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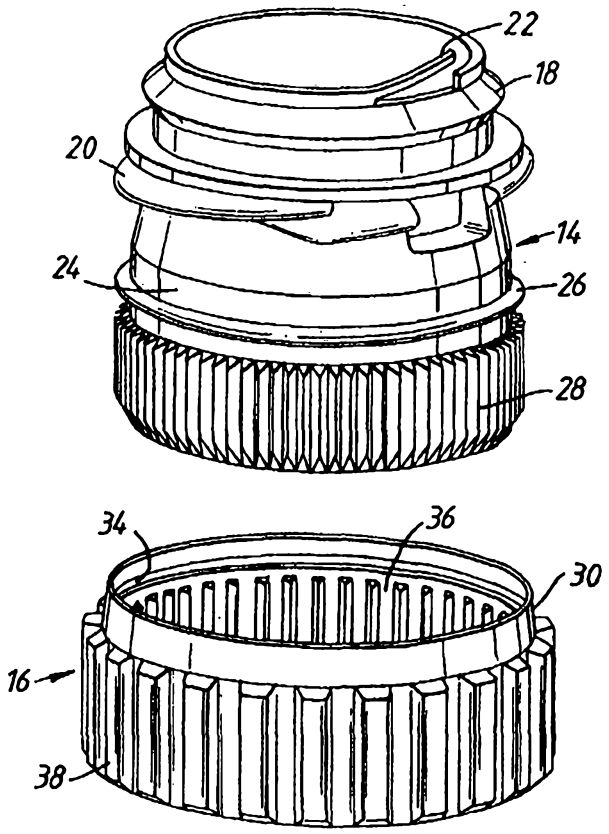
(57) Abstract

An inhaler for administering powder by inhalation and a method of constructing the same, the inhaler comprising a member which defines a chamber for containing desiccant, the member comprising first and second parts (14, 16) which when fitted together define the chamber for containing desiccant and comprise cooperating detent means for holding the same together on fitting, wherein the first part (14) has an outer surface provided with at least one of an internal or external spline (28) and the second part (16) has an inner surface provided with at least one of the other of an internal or external spline (36), the splines (28, 36) being dimensioned and spaced relative to the cooperating detent means such that, when the first and second parts (14, 16) are fitted together, the at least one external spline (28) is engaged within the at least one internal spline (36) before any resistance to further insertion is caused by the cooperating detent means.



INHALATION DEVICE

The present invention relates to a powder inhaler for administering powder by inhalation.

A number of powder inhalers are known which use different systems for introducing a dose of powder into an air stream. Typically, the powder is inhaled into the lungs of a patient in order to treat, for example, asthma.

EP-A-0237507 discloses one such powder inhaler. This inhaler comprises an inhalation channel and a mouthpiece comprising an air chamber and an outlet nozzle, which together define a flow path through which a stream of air is drawn during inhalation by a user. This inhaler further comprises means for introducing powder into the inhalation channel. During inhalation, air is first drawn into and through the inhalation channel so as to pick up powder. The stream of air containing powder is then drawn through the air chamber and out of the outlet nozzle of the mouthpiece.

Powder inhalers are, however, particularly susceptible to the effects of moisture and should therefore include a desiccant, such as silica gel, to absorb any moisture. It will of course be appreciated that it is a requirement that the desiccant be contained entirely separate from the powder to be inhaled so as to avoid contamination of the powder.

DE-C-4415462 discloses a powder inhaler which includes a chamber that contains desiccant, which chamber is in part defined by first and second parts which are clipped together.

In powder inhalers of the kind as disclosed in EP-A-0237507 which comprise an inhaler body and a grip portion at one end thereof, which grip portion is rotatable relative to the inhaler body so as to provide a dose of powder for inhalation, it has been proposed to provide a chamber in the grip portion for containing desiccant. In one proposed construction the grip portion comprises first and second parts which fit together to define a

chamber; the first and second parts having cooperating splines to lock the same in the rotational sense and a cooperating circumferential groove and ridge to lock the same axially.

Normally, powder inhalers are assembled automatically by machine. However, automatic assembly would be problematic where the grip portion comprises first and second parts which have to be fitted together. This problem would arise particularly because of the fact that the parts would have to be pressed together with a significant force sufficient at least to engage the ridge and the groove, and, if, as is likely, the parts are not first precisely aligned, both rotationally and axially, the parts could be forced together at an angle such that the splines are damaged and/or the grip portion is not assembled correctly.

It is an aim of the present invention to provide a powder inhaler which includes a chamber for containing desiccant that can be formed simply and reliably.

Accordingly, the present invention provides an inhaler for administering powder by inhalation which comprises a member that defines a chamber for containing desiccant, wherein the member comprises first and second parts which, when fitted together, define the chamber for containing desiccant and comprise cooperating detent means for holding the same together on fitting; characterized in that the first part has an outer surface provided with at least one of an internal or external spline and the second part has an inner surface provided with at least one of the other of an internal or external spline and in that the splines are dimensioned and spaced relative to the cooperating detent means such that, when the first and second parts are fitted together, the at least one external spline is engaged within the at least one internal spline before any resistance to further insertion is caused by the cooperating detent means.

Preferably, the splines are configured such that the axes of the first and second parts are substantially relatively angularly immovable before any resistance to further insertion is caused by the cooperating detent means.

Preferably, the relative lengths and positions of the splines are such that at least one-third of the length of each of the external and internal splines is engaged before any resistance to further insertion is caused by the cooperating detent means.

Preferably, the at least one internal spline extends from a position sufficiently near to the peripheral edge of the surface in which the same is provided that, on fitting together the first and second parts, the splines engage before any resistance to further insertion is caused by the cooperating detent means.

Preferably, the cooperating detent means comprise an at least part circumferential groove and an at least part circumferential ridge which is configured to engage therewithin.

More preferably, the at least part circumferential ridge is provided on the outer surface of the first part and the at least part circumferential groove is provided in the inner surface of the second part.

Still more preferably, the at least part circumferential groove is provided in the inner surface of the second part between the peripheral edge of the inner surface and the at least one spline provided to the inner surface.

Preferably, the at least one external spline is about three-quarters of the length of the at least one internal spline.

Preferably, the outer surface of the first part is provided with at least one external spline and the inner surface of the second part is provided with at least one internal spline.

Preferably, the inhaler further comprises an inhaler body and a mouthpiece from which powder is in use inhaled, the inhaler body housing a dosing mechanism for providing a dose of powder for inhalation.

More preferably, the member comprises a grip portion for operating the dosing mechanism.

Still more preferably, the grip portion is rotatably mounted to the inhaler body.

Yet still more preferably, the inhaler body comprises one of an at least part circumferential ridge or an at least part circumferential groove and the grip portion comprises the other of the at least part circumferential ridge or at least part circumferential groove, the at least part circumferential ridge being configured to engage within the at least part circumferential groove.

Preferably, at least a part of a wall of the chamber adjacent the inhaler body is permeable to moisture.

Preferably, the outer surface of the second part has a knurled or ridged surface which can be gripped by a user.

Preferably, the one of the first and second parts which is provided with the at least one internal spline includes at least one element which is disposed so as to be abutted by at least one of the at least one external spline when the first and second parts are fitted together.

Preferably, at least one of the at least one internal spline is bridged at the forward end in the direction of fitting by an element at least one of which is abutted by the at least one external spline when the first and second parts are fitted together.

More preferably, each element is formed of a material which is deformed by the respective external spline.

With this construction, the first and second parts may be put together with the internal and external splines interlocking before any significant force need be applied. With the splines interlocking, and, therefore, the first and second parts aligned, a force may then be applied to engage the detent means and hence axially fix the first and second parts without damaging the splines. With the splines engaging, the first and second parts are disposed with the axes thereof parallel, such that, when the first and second parts are driven together, the first and second parts move squarely and the bottom peripheral edge of the first part cannot be driven into the side of the second part.

In the inhaler of the present invention the chamber is formed easily by merely pressing together the first and second parts. In particular, the construction of the inhaler of the present invention ensures that the significant force required to clip the first and second parts together need not be applied until the first and second parts are aligned and significantly engaged. In other words, during assembly, the first and second parts would not be forced together in a misaligned state.

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 a powder inhaler in accordance with a first embodiment of the present invention;

Figure 2 illustrates in exploded view the component parts of the grip portion of the inhaler of Figure 1;

Figure 3 illustrates a fragmentary part sectional view of the inner surface of one component part of the grip portion of the inhaler of Figure 1; and

Figure 4 illustrates a fragmentary part sectional view of the inner surface of one component part of the grip portion of an inhaler in accordance with a second embodiment of the present invention.

Figure 1 illustrates a powder inhaler in accordance with a first embodiment of the present invention.

The inhaler comprises a mouthpiece 2 comprising an outlet nozzle 4, an inhaler body 6 and a rotatable grip portion 8 for operating a dosing mechanism disposed in the inhaler body 6 for providing doses of powder for inhalation. The inhaler body 6 is provided with an opening 10 which is filled with a window 12 through which an indicating wheel (not illustrated) is visible so as to provide an indication as to the usage of the inhaler.

In use, the grip portion 8 is first rotated in one sense, in this embodiment in the counter-clockwise sense when viewed from above, through a predetermined angle relative to the inhaler body 6 and then rotated in the opposite, clockwise, sense back to the original position. This action operates the dosing mechanism to provide a dose of powder for inhalation. The user then takes the mouthpiece 2 in the lips and inhales so as to draw powder into the lungs.

The grip portion 8 comprises first and second hollow parts 14, 16 which are mutually configured so as to define an enclosed chamber (not illustrated) for containing desiccant when fitted together.

The first part 14 comprises a circumferential ridge 18 disposed about the outer surface of one, the upper, end thereof to which the inhaler body 6 is clipped and external threads 20 to which a cap (not illustrated) having corresponding internal threads is screwed so as to cover the mouthpiece 2 and the inhaler body 6 and thus form a tight seal. The first part 14 further comprises an upwardly-directed resiliently-biased arm 22 disposed at the periphery of the upper end thereof, which arm 22, on rotation of the grip portion 8, engages part of

the dosing mechanism so as to provide a dose of powder for inhalation. The first part 14 yet further comprises a tubular section 24, in this embodiment of generally cylindrical cross-section, one, the upper, end of which is closed by a wall (not illustrated) which is permeable to moisture. In a preferred embodiment the wall is formed of cardboard. The outer surface of the tubular section 24 includes a circumferential ridge 26 and a plurality of external splines 28, in this embodiment of triangular cross-section.

The second part 16 comprises a tubular section 30, in this embodiment of generally cylindrical cross-section, one, the lower, end of which is closed by a wall 32. The inner surface of the tubular section 30 includes a circumferential groove 34 at the upper end thereof and a plurality of internal splines 36, in this embodiment of quadrilateral cross-section with outwardly-flaring flanks. The outer surface of the tubular section 30 includes a plurality of axially-directed ridges 38 which are gripped by a user on rotation of the grip portion 8. In another embodiment the outer surface of the tubular section 30 could be knurled. In this embodiment the inner dimension of the tubular section 30 is configured so as to be a close radial fit over the tubular section 24 of the first part 14.

With this construction, the first and second parts 14, 16 are clipped together on locating the ridge 26 in the groove 34; relative rotation of the first and second parts 14, 16 being prevented by the mating splines 28, 36.

The splines 28, 36 are configured, in terms of axial position and axial length, so as to be substantially entirely interengaged before the upper end of the tubular section 30 meets the ridge 26. In practice, it is sufficient for the internal splines 36 to extend near to the upper end of the tubular section 30, though how near is dependent of course upon how near the external splines 28 extend to the lower end of the tubular section 24. If the external splines 28 are relatively long, the internal splines 36 may be relatively short, and, conversely, if the external splines 28 are relatively short, the internal splines 36 must be relatively long.

It will of course be appreciated that the splines 28, 36 can have any dimension and spacing which are such as to fix the first and second parts 14, 16 rotationally relative to one another. In a preferred embodiment, however, the splines 28, 36 are configured so as to fix the first and second parts 14, 16 rotationally relative to one another irrespective of the relative angular position of the first and second parts 14, 16 when fitted together.

In this embodiment the external splines 28 are spaced differently to the internal splines 36 such that when the first and second parts 14, 16 are fitted together axially-extending spaces exist between the splines 28, 36. In this way, if particles of desiccant happen to pass between the splines 28, 36 during assembly, those desiccant particles will not impede assembly, but rather fall into the spaces.

As illustrated in Figure 3, the ends of the internal splines 36 adjacent the end wall 32, in this embodiment at the junction between the tubular section 30 and the end wall 32, include elements 40 which bridge the flanks thereof. In this embodiment the elements 40 are of triangular cross-section with the hypotenuse facing upwardly and inwardly relative to the inner surface of the tubular section 30. It is not necessary that all of the internal splines 36 be bridged by elements 40. However, for ease of moulding and optimum effect, the elements 40 are provided by a circumferential bead. The purpose of the elements 40 is as follows. When the external splines 28 are passed into the internal splines 36, the lower ends of the external splines 28 contact the respective elements 40 before the ridge 26 is located in the groove 34. In this way, when the ridge 26 is located in the groove 34 and the first and second parts 14, 16 are fitted together, the external splines 28 cut into the respective elements 40 so as further to anchor the first and second parts 14, 16 together, both in a rotational and an axial sense.

Figure 4 illustrates the inner surface of the second part 16 of the grip portion 8 of an inhaler in accordance with a second embodiment of the present invention. The inhaler of this embodiment is almost identical in structure to the inhaler of the above-described first embodiment and differs only in that the elements 40 bridging the internal splines 36 are of

square cross-section, with one surface of the elements 40 being parallel to the inner surface of the tubular section 30.

Finally, it will be understood by a person skilled in the art that the present invention has been described in its preferred embodiments and can be modified in many different ways without departing from the scope of the invention as defined in the appended claims.

In another embodiment the circumferential ridge 26 could be disposed at the lower end of the tubular section 24, that is forward of the external splines 28 in the direction of fitting, and the circumferential groove 34 disposed at the lower end of the tubular section 30, that is forward of the internal splines 36 in the direction of fitting. Thus, in the same manner as the above-described embodiments, the ridge 26 will not engage in the groove 34 until after the splines 28, 36 are interlocked.

In yet another embodiment the circumferential ridge 26 could be replaced by a circumferential groove and the circumferential groove 34 replaced by a circumferential ridge.

In still yet another embodiment the first part 14 could be provided with internal splines and the second part 16 provided with external splines.

The claims defining the invention are as follows:

1. An inhaler for administering powder by inhalation which comprises a member that defines a chamber for containing desiccant, wherein the member comprises first and second parts (14, 16) which, when fitted together, define the chamber for containing desiccant and comprise cooperating detent means for holding the same together on fitting; characterized in that the first part (14) has an outer surface provided with at least one of an internal or external spline (28) and the second part (16) has an inner surface provided with at least one of the other of an internal or external spline (36) and in that the splines (28, 36) are dimensioned and spaced relative to the cooperating detent means such that, when the first and second parts (14, 16) are fitted together, the at least one external spline (28) is engaged within the at least one internal spline (36) before any resistance to further insertion is caused by the cooperating detent means.

2. The inhaler according to claim 1, wherein the splines (28, 36) are configured such that the axes of the first and second parts (14, 16) are substantially relatively angularly immovable before any resistance to further insertion is caused by the cooperating detent means.

3. The inhaler according to claim 1 or 2, wherein the relative lengths and positions of the splines (28, 36) are such that at least one-third of the length of each of the external and internal splines (28, 36) is engaged before any resistance to further insertion is caused by the cooperating detent means.

4. The inhaler according to any one of claims 1 to 3, wherein the at least one internal spline (36) extends from a position sufficiently near to the peripheral edge of the surface in which the same is provided that, on fitting together the first and second parts (14, 16), the splines (28, 36) engage before any resistance to further insertion is caused by the cooperating detent means.

5. The inhaler according to any one of claims 1 to 4, wherein the cooperating detent means comprise an at least part circumferential groove (34) and an at least part circumferential ridge (26) which is configured to engage therewithin.

6. The inhaler according to claim 5, wherein the at least part circumferential ridge (26) is provided on the outer surface of the first part (14) and the at least part circumferential groove (34) is provided in the inner surface of the second part (16).

7. The inhaler according to claim 6, wherein the at least part circumferential groove (34) is provided in the inner surface of the second part (16) between the peripheral edge of the inner surface and the at least one spline (34) provided to the inner surface.

8. The inhaler according to any one of claims 1 to 7, wherein the at least one external spline (28) is about three-quarters of the length of the at least one internal spline (36).

9. The inhaler according to any one of claims 1 to 8, wherein the outer surface of the first part (14) is provided with at least one external spline (28) and the inner surface of the second part (16) is provided with at least one internal spline (36).

10. The inhaler according to any one of claims 1 to 9, further comprising an inhaler body (6) and a mouthpiece (4) from which powder is in use inhaled, the inhaler body (6) housing a dosing mechanism for providing a dose of powder for inhalation.

11. The inhaler according to claim 10, wherein the member comprises a grip portion (8) for operating the dosing mechanism.

12. The inhaler according to claim 11, wherein the grip portion (8) is rotatably mounted to the inhaler body (6).

13. The inhaler according to claim 12, wherein the inhaler body (6) comprises one of an at least part circumferential ridge (18) or an at least part circumferential groove and the grip portion (8) comprises the other of the at least part circumferential ridge (18) or at least part circumferential groove, the at least part circumferential ridge (18) being configured to engage within the at least part circumferential groove.

14. The inhaler according to any one of claims 10 to 13, wherein at least a part of a wall of the chamber adjacent the inhaler body (6) is permeable to moisture.

15. The inhaler according to any one of claims 10 to 14, wherein the outer surface of the second part (16) has a knurled or ridged surface (38) which can be gripped by a user.

16. The inhaler according to any one of claims 1 to 15, wherein the one of the first and second parts (14, 16) which is provided with the at least one internal spline (36) includes at least one element (40) which is disposed so as to be abutted by at least one of the at least one external spline (28) when the first and second parts (14, 16) are fitted together.

17. The inhaler according to any one of claims 1 to 16, wherein at least one of the at least one internal spline (36) is bridged at the forward end in the direction of fitting by an element (40) at least one of which is abutted by the at least one external spline (28) when the first and second parts (14, 16) are fitted together.

18. The inhaler according to claim 16 or 17, wherein each element (40) is formed of a material which is deformed by the respective external spline (28).

DATED this 24th day of August 1999

ASTRA AKTIEBOLAG,
By its Patent Attorneys,
E. F. WELLINGTON & CO.,
By:

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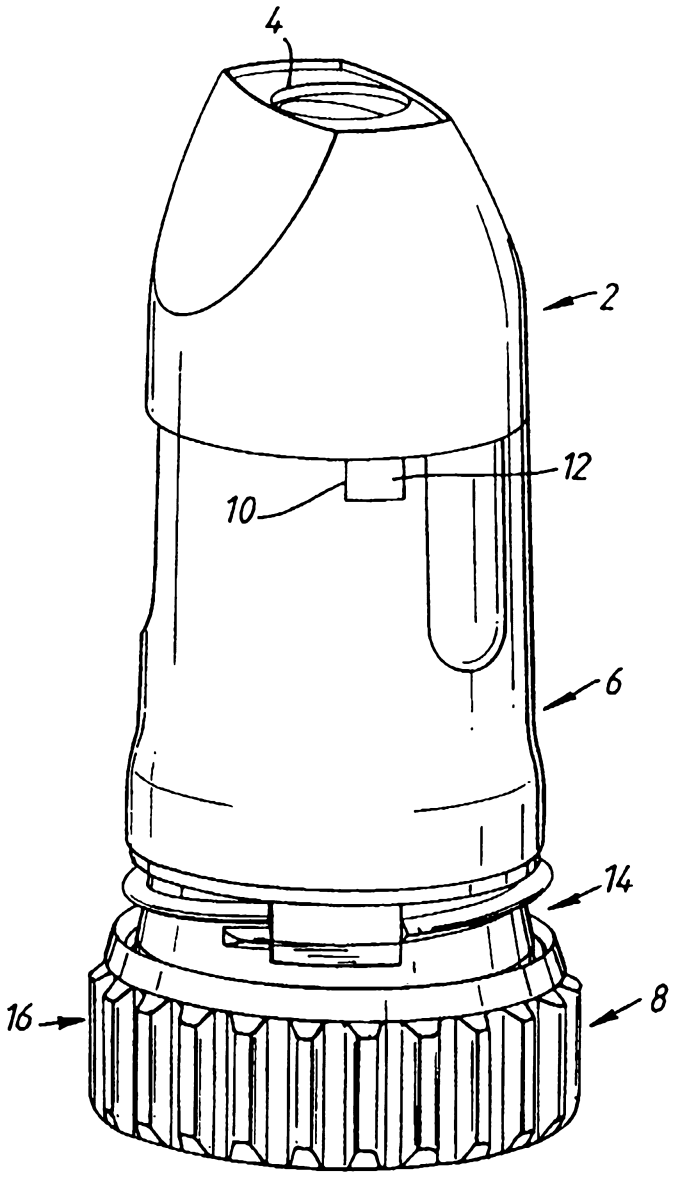

Fig. 1

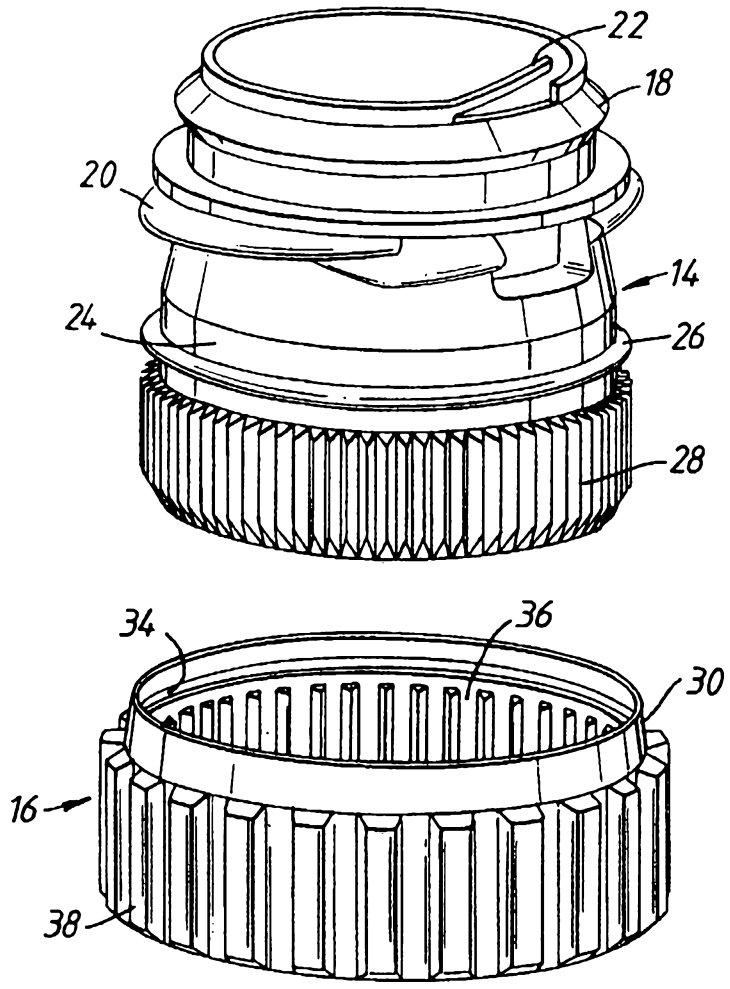

Fig.2

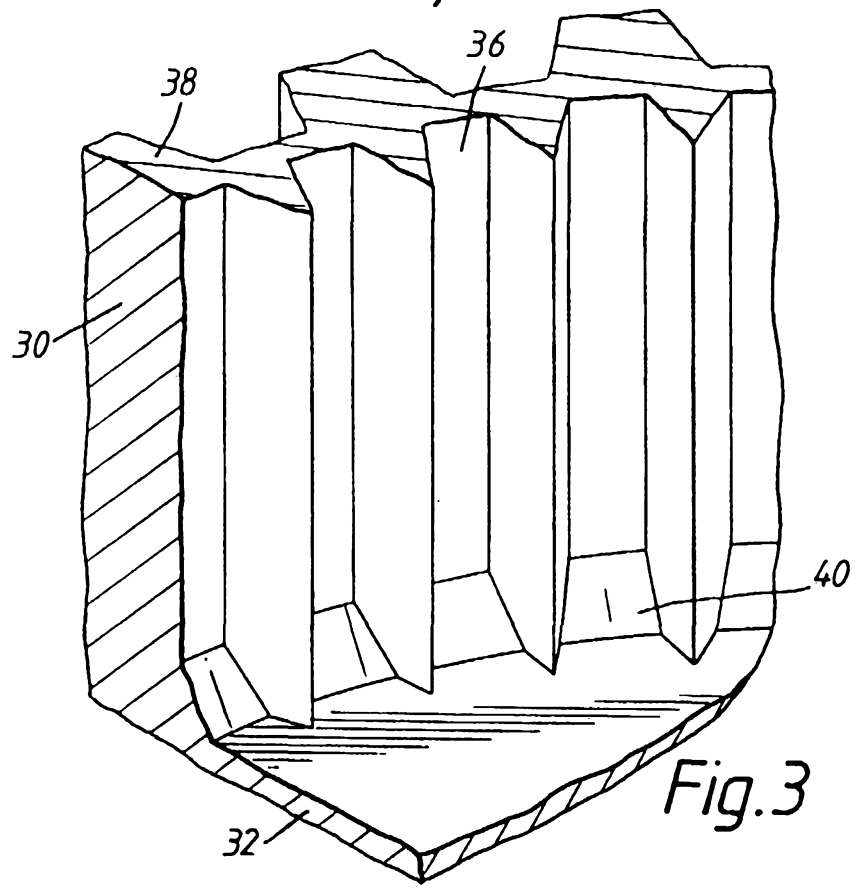

Fig.3

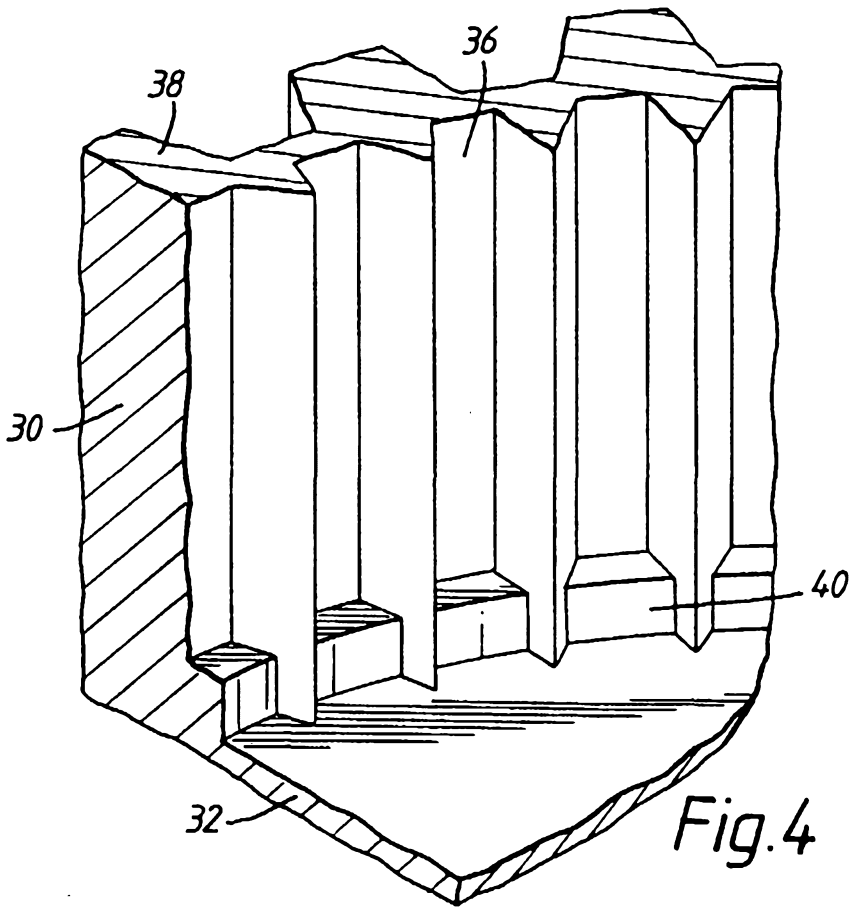

Fig.4