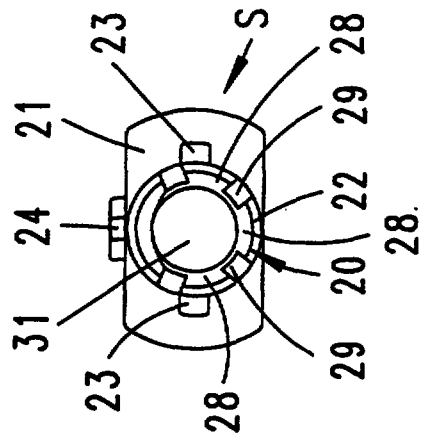


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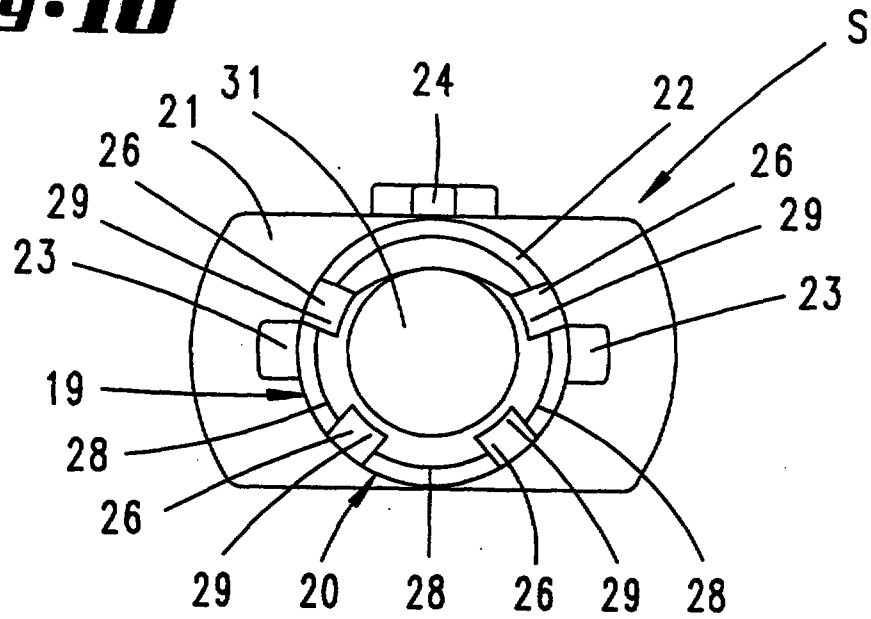
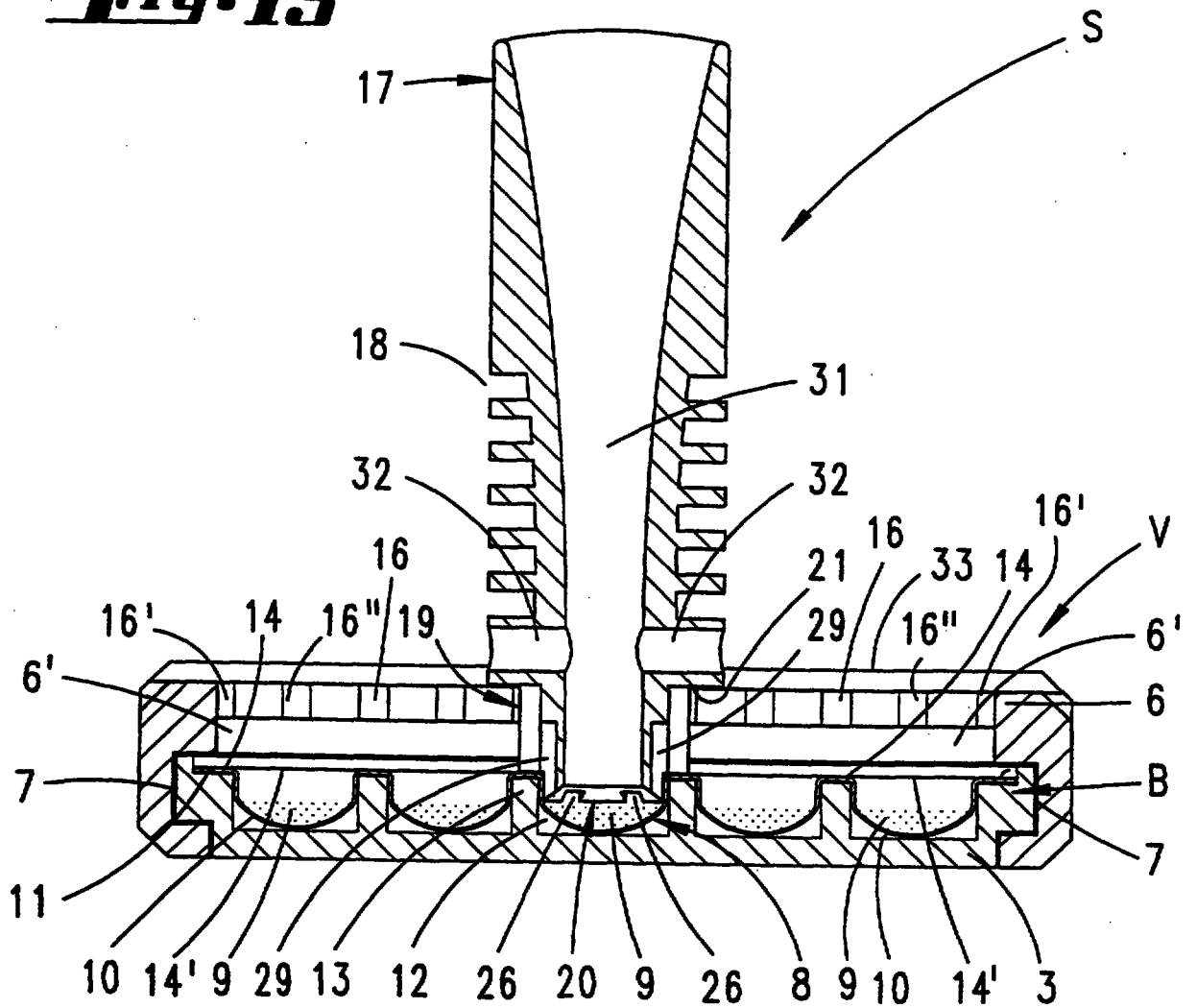


Fig. 13



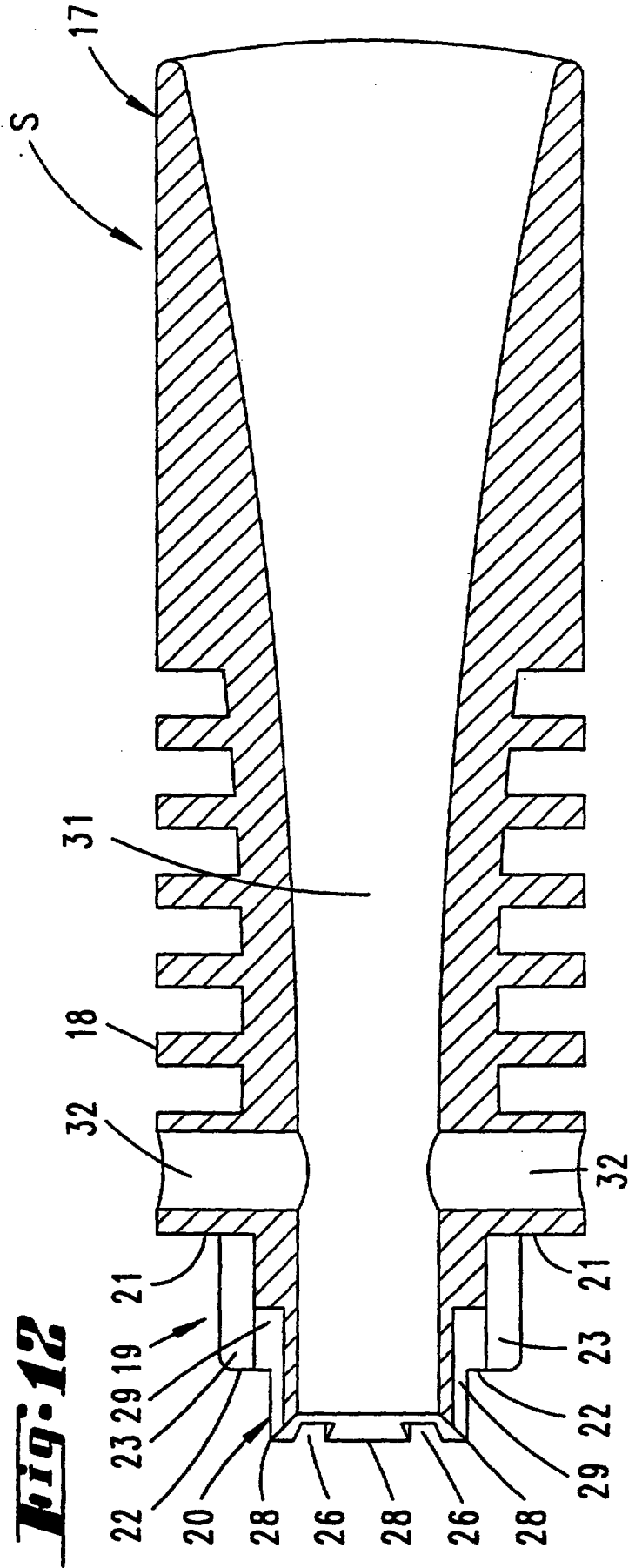
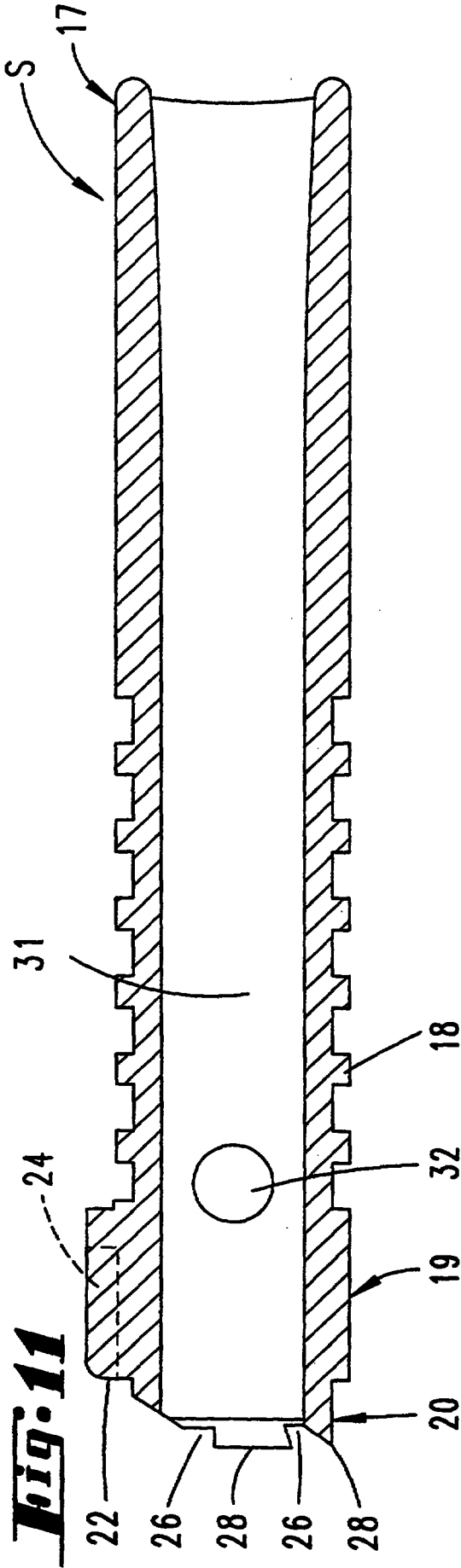


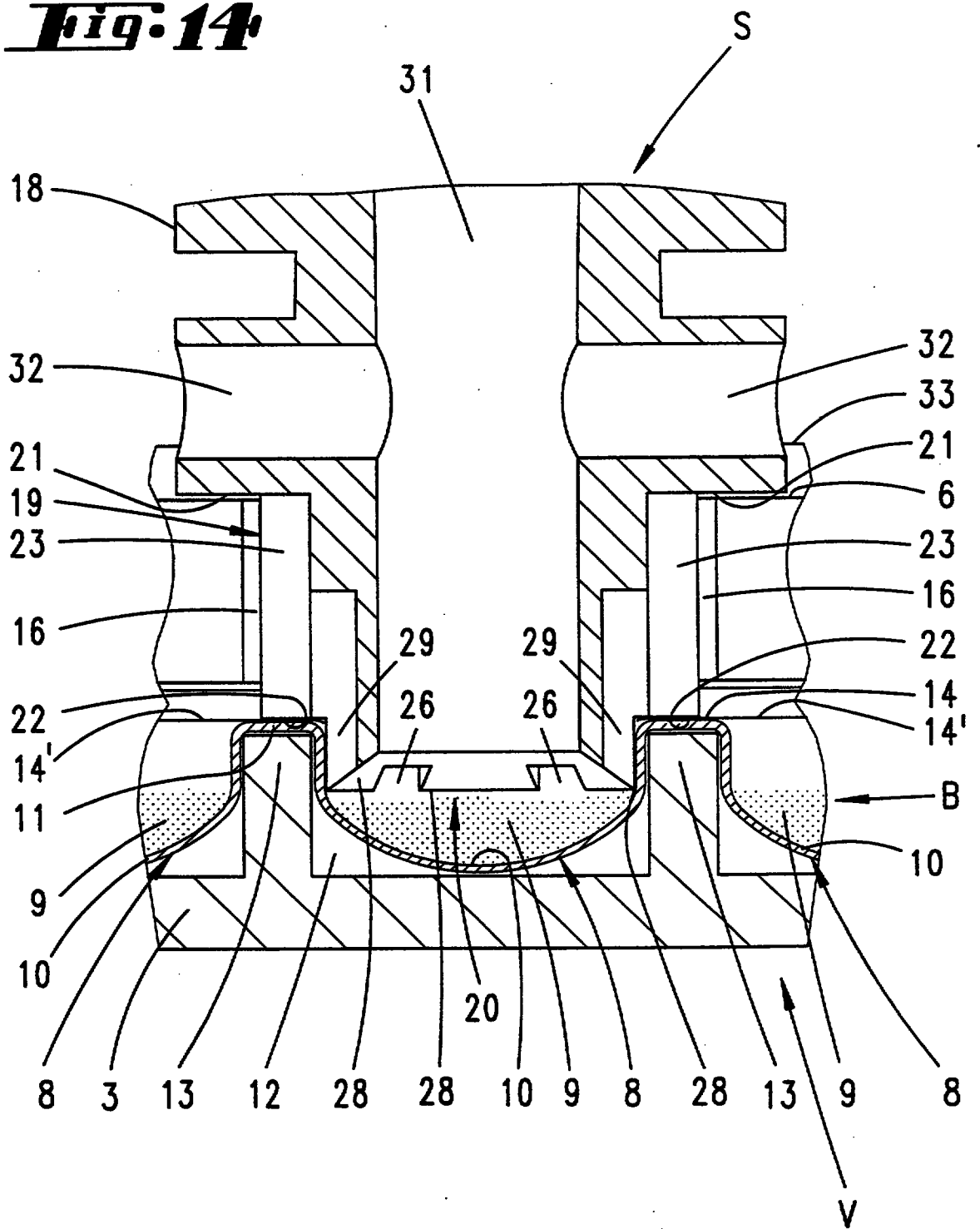
Fig. 14

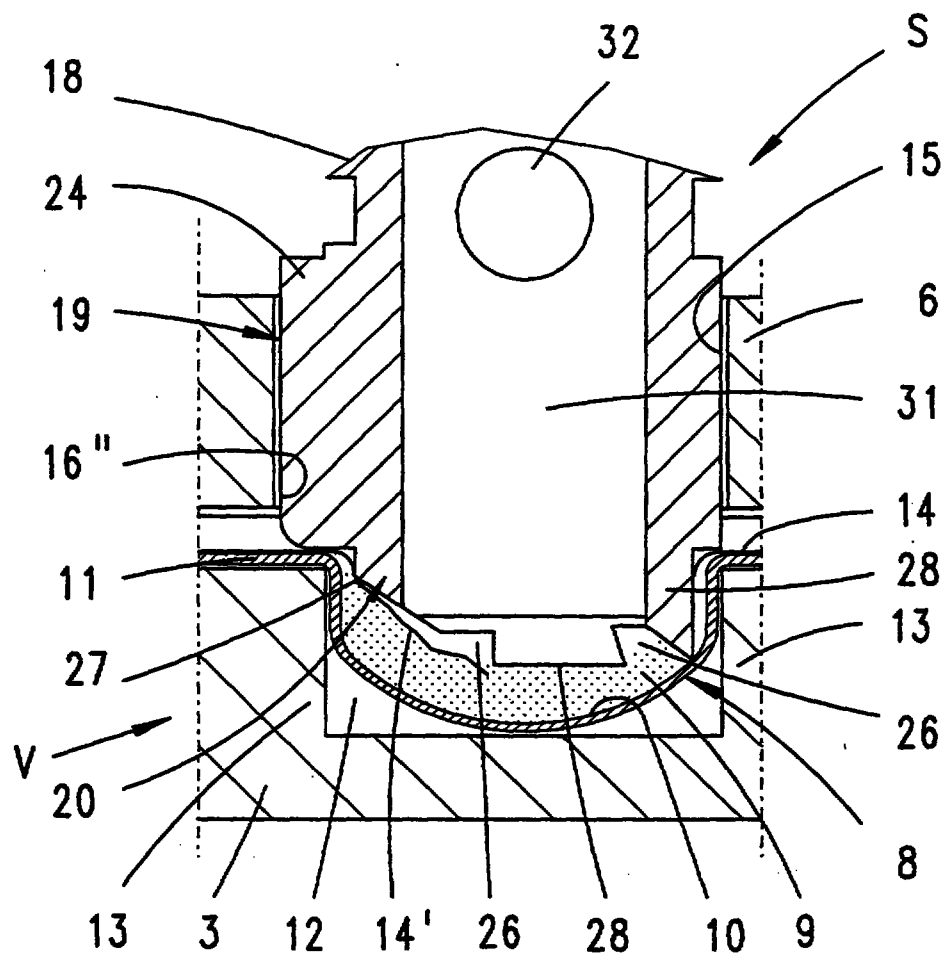
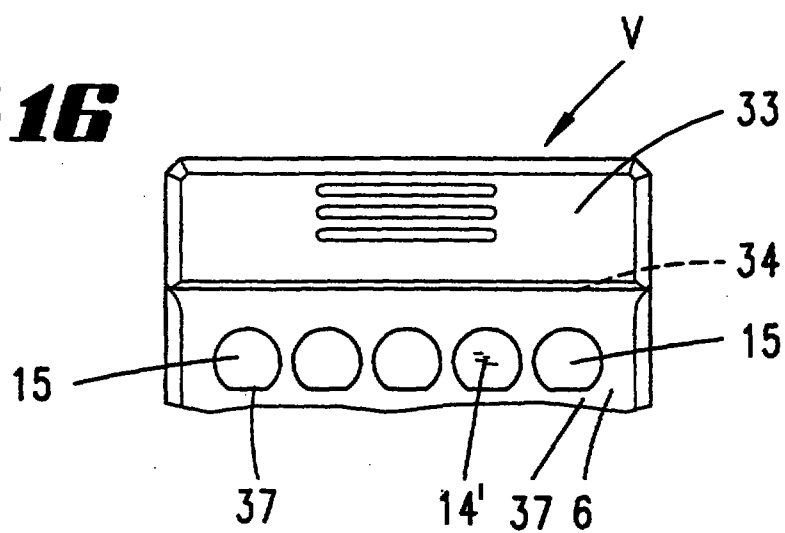
Fig. 15**Fig. 16**

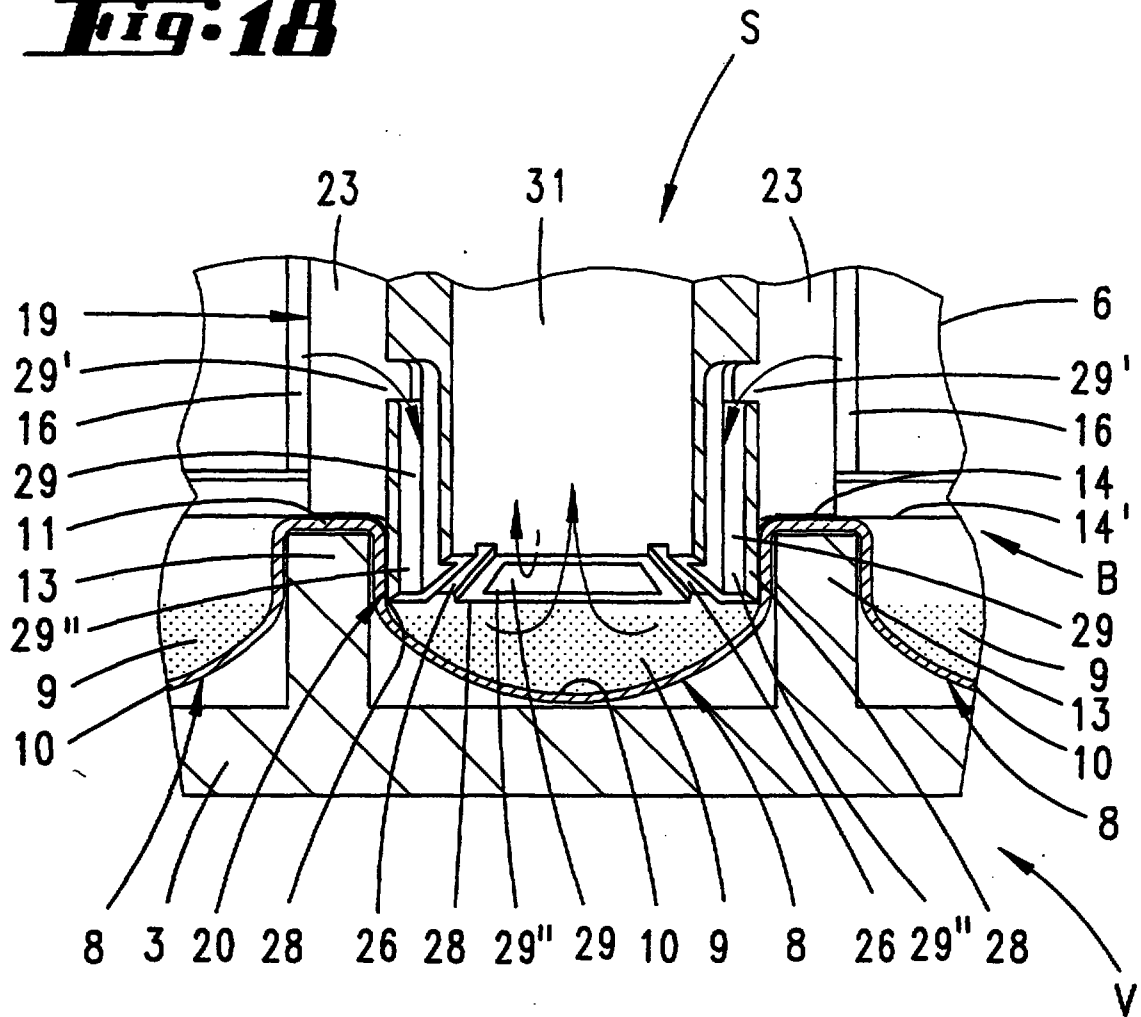
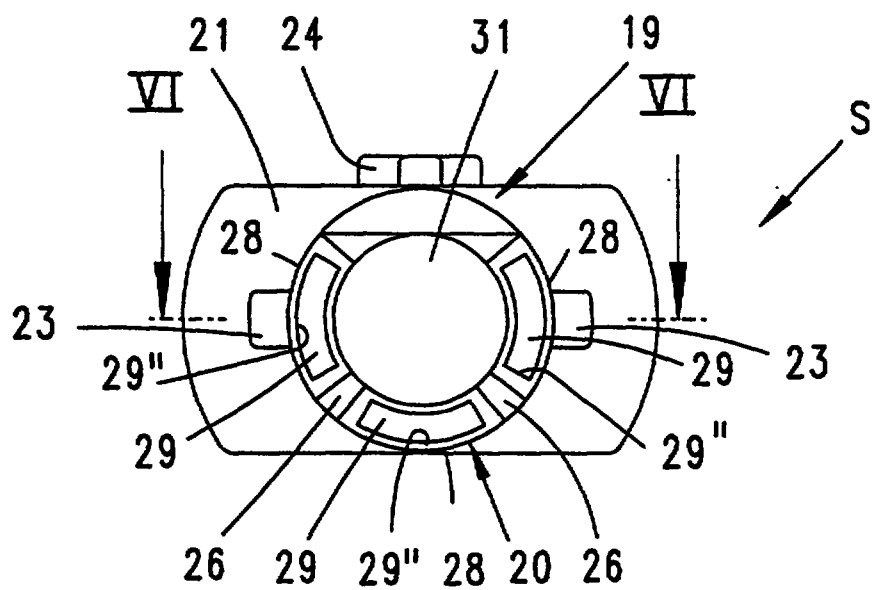
Fig. 18**Fig. 17**

Fig. 19

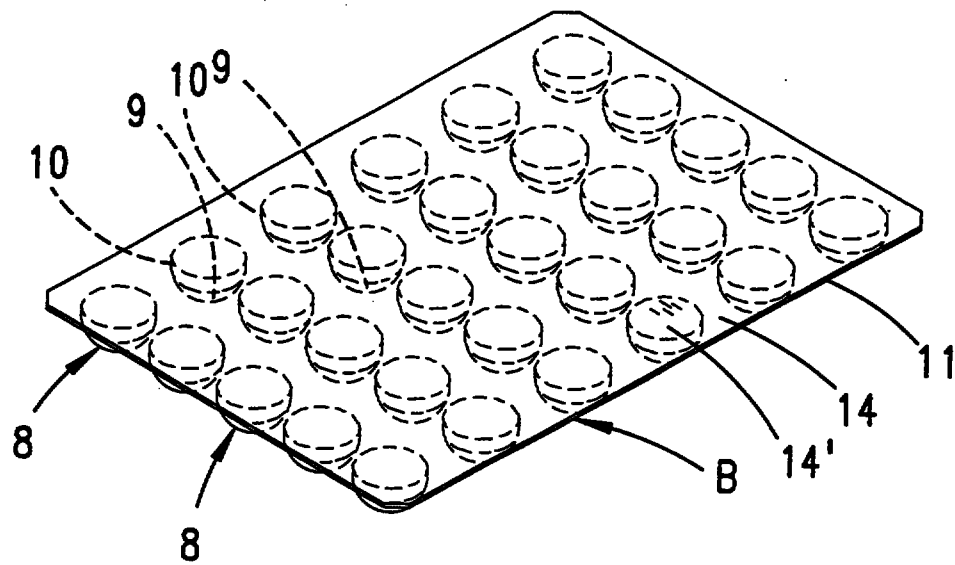


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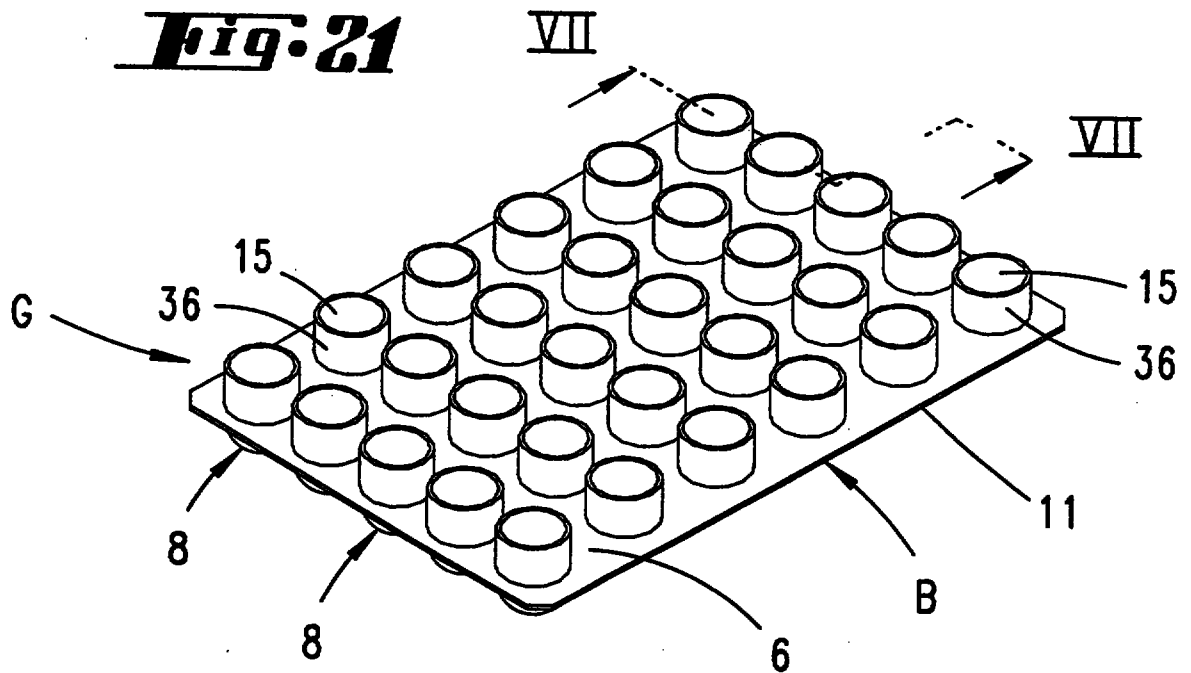


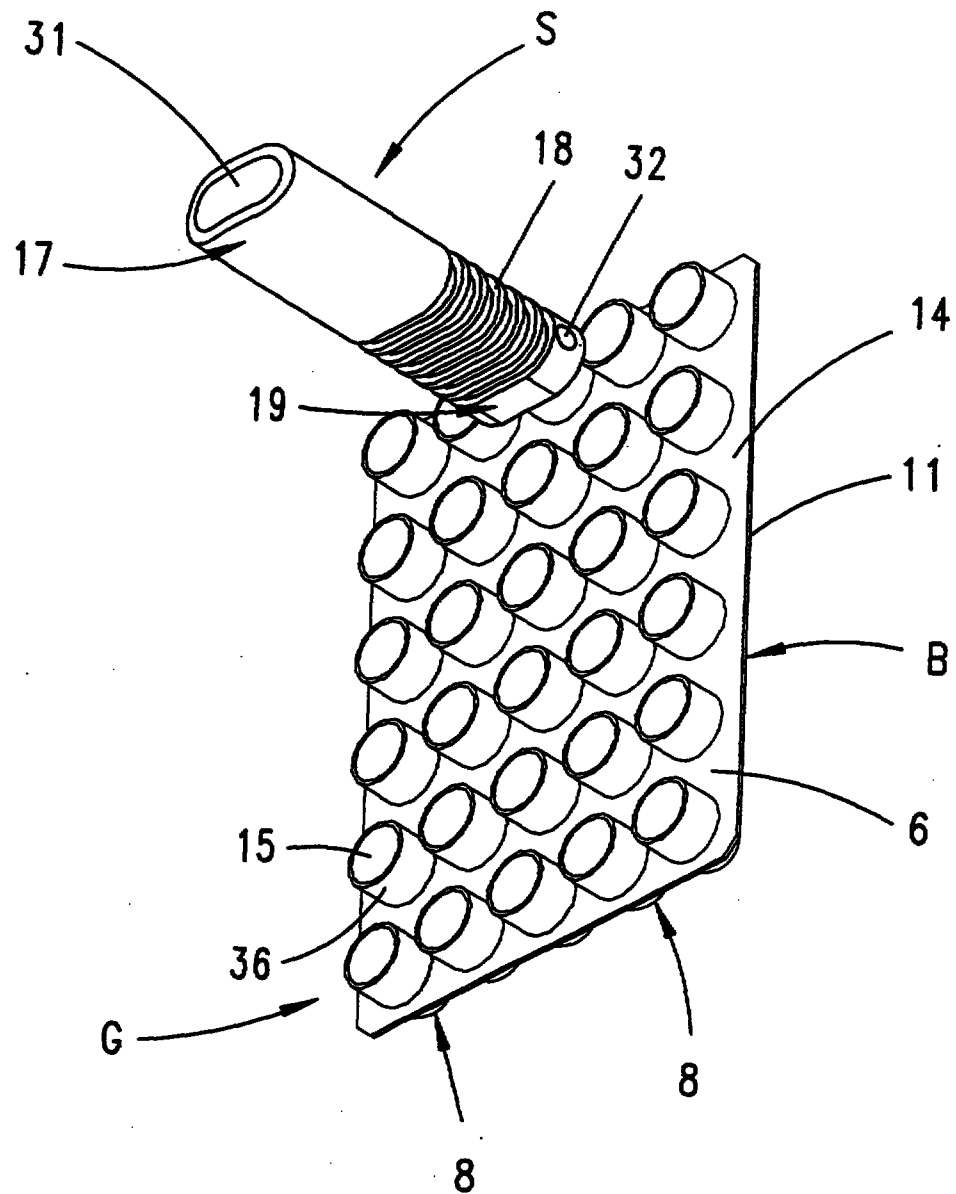
Fig. 20

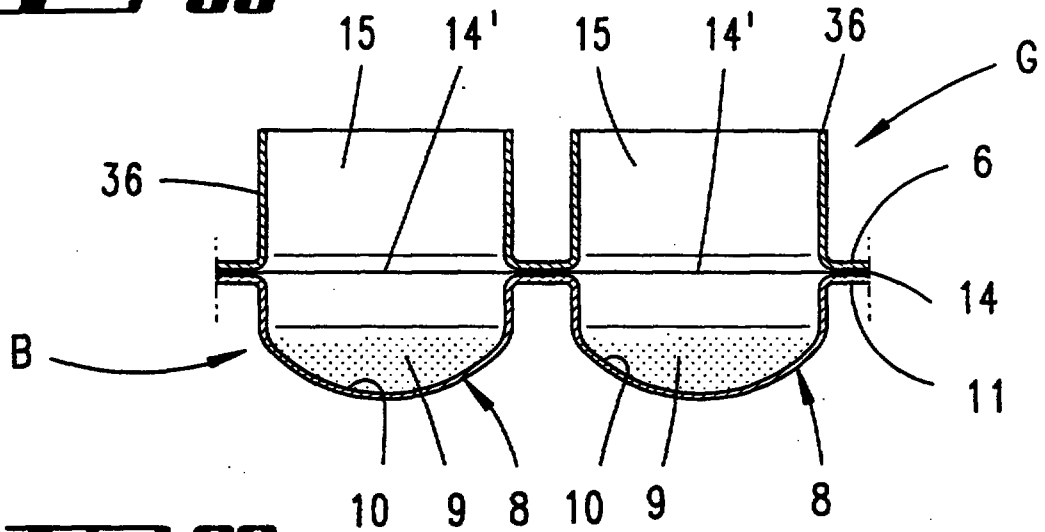
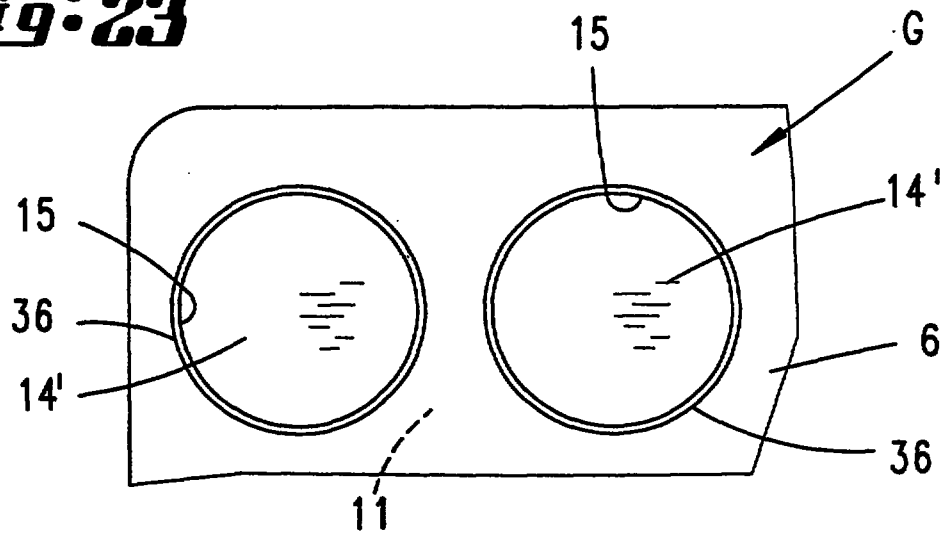
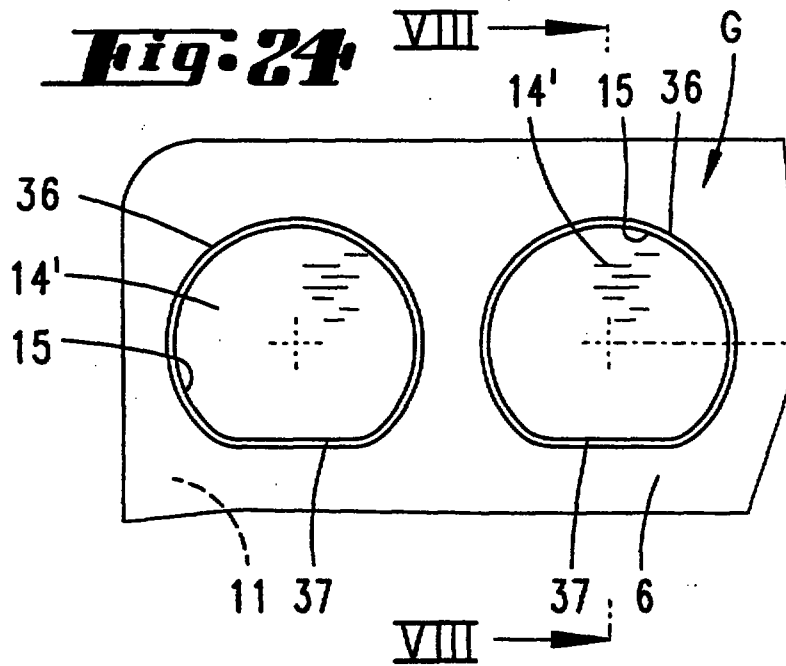
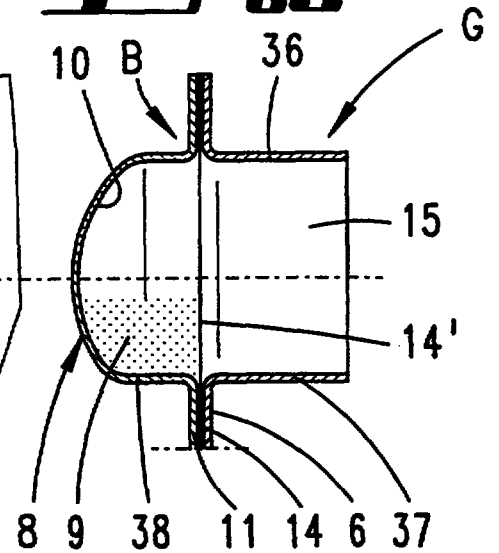
Fig. 22**Fig. 23****Fig. 24****Fig. 25**

Fig. 26

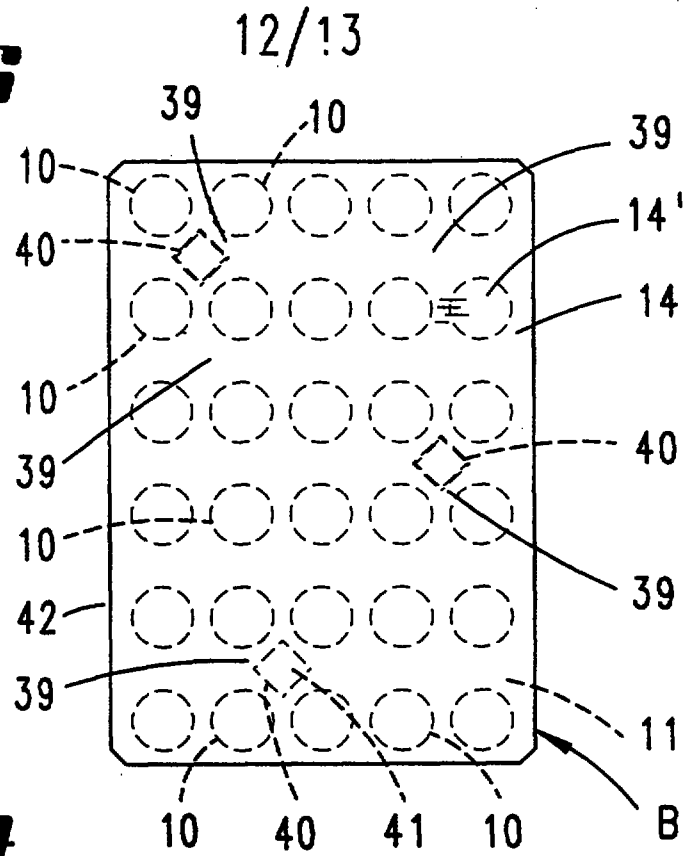


Fig. 27

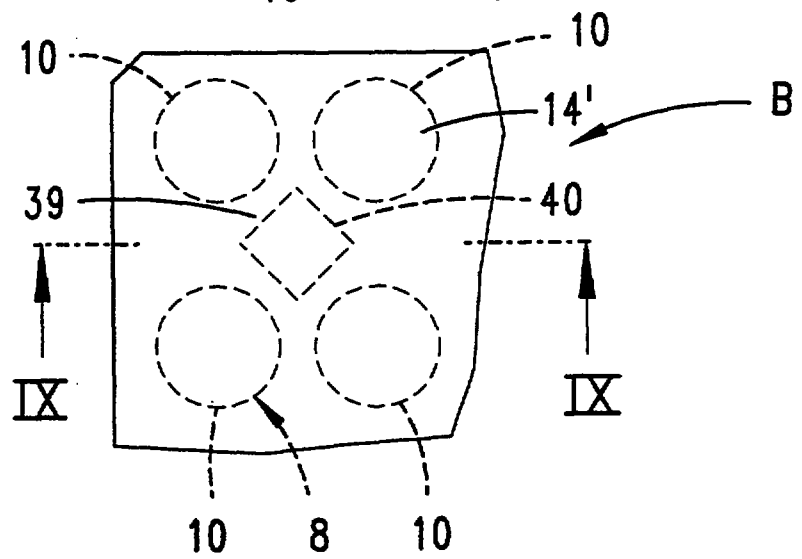


Fig. 28

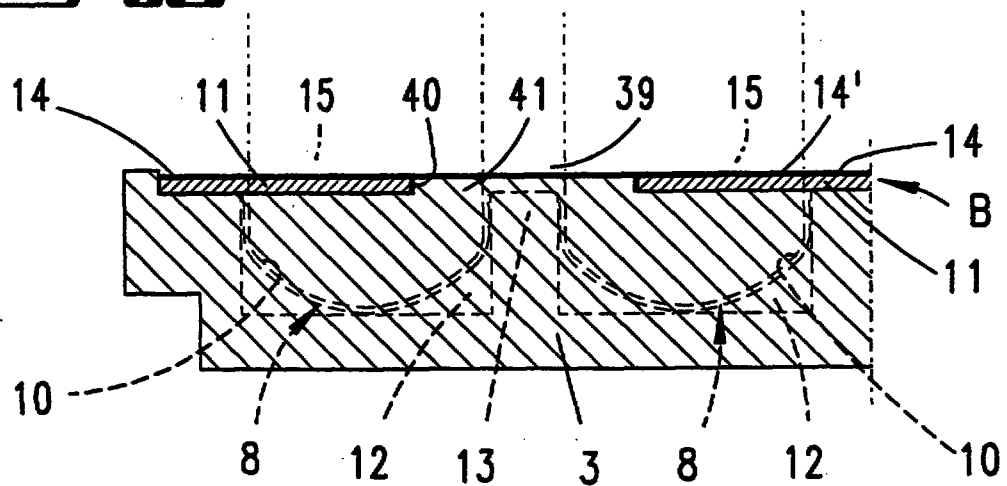
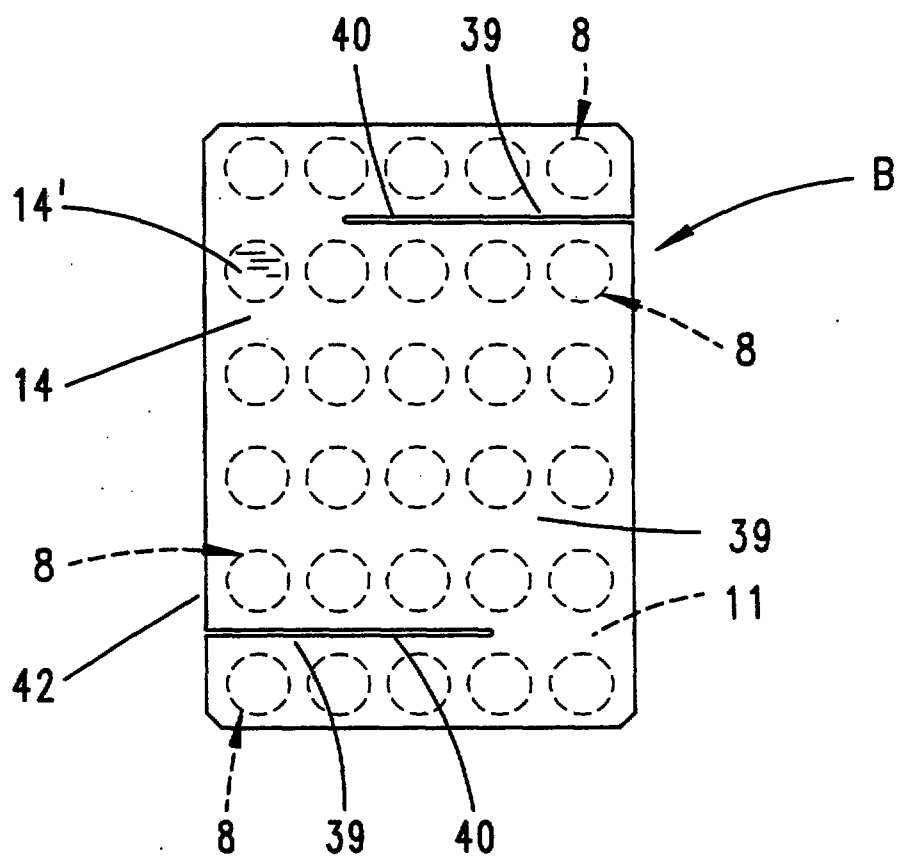


Fig. 29





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(57) Abstract

An inhaler having an inhaler body extending between two ends, an outlet at one of said two ends, a suction tube at the other of said two ends and an inhalation channel within the body providing fluid connection between the suction tube and the outlet, the suction tube being shaped and dimensioned for insertion into a blister containing powder such that the drawing of air through the inhaler body will draw powder from the blister through the suction tube and inhalation channel and out of the outlet, a channel inlet being provided in the suction tube and a cutter being provided around only part of the channel inlet to cut a film cover of a blister around only part of the channel inlet, at least one inlet passage extending between a passage inlet at a position along the length of the suction tube and a passage outlet adjacent the channel inlet to allow air into a blister and blister packs which are distinguishable according to their orientation and/or contents.

