Atomiser

The present invention relates to an atomiser according to the preamble of claim 1 or 19, to a reservoir for an atomiser according to the preamble of claim 20 and to a method for delivering a formulation according to the preamble of claim 32.

The present invention relates in particular to the delivery and atomisation of a formulation for inhalation or for other medical or therapeutic purposes. Particularly preferably the present invention relates to the delivery of medical, pharmaceutical and/or therapeutic formulations which in particular contain or consist of at least one active substance.

The present invention relates in particular to an inhaler. During atomisation an aerosol or a spray cloud is produced having, particularly for inhalation, very fine, solid and/or liquid particles, preferably in the range from 1 to 10 µm.

The formulation is preferably a powder. Particularly preferably the invention therefore relates to a powder inhaler. The term "formulation" according to the present invention preferably also includes liquids, however, while the term "liquid" is to be understood in a broader sense as including *inter alia* solutions, suspensions, suslutions (mixture of solution and suspension), dispersions, mixtures thereof or the like.

The specification that follows is directed primarily to the delivery and atomisation of a powdered formulation or to a powder inhaler, even if the invention is not restricted thereto, but may also be used, in particular, for other inhalers, atomisers or dispensers.

The present invention relates in particular to an atomiser with a pre-metered formulation. In particular the individual doses are contained in separate receptacles such as chambers, blister pouches, inserts, capsules or the like, and can be individually taken out and atomised.

Basically, there are passive and active atomisers. In the passive type the formulation is expelled through the air current produced by the user on inhaling or breathing in. In the active type the formulation is expelled independently of the breathing in during inhaling, and the delivery can be triggered by the inhalation process - in particular by so-called breath triggering. In particular a current of a delivery medium such as air or some other gas is generated by the atomiser or inhaler itself in order to deliver the formulation. For this purpose the atomiser has a delivery device such as an air pump or a pressurised gas container. The advantage of the active type over the passive type is that in the active type a very easily reproducible delivery and atomisation of the formulation can be achieved independently of the user.

EP 0 950 423 B1 discloses an active dispenser for media, particularly powders, with a compressed air pump, namely a piston pump, integrated in the dispenser. The dispenser has a blister disc with blister pouches containing the powder arranged in a circle. To actuate or open the individual blister pouches the housing part is moved axially.

EP 1 132 104 B1 discloses an active dispenser for delivering a medium containing at least one pharmaceutical active substance from a blister strip. The dispenser has a pump for a fluid, particularly air, for expelling the medium, an impact spike for creating a fluid connection between the pump and a blister pouch and a lateral actuating device which when actuated both positions a blister pouch in relation to the impact spike and also brings about the expulsion of the medium. The dispenser also has a spring which is under tension during a first actuating step and can be released into a relaxed position during a second actuating step by releasing a latch, the spring successively causing the blister pouch to be positioned in relation to the impact spike, the blister pouch to be opened by the impact spike and air to be supplied to the blister pouch in order to expel the medium.

WO 91/06333 A1 discloses an active dispenser having a hollow cylindrical reservoir comprising a plurality of axially extending chambers containing powder. By axially pushing the dispenser together air is compressed in a piston pump and is finally conveyed through the respective chamber in order to expel the respective dose of powder.

Object of the present invention is to provide an atomiser, a reservoir for an atomiser and a method for delivering (discharging) a formulation, wherein the respective atomiser can be operated very simply, particularly intuitively, while being simple and inexpensive in its construction, and/or has a compact structure, particularly a low overall height, and/or good atomisation characteristics.

The object stated above is solved by an atomiser according to claim 1 or 19, by a reservoir according to claim 20 or by a method according to claim 32. Further features are subject of the subclaims.

According to one aspect of the present invention, the delivery device, the energy store and/or a connecting device are arranged within an annular reservoir or an annular arrangement of receptacles, each of which contains one dose of the formulation. This results in a simple and particularly compact construction.

According to another aspect, the delivery device, the energy store and/or the connecting device is or are moveable in linear, radial and/or sliding manner and/or are moveable together. This facilitates a simple and/or compact construction.

According to another aspect, the atomiser is constructed so that the delivery medium can be put under pressure by the energy or spring store in order to deliver the formulation. This allows a very simple construction and enables achievement of very good atomisation characteristics, in particular equal atomisation characteristics independent on the breathing or inhaling of a patient and/or independent on actuation by a patient.

A further aspect of the present invention is directed to a reservoir having receptacles respectively comprising an insert, wherein the receptacles are constructed as separates parts and/or arranged on a common or annular area and/or sealed separately and/or on its outer circumferentional periphery. This facilitates a simple and/or compact construction. Further, very good atomisation characteristics can be achieved.

According to a further aspect of the present invention, the delivery medium, such as air, is compressed and/or forced through the respective receptacle by the force of a spring store. This results in very uniform atomisation characteristics at each delivery or discharge.

According to another aspect, the spring store is put under tension and/or the delivery medium is sucked into a pump, the next receptacle and a connecting element are aligned relative to each other, and finally the aligned receptacle is pierced by the connecting element for supplying the delivery medium, i.e. for discharging or atomising the respective dose from the pierced receptacle. This allows a very simple and/or compact construction. Further, very simple and easy operation is possible.

Further aspects, features, properties and advantages of the present invention will become apparent from the claims and the following description of preferred embodiments, with reference to the drawings, wherein:

Fig. 1 shows a schematic section through a proposed atomiser according to a first embodiment in a transportation position;

Fig. 2 shows a schematic section through the atomiser according to Fig. in an activated state;

Fig. 3 shows a perspective view of the atomiser in the opened or activated state;

Fig. 4a shows a schematic view of a sliding guide in the atomiser according to Fig. 1;

Fig. 4b shows a schematic view of the open or cutaway atomiser according to Fig. 1 with a ratchet mechanism;

Fig. 4c shows a schematic section through the atomiser according to Fig. 1 with a locking device;

Fig. 4d shows a perspective view of a control ring of the locking device according to Fig. 4c;

Fig. 4e shows another schematic section through the atomiser with the locking device according to Fig. 4c;

Fig. 5 shows a schematic section through the atomiser according to Fig. 1 after a delivery or atomisation;

Fig. 6 shows a schematic section through a proposed atomiser according to a second embodiment in the transportation position;

Fig. 7 shows a schematic section through the atomiser according to Fig. 6 in the activated or opened state;

Fig. 8 shows a schematic section through a proposed atomiser according to a third embodiment in the opened or activated state;

Fig. 9 shows a schematic view of a proposed atomiser according to a fourth embodiment in the transportation position;

Fig. 10 shows a schematic section through the atomiser according to Fig. 9 in the unlatched state;

Fig. 11 shows a schematic section through the atomiser according to Fig. 9 in the activated, pressed-together state;

Fig. 12 shows a schematic section through a proposed atomiser according to a fifth embodiment in the transportation position;

Fig. 13 shows a schematic section through the atomiser according to Fig. 12 in the unlatched state;

Fig. 14 shows a schematic section through the atomiser according to Fig. 12 in the activated, pressed-together state;

Fig. 15 shows a schematic section through a proposed atomiser according to a sixth embodiment in the transportation position;

Fig. 16 shows a schematic section through the atomiser according to Fig. 15 in the unlatched state;

Fig. 17 shows a schematic view of a connecting element of the atomiser according to Fig. 16;

Fig. 18 shows another schematic detail from Fig. 16;

Fig. 19 shows a side view of a detail of the atomiser according to Fig. 15 with a counter in the transportation position;

Fig. 20 shows a side view, corresponding to Fig. 19, of the atomiser in the unlatched state;

Fig. 21 shows a perspective view of the atomiser according to Fig. 15 with a timer;

Fig. 22 shows a perspective view of the atomiser according to Fig. 15 with a medicament receptacle;

Fig. 23 shows a schematic section through a proposed atomiser according to an eighth embodiment in the transportation position;

Fig. 24 shows a schematic section through the atomiser according to Fig. 23 in the opened or activated state;

Fig. 25 shows a schematic view of a transporting device of the atomiser according to Fig. 23;

Fig. 26 shows a schematic view of a part of a proposed atomiser according to a ninth embodiment;

Fig. 27 shows a view corresponding to Fig. 26 of the atomiser in an activated state;

Fig. 28 shows a schematic functional representation of a proposed atomiser according to a tenth embodiment; and

Fig. 29 shows a schematic section through the atomiser according to Fig. 28.

In the Figures, the same reference numerals have been used for identical or similar parts, even if the associated description has not been repeated. In particular, the same or corresponding advantages and properties are obtained thereby.

Fig. 1 shows in schematic section a proposed atomiser 1 according to a first embodiment in the transportation position. In particular it is a preferably portable inhaler, particularly preferably for aerosol therapy.

The atomiser 1 is designed to deliver and atomise a formulation 2, preferably powder. In particular the atomiser 1 can be used for a formulation 2 in the sense explained hereinbefore.

The formulation 2 is preferably pre-metered into individual doses which can be delivered one after another by the atomiser 1, particularly for inhalation.

The atomiser 1 has a reservoir 3 or is designed to hold one. If necessary the reservoir 3 can be inserted in the atomiser 1 and optionally replaced for repeated use of the atomiser 1.

The reservoir 3 has a plurality of receptacles 4, each containing one dose of the formulation 2. The receptacles 4 may be e.g. blister pockets, but preferably contain inserts 28 with the respective dose of the formulation 2. The reservoir 3 is preferably of rigid and/or annular construction. In particular the reservoir 3 or the receptacles 4 form an annular arrangement, the receptacles 4 preferably being distributed around the circumference of the reservoir 3.

The atomiser 1 is preferably of the active type. In the embodiment shown by way of example the atomiser 1 preferably has a delivery device 5 for a delivery medium, particularly air or some other gas, for delivering the formulation 2. The delivery device 5 is constructed in particular as a pump, particularly preferably an air pump, or is designed in some other way to convey the delivery medium.

In particular the delivery device 5 has a pump chamber 6 which is preferably formed, delimited and/or variable by a bellows 7 and/or some other element of the delivery device 5.

Using the delivery device 5 ambient air, in particular, can be taken in as the delivery medium and put under pressure. Using the delivery medium the formulation 2, i.e. a dose of the formulation 2 can be expelled from a receptacle 4 on actuation or use of the atomiser 1, in particularly only after it has been triggered accordingly. However, the delivery device 5 may theoretically also produce, provide and/or pressurise air, other gas or even liquid as the delivery medium in some other way, so as to be able to deliver the formulation 2 particularly as an aerosol or spray mist with preferably fine particles (solid and/or liquid).

The atomiser 1 preferably has an endpiece or mouthpiece 8 for delivering the formulation 2, in particular to a user or patient (not shown). From now on only the term "mouthpiece" will be used. However, this may also be some other endpiece for administering or delivering the formulation 2, particularly when the atomiser 1 is not used as an inhaler.

A delivery opening of the mouthpiece 8 is optionally provided with a grid 9 or other protective element, particularly in order to be able to prevent damage to the atomiser 1, e.g. of the reservoir 3 or receptacles 4, caused by external effects or the like, and/or to prevent the expulsion of other parts, larger particles or the like.

The atomiser 1 preferably has a cover 10 associated with the mouthpiece 8, which is manually movable, in particular, to enable the mouthpiece 8 to be opened and closed. Fig. 1 shows the cover 10 in the closed state, i.e. covering

the mouthpiece 8. Fig. 2 shows in a similar sectional view the activated atomiser 1, i.e. the atomiser 1 ready for inhalation, with the cover 10 open, i.e. the mouthpiece 8 freely accessible.

The cover 10 is movable in particular at right angles to the delivery direction 11 indicated in Fig. 2, in particular slidable and/or pivotable.

In the embodiment by way of example the cover 10 is preferably pivotable or rotatable about a central axis 12 of the atomiser 1 or the annular arrangement of the reservoir 3 or the receptacles 4 or a rotation axis of the reservoir 3. The atomiser 1 or its housing 13 is preferably at least substantially rotationally symmetrical, particularly relative to the axis 12, and/or constructed to be at least substantially flat or disc-shaped, in particular substantially in the form of a circular disc. However, other geometric and constructive solutions and arrangements are also possible.

The cover 10 is preferably movable at a tangent to the housing 13 of the atomiser 1 or along a periphery of the atomiser 1. The cover 10 extends in particular substantially peripherally, in particular along a circumferential section of the atomiser 1.

Fig. 3 shows a preferred construction, particularly a flat, disc-shaped and/or round embodiment of the atomiser 1. It is also apparent that the cover 10 covers or overlaps a circumferential portion of the atomiser 1 of preferably at least 90°, in particular substantially about 150° to 170°, particularly both in the peripheral direction and also from one flat side through the circumferential portion to the other. However, here again, other constructive solutions and configurations are also possible.

In the fully opened position shown in Figs. 2 and 3, in the embodiment shown, the cover 10 is preferably rotated or pivoted through about 150° to 180° relative to the closed transportation position shown in Fig. 1. However, other pivot angles are also possible.

Alternatively, the cover 10 may be formed for example in the manner of a slide and/or shutter and may be guided, mounted or held for example by the housing 13 or mouthpiece 8.

The cover 10 is preferably coupled to the delivery device 5 such that by opening and/or closing, and in particular simply by opening, the cover 10 the delivery device 5 is operated or actuated and in particular the delivery medium (particularly ambient air) is taken in by the delivery device 5. Alternatively or additionally, the delivery medium can be put under pressure by the opening and/or closing movement of the cover 10. In this case operation is very simple and intuitive, as the actuation of the delivery device 5 is intuitively effected by opening and/or closing the cover 10 and in particular there is no need for any additional actuation of any other actuating element.

The atomiser 1 or delivery device 5 preferably has an energy store, particularly a spring store, in the form of a spring 14 in the embodiment shown. The cover 10 is preferably coupled to the energy store such that energy is produced by opening and/or closing the cover 10 and stored in the energy store. In particular opening and/or closing - particularly preferably just closing - the cover 10 causes energy to be stored by tensioning the spring store or the spring 14.

The energy store or spring store may drive various devices and/or serve different purposes and serves in particular to drive the delivery device 5 or to put the delivery medium under pressure or displace it from the pump chamber 6, in order to convey the delivery medium through a receptacle and expel the corresponding dose of the formulation 2 in the desired manner and then atomise it. The delivery medium is preferably only put under pressure during or for the purpose of delivering the formulation 2. However, in theory this may also take place beforehand, in which case a valve device or the like (not shown) is provided in particular to prevent premature delivery of the delivery medium and the formulation 2 before the actual desired delivery and atomisation.

The energy store is preferably associated with the delivery device 5 or forms a part thereof. Particularly preferably the energy store or spring store surrounds the delivery device 5 or is arranged or integrated therein.

In the embodiment shown by way of example the spring 14 is mounted on an axial extension relative to the direction of the pump or the pumping action or behind the pump chamber 6 or the bellows 7. In this case the spring 14 preferably acts as a compression spring which compresses or pushes together the pump chamber 6 or the bellows 7 or displaces, for example, a piston (not shown) in order to reduce the size of the pump chamber 6 or compress the delivery medium contained therein - i.e. put it under pressure - and thereby bring about the delivery of the delivery medium.

The delivery device 5 and/or the energy store is or are particularly preferably arranged inside the annular arrangement of the reservoir 3 or receptacles 4, in particular thus at least substantially in the centre of the housing 13. Preferably the delivery device 5 and the energy store are arranged in the region of the axis 12 or around the axis 12, preferably concentrically thereto.

The arrangement of the delivery device 5 and/or energy store or other devices within the annular arrangement of the reservoir 3 or receptacles 4 according to the invention also enables the delivery device 5 and/or the energy store to extend axially beyond the reservoir 3 or receptacles 4 or, for example, in the transportation position shown in Fig. 1, to be arranged in an axially offset position from the main or annular plane of the reservoir 3.

The arrangement of the delivery device 5 and/or the energy store inside the annular arrangement of the reservoir 3 or receptacles 4 or other devices results in a particularly compact construction and in particular a particularly low axial height of the atomiser 1.

The pivot axis of the cover 10 preferably corresponds to the axis 12 of the annular arrangement of the reservoir 3 or receptacles 4, the reservoir 3 preferably being rotatable about this axis, as will be described in more detail hereinafter.

The atomiser 1 preferably has a transmission or gear 15, particularly for the above-mentioned preferred coupling of the cover 10 to the delivery device 5 and/or the energy store. Alternatively or additionally, the transmission, named

gear 15 in the following, can also drive and/or actuate other devices or perform other functions.

Preferably, the gear 15 is arranged – partly or totally – within the annular arrangement of the reservoir 3 or receptacles 4. This in turn contributes to the compact structure of the atomiser 1.

The gear 15 is preferably driven by movement of the cover 10, and in particular is coupled directly or indirectly thereto.

Particularly preferably the gear 15 generates, from the opening and/or closing movement of the cover 10, an axial movement, particularly with respect to the annular arrangement and/or the axis 12. Particularly preferably the axial movement extends on or along the axis 12 or parallel thereto. The term "axial movement" is to be understood as meaning that at least one component of the movement generated by the gear 15 on the power takeoff side extends in the above-mentioned axial direction.

The axial movement that can be generated by the gear 15 is used particularly preferably for opening the next receptacle 4, for displacing and/or advancing the reservoir 3 or receptacles 4, for tensioning the spring store, for actuating the delivery device 5, particularly for taking in air, and/or for actuating another device of the atomiser 1, such as a counter. Preferably, the gear 15 has different transmission ratios on the power takeoff side for driving different devices.

The gear 15 preferably comprises at least one thread, particularly a rotatable threaded sleeve 16, which particularly preferably has an internal thread 17 and/or an external thread 18.

The thread or the threaded sleeve 16 is preferably directly or indirectly coupled or connected to the cover 10 and/or arranged coaxially with the pivot axis of the cover 10, or forms the latter. Rotation of the cover 10 in particular directly causes the threaded sleeve 16 to rotate.

In the embodiment shown, the delivery device 5 and in particular also the energy store can be driven or actuated by the gear 15, preferably in the axial direction, in particular via the internal thread 17. The internal thread 17 preferably engages with an inner engagement member 19 which comprises in particular a complementary threaded portion or other projections, engagement surfaces or the like, so that rotation of the threaded sleeve 16 causes axial movement of the non-rotating engagement member 19 associated with the delivery device 5 or the energy store.

In particular the spring 14 is supported at one end on the engagement member 19, which preferably forms a corresponding spring seat or abutment, e.g. by means of an end plate or the like, and at the other end is coupled to the movable end of the bellows 7 or other pumping element of the delivery device 5. However, once again, different constructional solutions are possible. In particular, the gear 15 or engagement member may also only act directly on the bellows 7 or other pumping element and in addition are coupled to the spring 14 only indirectly or not at all.

Starting from the transportation position shown in Fig. 1, when the cover 10 is opened the engagement member 19 is moved axially on the one hand, i.e. it performs the preferred axial movement, while on the other hand a preferably interlocking and/or releasable connection between the engagement member 19 and the delivery device 5 and/or the spring store - for example by means of at least one locking arm 20 - transmits the axial movement and in particular causes the pump chamber 6 to enlarge in the axial direction and preferably take in ambient air, the bellows 7 is pulled open or enlarged in the axial direction and/or - particularly when the axial end position is reached - a preferably centrally or axially arranged actuating element 21 is released and/or moved axially out, as shown in the end position in Fig. 2. The tensioned spring 14 is preferably moved axially together with the engagement member 19 and an axial end of the bellows 7.

During subsequent actuation of the actuating element 21, particularly by pressing radially inwards, the delivery is initiated and the formulation 2 is atomised from an adjacent receptacle 4. In particular the connection between the engagement member 19 on the one hand and the minimum of one locking arm

20 or the delivery device 5 and/or the energy store on the other hand is undone, in particular by the fact that at least one engaging element 22 springs the at least one locking arm 20 into a non-engaged position (radially inwards in the embodiment shown). The recoil or spring force of the spring store or of the tensioned spring 14 then causes the bellows 7 to be collapsed and the pump chamber 6 to be made smaller, as a result of which the delivery medium (particularly ambient air) contained in the pump chamber 6 is put under pressure and displaced, so that the formulation 2 is expelled and atomised in the desired manner, as will be discussed in more detail hereinafter.

Alternatively or in addition to the thread, theoretically some other control cam, ramp, inclined plane or other geared connected may be used, particularly to achieve the sequence of movements described hereinbefore, a sequence of movements described hereinafter and/or some other sequence of movements.

The atomiser 1 preferably has a transporting device 23 to enable the reservoir 3 to be advanced or further rotated preferably stepwise to the next receptacle 4 or by one receptacle 4, and preferably a connecting device 24 for in particular connecting the receptacles 4 singly to the delivery device 5 and/or in particular for individually opening the receptacles 4.

Preferably the transporting device 23 and/or the connecting device 24 is driven or actuated by the opening and/or closing of the cover 10, particularly via the gear 15. Particularly preferably an axial movement generated by the gear 15 is used again.

In the embodiment shown the actuation of the transporting device 23 and the actuation of the connecting device 24 – i.e. the advancing of the reservoir 3 to the next receptacle 4 and the opening of the next receptacle 4 and/or attachment to the delivery device 5 – are combined or coupled. However, these actuations may also be controlled independently of one another or in particular through separate drives of the gear 15 or separate drive chains.

Preferably, combined driving of the transporting device 23 and connecting device 24 is achieved by means of an external engagement member 25 which engages with the external thread 18 of the threaded sleeve 16 – particularly

via a corresponding threaded portion, a sliding surface or the like. This engagement member 25 is in particular non-rotationally connected to the preferably annular reservoir 3 or is formed thereby. For example the engagement member 25 may form a closed inner ring of the reservoir 3. However, this is not absolutely necessary. For example the reservoir 3 may also engage directly with the gear 15, particularly the external thread 18 of the threaded sleeve 16, via corresponding sliding surfaces or the like.

The reservoir 3 is preferably locked at its outer periphery against free rotation with the threaded sleeve 16 or the external thread 18 about the axis 12, in particular by a sliding guide formed for example in collaboration with the housing 13.

Rotating the threaded sleeve 16 or external thread 18 (or other control cam) causes axial movement of the non-co-rotating engagement member 25 and hence of the reservoir 3. For example, the reservoir 3 with the receptacles 4 is moved from the axial position shown in Fig. 1 in the transportation position, during and as a result of the opening of the cover 10 – i.e. by means of the gear 15 – axially into the position shown in Fig. 2. This axial or lifting movement takes place in the embodiment shown in the opposite direction to the axial movement for actuating the delivery device 5 (particularly taking in the ambient air) but may also go in the same direction.

Only after the actuating element 21 has been actuated – i.e. after the delivery and atomisation of the formulation 2 from a receptacle 4 – the cover 10 is closed again. Closing the cover 10 and rotating the threaded sleeve 16 causes the reservoir 3 to perform the opposite axial or lifting movement again. In the course of this axial movement and/or during the opposing axial movement during the opening of the cover 10, the sliding guide leads to an advancing or further rotation of the reservoir 3 by one receptacle 4, i.e. to the next receptacle 4.

Fig. 4a illustrates a possible constructional configuration of the sliding guide or of a control groove or control cam 26 preferably formed by the inner wall of the housing 13, in order to carry out the desired, preferably alternating axial movement of the reservoir 3 and the stepwise further rotation of the reservoir

3 by one receptacle 4. This combined movement is achieved in particular by the alternately axially and diagonally extending portions of the control cam 26, in which a projection of the reservoir 3 engages radially, for example. However, other radially inner and/or axial mechanisms are also possible.

In the embodiment shown the outer engagement member 25 and the above-mentioned sliding guide form the transporting device 23 or components thereof. In particular the sliding guide or the transporting mechanism is constructed in the manner of a ballpoint pen mechanism (axial movement back and forth leads to stepwise rotation). However, other constructional solutions are also possible which bring about, in particular, stepwise advancing or further rotation of the reservoir 3 by one receptacle 4 – particularly preferably by the axial movement and/or rotation of a gear component, such as the threaded sleeve 16.

According to an alternative embodiment shown in Fig. 4b, the transporting device 23 may have, alternatively or in addition to the sliding guide or control cam 26, a ratchet mechanism or locking latch mechanism 27 which allows an, in particular, stepwise advancing or further rotation of the reservoir 3 which is shown open or cut away in the drawing. The ratchet mechanism 27 is formed in particular between the outer engagement member 25 and the annular reservoir 3, so that these two are rotatable in one direction relative to one another by corresponding ratchet steps.

The ratchet mechanism 27 has in the embodiment shown in particular a ratchet 27a in which a transporting arm 27b can engage. Particularly preferably radial locking engagement takes place. However, in principle it may also occur in the axial direction. Preferably the ratchet mechanism 27 is formed on the inside and/or encircling the reservoir 3. The transporting arm 27b can be moved by the delivery device 5, particularly the gear 15, particularly preferably in alternating manner. In the embodiment shown the transporting arm 27b is directly or indirectly connected to the threaded sleeve 16, particularly formed on the outer engagement member 25. Preferably the transporting arm 27b is biased elastically - particularly by its inherent elasticity - towards the ratchet 27a to produce the desired locking engagement. Particularly preferably a plurality of transporting arms 27b are provided, to obtain the desired reliable

stepwise movement of the reservoir 3 by back and forth movement or rotation of the cover 10 or threaded sleeve 16.

A preferred construction of the connecting device 24 will now be described in more detail. However, for ease of understanding, a preferred embodiment of the reservoir 3 will first be explained in more detail.

There are various possibilities for the construction and configuration of the reservoir 3 and receptacles 4. For example, it may be a blister arrangement, optionally combined with a carrier, or the like. The individual receptacles 4 are then formed by blister pouches, for example.

Particularly preferably the receptacles 4 are formed by inserts 28 which are accommodated in preferably separate, in particular radially extending guides or receiving chambers 29 of the reservoir 3. In particular, each insert 28 is preferably radially displaceable or movable.

In the embodiment shown in particular the inserts 28, receiving chambers 29, mouthpiece 8 and/or delivery device 11 are aligned radially. However, theoretically it is also possible to have a different alignment, for example axial.

The receiving chambers 29 are preferably provided on the outer periphery of the reservoir 3 or the annular arrangement with openings 30 which are preferably closed, in particular sealed, or otherwise closed off or covered, when not in use or in the state as supplied. A corresponding sealing, foil, film or the like is indicated by reference sign 30 in Fig. 1. In the state as supplied, the receiving chambers 29 containing the inserts 28 are each hermetically sealed, particularly in fluid tight and possibly also gastight manner. The reservoir 3 is made in particular of diffusion proof plastics and/or is optionally provided with a diffusion proof outer packaging.

Each insert 28 has a storage chamber 31 which contains the dose or formulation 2 of the particular insert 28 and in particular has been filled with the formulation 2 during the manufacture of the reservoir 3 or atomiser 1 at the factory end. Adjoining the storage chamber 31 is preferably a duct or channel 32 in the insert 28 for delivering, atomizing and/or de-agglomerating the formu-

lation 2. The channel 32 may if required merge into a nozzle (not shown) or form such a nozzle. In the embodiment shown, the inserts 28 thus form with their storage chambers 31 the receptacles 4 for the formulation 2 or the inserts 28 are accommodated in the receiving chambers 29 or the receptacles 4 formed in or by the reservoir 3.

In order to deliver the formulation 2 the respective receptacle 4 is opened. In the embodiment shown this is preferably carried out at the delivery end by moving the respective insert 28 partly out of its receiving chamber 29, particularly through the opening 30 and pushing a seal or the like (not shown) preferably radially outwards through it. In this way the receiving chamber 29 or its opening 30 is opened up and the channel 32 is freed. For example the sealing foil or the like (not shown) which closes off the respective opening 30 is torn away from the insert 28 or another closure or covering member that closes off the opening 30 is displaced, opened, pushed out or otherwise removed from the insert 28.

The preferred radial displacement of the insert 28 in order to open the respective receiving chamber 29 is carried out in the embodiment shown preferably by means of the connecting device 24 or the transporting device 23, in particular by having a finger 33 or other actuating member of the connecting device 24 penetrate in particular axially into the receiving chamber 29 in the region of the inner radial end of the respective insert 28 and in particular by a corresponding sliding surface (on the finger 33 and/or insert 28) performing the desired outward radial movement of the insert 28.

The penetration of the finger 33 is possible for example because the reservoir 3 has a sufficiently thin wall or frangible point in the region of penetration. Alternatively the reservoir 3 may also comprise an opening or the like which is sealed, covered or provided with a closure and can be opened or penetrated by the finger 33.

Fig. 1 shows in section on the left-hand side a still closed receiving chamber 29 with an insert 28 which has not yet been radially pushed out. Fig. 2 shows the receiving chamber 29 which has already been opened on the outlet side,

having the insert 28, which has already been moved radially, protruding from the opening 30.

The connecting device 24 in this embodiment has a connecting element 34 for creating a fluidic connection with the respective receptacle 4 for supplying the delivery medium, in particular so that the delivery medium can be supplied, for example through a delivery channel 35 as shown by the delivery device 5 via the connecting element 32 of the respective receptacle 4 – i.e. the respective insert 28 or its storage chamber 31 – for delivery and in particular for atomisation of the respective dose of formulation.

The fluidic connection is preferably also created by the axial movement of the reservoir 3 relative to the housing 13 or connecting element 34. In particular the finger 33 first engages axially in the respective receiving chamber 29 in order to move the insert 28 which is to be used next in the radial direction. After this radial movement, as the axial movement continues, the connecting element 34 engages in the receiving chamber 29 and in the insert 28. For this purpose the connecting element 34 is constructed in particular as a piercing element, for example in the form of a cannula or needle with a corresponding point, so as to assist in particular with the piercing or other penetration of the storage chamber 31 in order to create the desired fluidic connection. Thus, the fluidic connection for the delivery medium to the storage chamber 31 is provided and the delivery medium can be supplied to the storage chamber 31 for the expulsion of the formulation 2.

In the embodiment shown, the outer engagement member 25, the finger 33 and the connecting element 34 form the connecting device 24 or components thereof. However, other constructional solutions are possible for opening or piercing the receptacles 4 one after another or as necessary on the supply side and/or on the outlet side and/or for connecting them to the delivery device 5 or for creating another fluidic connection, e.g. for the direct supply or intake of ambient air, and in particular for moving the relevant insert 28 preferably radially, but optionally also axially, for opening the respective openings 30 of the receiving chamber 29 and/or for connecting the storage chamber 31 in the insert 28 to the supply of delivery medium, in particular for inserting the connecting element 34 into the storage chamber 31.

In the embodiment shown, in particular an axial movement leads to the opening, connecting or piercing through the connecting device connecting device 24, preferably at right angles to the direction of delivery 11 or the direction of conveying of the receptacles 4 or the direction of movement or rotation of the reservoir 3. In particular axial connection or piercing is carried out in the embodiment shown. However, radial or other connection or piercing is also fundamentally possible, and this can also be effected if necessary by means of the axial movement provided or carried out by the gear 15.

Theoretically, the direction of connection, opening, piercing and/or delivery 11 may run radially.

Particularly preferably the connecting device 24 – in particular like the delivery device 5 and/or transporting device 23 – may be actuated by opening and/or closing the cover 10 and/or may be actuated by the preferably common gear 15 or at least one axial movement.

According to another feature explained hereinafter with reference to an alternative embodiment it is also possible to arrange the transporting device 23 and/or the connecting device 24 inside the annular arrangement of the reservoir 3 or receptacles 4. This in turn contributes to a particularly compact structure for the atomiser 1 and in particular helps to minimise the axial height of the atomiser 1.

The reservoir 3 is preferably rigid. The term "rigid" is to be taken to mean that the reservoir 3 or its receiving chambers 29 preferably form a sufficiently stable or well-defined holder and possibly guide for the inserts 28. However, other constructional solutions are possible. For example by externally guiding the reservoir 3 or the respective receiving chamber 29 it is possible to achieve the desired guiding of the insert 28 contained in the receiving chamber 29, even if the reservoir 3 is not of rigid construction, for example. Alternatively or additionally, the insert 28 may be removed completely from the reservoir 3 for connecting the receptacle 4 or when opening the receiving chamber 29 or for delivering the respective dose. In this case, in particular, the reservoir 3 may also for example be constructed only as a blister pack or other package.

Fig. 2 shows the atomiser 1 in the activated state. Ambient air is sucked into the pump chamber 6. The spring 14 is tensioned. The receptacle 4 selected for delivering the next dose has been opened and connected, the corresponding insert 28 has been pushed radially outwards and connected to the supply of delivery medium by means of the connecting element 34, in particular pierced by the latter.

In the embodiment shown the actual delivery and in particular the atomisation of the formulation 2 or dose contained in the pierced receiving chamber 29 can only take place after a corresponding triggering or further actuation, for example after another or further actuation of the cover 10, but in particular as a result of the actuating element 21, which is preferably only moved axially outwards in this state, being actuated, particularly pressed axially inwards by a user or patient (not shown). This releases the latch or other engagement means, so that the spring store or the spring 14 can relax. The delivery medium in the pump chamber 6 is put under pressure and conveyed through the delivery channel 35 and the connecting element 34 into the adjoining storage chamber 31. The delivery medium continues to flow through the channel 32 and out of the insert 28, the formulation 2 contained in the storage chamber 31 being expelled at the same time. The resulting aerosol or spray cloud is emitted through the optional grid 9 through the mouthpiece 8, so that the user or patient can inhale the formulation 2 which has been emitted and in particular atomised.

Fig. 5 shows the atomiser 1 in schematic section after inhalation, i.e. with the spring 14 relaxed, the receptacle 4 empty and the cover 10 still open.

After the inhalation or after the delivery of the formulation 2 the cover 10 is closed again. This is done in particular in the opposite direction of rotation. Because of the coupling provided - in particular by means of the gear 15 - the inner engagement member 19 is moved back again in the axial direction into its starting position shown in Fig. 1, while the spring store or the spring 14 is tensioned again and finally the operative connection or other axial connection between the engagement member 19 and the delivery device 5 or the spring store – particularly via the locking arm 20 – is re-established, so that the start-

ing position shown in Fig. 1 with the spring 14 relaxed and with the desired retaining connection between the engagement member 19 and particularly the bellows 7 and/or the spring 14 is recreated. Moreover, the reservoir 3 is moved back into its axial starting position, i.e. pushed axially back in the opposite direction. In particular this releases the reservoir 3 from the finger 33 and from the connecting element 34.

The advancing or further rotation of the reservoir 3 by one receptacle is preferably superimposed on the axial movement, and this always takes place during the up and down movement, i.e. during the opening and/or closing of the cover 10, when the connecting device 24 - particularly the fingers 33 and connecting element 34 thereof - is no longer engaging in the reservoir 3 but is allowing the desired rotary movement. In the embodiment shown the sliding guide or control cam 26 is therefore preferably designed so that the desired advance or further rotation of the reservoir 3 by one receptacle 4 takes place during only part of the axial movement.

The measures described above result in a very compact, simple structure of the atomiser 1, particularly with few components.

The proposed atomiser 1 can be operated very simply and intuitively. Essentially all that is needed to operate it is to open and close the cover 10. All the functions or processes envisaged are triggered or controlled thereby or take place automatically. In addition to actuation of the cover 10, when the atomiser 1 is constructed as an active atomiser 1, it only remains to trigger the actual delivery and atomisation after opening the cover 10. This is preferably done by actuating, particularly pressing, the actuating element 21. As the actuating element 21 is preferably only actuatable, axially moved out and/or accessible once the atomiser 1 has been activated, i.e. once the cover 10 has been opened, simple intuitive operation is made possible and incorrect operation is ruled out.

The actuating element 21 passes in particular through an opening in the cover 10. However, here again different embodiments are possible. In addition it is also possible for the actuating element 21 to be accessible, e.g. revealed by the cover 10, in the activated state of the atomiser 1.

After inhalation the atomiser 1 or the cover 10 can be closed again. Preferably the cover 10 is secured against closure as long as the actuating element 21 has not been actuated, i.e. in the embodiment shown is still in the axially extended position, or until the formulation 2 has been delivered from the receptacle 4 which has already been opened or connected up or pierced.

Fig. 3 shows the proposed atomiser 1 in the opened or activated state. The cover 10 is thus rotated by about 160° to 180° relative to the closed transportation position shown in Fig. 1. The cover 10 can preferably only be rotated in opposite directions to open and close it. Preferably therefore a rotation stop 36 is provided which is visible from the outside in the embodiment shown and protrudes for example from the periphery or housing 13. This helps to ensure simple and intuitive operation of the atomiser 1, as the user intuitively grasps how far and in which direction the cover 10 has to be opened or closed. Particularly preferably the atomiser 1 is constructed so that the rotation stop 36 forms a stop both for the cover 10 in the open state and also for the cover 10 in the closed state. Alternatively, separate projections or stops could also be provided for this purpose.

The atomiser 1 or cover 10 also preferably comprises a locking device 37 shown in Fig. 4c (partial section through the atomiser 1 in the activated state) which ensures that the cover 10 can only ever be opened and closed alternately. For this purpose at least one corresponding latch 38 or the like is provided for example between regions of the cover 10 and housing 13 arranged axially above or behind one another, providing the desired functionality.

Preferably the atomiser 1 or the locking device 37 comprises a control ring 39 which is shown separately in perspective view in Fig. 4d. The control ring 39 is provided with teeth or a latch 38 on both of its axial or flat sides. The control ring 39 is rotatably guided in particular in an annular channel or the like in the atomiser 1 or the housing 37 thereof, as shown in Fig. 1, 2 and 4c.

Engaging in a latch 38 of the control ring 39 is a locking arm 40a on the housing side while engaging in the other latch 38 is a locking arm 40b on the cover side, as indicated in Fig. 4c. The latches 38 and locking arms 40a und 40b are

matched to one another such that the cover 10 is initially only movable or rotatable in one direction relative to the housing 13, and hence rotation in the opposite direction is prevented by the locking device 37 or by locking arms 40a or 40b acting in the opposite direction.

Preferably a plurality of locking arms 40a are provided on the housing 13, which engage in the associated latch 38 of the control ring 39 and allow the control ring 39 to rotate only in one direction relative to the atomiser 1 or housing 13. Accordingly, a number of locking arms 40b are preferably also arranged on the cover 10 or associated therewith and allow the control ring 39 to rotate in only one direction of rotation relative to the cover 10.

To ensure that the cover 10 can only be fully opened or closed alternately, the rotation of the control ring 39 relative to the housing 13 or to the cover 10 which is in any case only possible in one direction can alternately be blocked off and only re-activated or unlocked when the respective end position is reached, i.e. either in the fully opened or fully closed position. This locking of the control ring 39 relative to the housing 13 or to the cover 10 will be explained briefly hereinafter with reference to another section through the atomiser 1 according to Fig. 4e.

On the control ring 39 are formed stops 40c, as shown in Fig. 4d, which cooperate with stop arms 40d as shown in Fig. 4e. Fig. 4e shows by way of example the locking of the control ring 39 against rotation relative to the housing 13. This locking is carried out in a corresponding or similar manner between the cover 10 and the control ring 39 and acts during the opposite movement of the cover 10 relative to the housing 13.

In the above-mentioned locking, at least one stop 40c strikes against at least one stop arm 40d, so that the rotation of the control ring 39 relative to the housing 13 which would otherwise be possible into the direction of rotation which is not blocked off by the locking arm 40a and its associated latch 38 is also blocked. This blocking by the stop arm 40d remains until the cover 10 moves into its end position.

When the end position is reached, a control slope or sliding surface 40e formed on the cover 10 leads to a springing of the stop arm 40d, so that now the previously blocked stop 40c is freed and hence the cover 10 can be turned back relative to the control ring 39 and hence also rotated or moved in the opposite direction. At the same time, in this end position, another stop 40c of the control ring 39, not shown in Fig. 4e, comes to abut on a stop arm 40d arranged on the cover 10, thereby blocking the relative rotatability of the control ring 39 relative to the cover 10. As a result, the cover 10 can now only be rotated or moved together with the control ring 39 in the opposite direction until the other end position is reached. In the other end position again the rotation of the control ring 39 relative to the housing 13 is blocked accordingly and in turn the rotatability of the cover 10 is freed relative to the control ring 39. Accordingly, the cover 10 can only be fully opened or closed alternately, so as to ensure simple and intuitive operation or actuation and in particular to rule out incorrect operation.

The embodiment shown illustrates an active atomiser 1. Theoretically, however, the atomiser 1 may also be constructed as a passive atomiser. In this case, the delivery device 5 and/or the energy store or spring store can be dispensed with. Instead, for example, ambient air can be taken in by the action of breathing during inhalation, and this air is conveyed through the respective receptacle 4 - particularly the receiving chamber 29 and the channel openings 30 of the insert 28 in question - to the mouthpiece 8, so that the formulation 2 is delivered or expelled and atomised in the desired manner.

If required the spring store may also be used independently of the delivery device 5 for example for advancing and/or opening or closing the receptacles 4, particularly for driving and/or actuating the transporting device 23 and/or the conveying device 24.

If the atomiser 1 does not have a delivery device 5 and/or an energy store, the actuating element 21 and an actuation required in addition to the movement of the cover 10 – i.e. an additional triggering of the actual release and atomisation of the formulation 2 – may be omitted. Rather, it is then preferably sufficient to open the cover 10 in order to activate the atomiser 1, so that the next

receptacle 4 is ready directly with its dose or formulation 2 for inhalation and inhalation can take place immediately.

The mouthpiece 8 is preferably of fixed construction and/or radially aligned and/or preferably formed directly on the housing 13. This results in a simple and compact structure of the atomiser 1 with, in particular, an at least substantially smooth outer contour. However, the mouthpiece 8 may also theoretically be movable, e.g. foldable, slidable, telescopically extendable or movable in some other way. Alternatively or additionally, the mouthpiece 8 may also be aligned or arranged in a different direction, e.g. diagonally or axially, for delivering the formulation 2 or the aerosol.

The proposed atomiser 1 preferably additionally comprises a counter (not shown).

The proposed atomiser 1 preferably operates purely mechanically.

The proposed atomiser 1 is preferably made up at least essentially of only plastics components or parts or made at least essentially only of plastics. Only the spring 14 and optionally the grid 13 may be made of metal, if necessary.

According to a further feature the manual actuation of the active delivery and atomisation of the formulation 2, which is carried out in the first embodiment by pressing the actuating element 21, in particular, may also be omitted. Instead, an actuation controlled by breathing in is preferably provided. For example, when a corresponding vacuum is produced in the atomiser 1 by breathing in, the holding connection between the inner engagement member 19 on the one hand and the biased spring 14 or the bellows 7, another conveying or pumping element or the like, on the other hand, can be undone in order to enable the desired delivery and particularly the atomisation of the formulation 2 to take place virtually automatically during inhalation, namely by means of the energy stored in the energy store or spring store.

Some additional embodiments of the proposed atomiser 1 will be described in the following, with only the essential differences or new aspects compared with the first embodiment being emphasised. The explanations and remarks

given hereinbefore therefore preferably still apply as they stand or in supplementary or similar fashion.

Fig. 6 and 7 show schematic views of a second embodiment of the proposed atomiser 1. Fig. 6 shows the atomiser 1 in the closed position with the receptacle 4 not yet pierced. Fig. 7 shows the atomiser 1 in the activated state with the receptacle 4 opened or pierced.

In the second embodiment the reservoir 3 is not axially movable, in contrast to the first embodiment. Instead, the connecting device 24 is preferably axially slidable or movable. In the embodiment shown the reservoir 3 is held by a rotatable inner part 41. The connecting device 24 (at least the connecting element 34 thereof and preferably the fingers 33 thereof) is mounted on a carrier 42, which is axially movable but not rotatable. The carrier 42 is in turn preferably axially movable by opening and/or closing the cover 10, particularly by means of the gear 15 which is not shown in detail here.

The carrier 42 preferably has axially operating teeth 43, e.g. with sawtooth-like sliding surfaces or the like, which cooperate with complementary or corresponding mating teeth 44 provided or formed on the inner part 41 and in particular engage therein such that the axial movement of the carrier 42 causes a defined, stepwise further rotation of the inner part 41 with the reservoir 3.

In a second embodiment the carrier 42 fits over or around the inner part with the reservoir 3 preferably peripherally and in particular in such a manner that the carrier 42 extends from an end face of the inner part 41 around the outside of the reservoir 43 to the other end face of the reservoir 3 and radially back inwards to an inner edge on which the preferably axial teeth 43 are formed. The carrier 42 has a peripheral opening 45 which at least in the activated state lies on an extension of the particular receptacle 4 which has been opened or pierced, or of the radially advanced insert 28, such that the delivery of the formulation 2 is made possible and not obstructed.

In the second embodiment the same operating procedure is used as in the first embodiment.

Fig. 8 shows in schematic section a third embodiment of the proposed atomiser 1 in the opened, activated state. The third embodiment largely corresponds to the second embodiment, although the connecting device 24 does not engage, as in the second embodiment, from the flat side covered by an annular flange of the inner part 41, but from the opposite flat side into the reservoir 3 - particularly with the finger 33 and the connecting element 34.

Fig. 9 shows in schematic view a fourth embodiment of the proposed atomiser 1 in the transportation position or locked state.

The cover 10 here is in the form of a cap. The pivot axis of the cover 10 is eccentrically arranged or formed, particularly in the region of the periphery or edge of the atomiser 1. In contrast to the previous embodiments the cover 10 essentially only covers the mouthpiece 8.

In the fourth embodiment the opening and/or closing of the cover 10 is preferably not coupled with the other functions of the atomiser 1.

The atomiser 1 has a release mechanism 46 which is constructed in particular as a peripherally movable slide.

Fig. 10 shows in schematic section the atomiser 1 in the unlocked state.

In the fourth embodiment the atomiser 1 has two preferably external housing parts, particularly an upper housing part 47 and a lower housing part 48 which are movable axially towards one another. In particular, the housing parts 47, 48 are biased away from one another preferably by a plurality of spring elements 49, so that in the unlocked and non-compressed state the upper housing part 47 is axially raised relative to the lower housing part 48, as shown in Fig. 10.

The two housing parts 47, 48 are movable axially together counter to the force of the spring elements 49. In the axially compressed state the two housing parts 47, 48 are latchable together, in particular. This latching can be released by actuating the release mechanism 46.

Starting from the transportation position, after release, the upper housing part 47 is automatically moved axially away from the lower housing part 48 by the spring elements 49. This movement away or lifting movement causes actuation of the delivery device 5, namely enlargement of the pump chamber 6 and an intake of ambient air. Moreover, the spring 14 associated with the delivery device 5, particularly its bellows 7, is axially tensioned or compressed thereby. The spring elements 21 accordingly have a greater spring force than the spring 14.

Moreover, the above-mentioned axial or lifting movement causes the actuating element 41 associated with the spring 14 to be raised axially or moved out.

Furthermore, the axial lifting movement causes the reservoir 3 to be axially moved and separated from the connecting device 24 (not shown in detail).

Next, the two housing parts 47, 48 have to be manually pushed together axially counter to the force of the spring elements 49 by a user (not shown). During this axial movement and/or during the preceding lifting movement, the reservoir 3 is further rotated by one receptacle 4. The further rotation or advancing of the reservoir 3 is preferably carried out in turn by slidable controlling of the transporting device 23 or the like. As the process continues the receptacle 4 that has been rotated into the delivery position is then opened and connected to the conveying device, preferably in turn through the connecting device 24 (not shown here).

Fig. 11 shows the activated state of the atomiser 1 that results after the pushing together, with the housing parts 47, 48 latched or locked together, and with the axially protruding actuating element 21. Preferably it is only when this state is reached that it is possible to actuate the actuating element 21 or only after the cover 10 has been opened, to allow the delivery and atomisation of the formulation of the dose from the opened receptacle 4.

By actuating - particularly axially pressing in - the actuating element 21 the blocking of the spring 14 is released, so that the spring 14 can relax axially and thereby actuate the delivery device 5, particularly pressurise the air contained in the pump chamber 6, so that this air is conveyed through the attached

receptacle 4 and delivers the formulation 2 in the desired manner through the mouthpiece 8.

The fourth embodiment also allows very simple intuitive operation. Improper operation is prevented in particular by suitable blocking means.

Fig. 12 to 14 show a fifth embodiment of the proposed atomiser 1 in various states corresponding to those shown in Fig. 9 to 11.

The fifth embodiment differs essentially from the fourth embodiment in that the direction of opening, piercing and/or displacement and/or alignment of the receptacles 4 or inserts 28 extend at least substantially axially or parallel, but not radially relative to the axis 12 or the annular arrangement of the reservoir 3 or of the receptacles 4. In the embodiment shown the mouthpiece 8 is accordingly arranged or formed above the reservoir 3 on the side of the atomiser 1 or housing 13 - in this case the upper housing part 47, in particular - while the mouthpiece 8 protrudes or projects substantially at right angles or perpendicularly to the flat side of the atomiser 1.

In the fifth embodiment starting from the transportation position shown in Fig. 12, first of all the cover 10 has to be opened, and in the embodiment shown it is preferably pivotable about the tangentially extending axis 12. Only when the cover 10 has been opened is the release mechanism 46 accessible. Otherwise the procedure is the same as for the fourth embodiment.

Fig. 15 shows in schematic section a sixth embodiment of the proposed atomiser 1 in the transportation position. The sixth embodiment resembles the fourth embodiment in particular, in principle. However, unlike the previous embodiments the sixth embodiment does not have a delivery device 5. Rather, it is a passive atomiser 1.

In the transportation position, the two housing parts 47 and 48 which can be moved axially away from each other are latched or locked together, particularly by at least one snap-fit hook 50 or the like. The at least one snap-fit hook 50 may preferably engage behind an annular shoulder 51 or the like on the other housing part 47, 48, in order to form an interlocking holding connection

between the two housing parts 47, 48 in the axial direction in the locked position.

In the fourth embodiment, preferably a plurality of spring elements 49 are provided. In the sixth embodiment preferably only a central spring element 49 is provided which is formed in particular by a central helical spring which braces the two housing parts 47 and 48 apart. When the in this case central release mechanism 46 is actuated, particularly by axial pressure, the at least one snap-fit hook 50 or the like is sprung out, i.e. the latching of the two housing parts 47 and 48 is undone, so that the two housing parts 47 and 48 can move axially away from one another, as shown in Fig. 16. As a result of this lifting movement, the reservoir 3 is preferably rotated further by one receptacle 4. The movement away or axial movement takes place automatically as a result of the spring force of the spring element 49. This axial movement is preferably in turn converted by a gear or teeth, sliding guide or the like (not shown) into the desired, stepwise rotary movement of the reservoir 3. Preferably the ballpoint pen mechanism mentioned earlier can come into play here, too. At the same time, as a result of the movement away, the connecting element 34 of the connecting device 24 can be detached from the receptacle 4 which has already been emptied during the last delivery.

Then the two housing parts 47, 48 are pressed manually together counter to the force of the spring element 49. In this way the spring element 49 is tensioned again and the next receptacle 4 is connected or opened by the connecting device 24, particularly the connecting element 34 thereof. Finally, the at least one snap-fit hook 50 automatically locks the two housing parts 47 and 48 together again in the pushed-together end position, as shown in Fig. 15.

Now inhalation can take place. In the sixth embodiment, by breathing in, a user or patient (not shown) produces an air current which is conveyed through an inlet 52 of the connecting element 34 into the opened or pierced receptacle 4 and is passed through an outlet 53 of the connecting element 34 together with the formulation 2 from the receptacle 4 to the mouthpiece 8 as schematically indicated by arrows 54 for the connecting element 34 in Fig. 17.

In the sixth embodiment the receptacle 4 in question is preferably also axially opened or pierced. For example, the reservoir 3 is constructed here as a blister ring (not shown) comprising a plurality of blister pouches or, in particular, as an annular carrier 55 with a plurality of preferably axially open recesses 56 for receiving the blister ring (not shown) or blister pouches, as indicated in particular in the detail shown in Fig. 18. In particular the reservoir 3 is formed directly by the lower housing part 48 or is in particular fixedly connected thereto, in the embodiment shown.

The sixth embodiment preferably comprises a blocking device 57 which blocks further actuation, particularly further opening of the atomiser 1 or movement of the housing parts 47 and 48 after all the receptacles 4 have been used or emptied. The blocking device 57 is for example formed like a hook on the reservoir 3, an associated inner part 41 or the annular carrier 55 and when the blocking position is reached, for example, engages in an abutment 58 formed on the upper housing part 47 so that the two housing parts 47 and 48 can no longer be moved axially apart. This blocking is preferably irreversible as well. Fig. 18 shows the housing parts in the position where they are still apart from each other.

The sixth embodiment, like the others, preferably comprises a counter 59 which in the embodiment shown preferably comprises a corresponding scale 60 on the reservoir 3, particularly on the outer periphery of the reservoir 3 or lower housing part 48, and a corresponding window 61 in the housing 13, particularly the upper housing part 47. The relative rotational position of the reservoir 3 corresponds to the number of receptacles 4 which have already been used or are still available for use. Accordingly, the scale 60 can indicate the number of receptacles 4 which are still available for use or have already been used. Fig. 19 shows the counter 59 in a cut-away side view.

Fig. 20 shows in a view corresponding to Fig. 19 the atomiser 1 in the unlocked state, i.e. with the upper housing part 47 axially raised. In this position the reservoir 3 has preferably been moved axially relative to the window 61 so that the scale 60 is not visible. Instead, preferably a symbol, particularly an arrow or the like, is indicated, to show the user how to operate it, namely by pressing the two housing parts 47 and 48 together as required. To this extent

the counter serves not only to count but also has another function and assists with the operation of the proposed atomiser 1.

The atomiser 1 according to the sixth embodiment may have a central or axial recess 62 in the housing 13 or upper housing part 47, as indicated in Fig. 15 and 16. This recess 62 may be used for additional functions or devices.

Fig. 21 shows an alternative embodiment of the atomiser 1 with a clock 63 or with a time measuring device. The clock 63 is preferably installed in the recess or otherwise integrated in the atomiser 1 or its housing 13. The clock 63 is in particular constructed so that a preferably optical, acoustic and/or vibratory signal can be emitted to remind the user to use the atomiser 1.

Fig. 22 shows another alternative embodiment of the atomiser 1 with a closable chamber or other receptacle for medicaments or the like (not shown). In particular, the recess 62 is constructed to accommodate medicaments or the like and can be closed off for example by a lid 64 or other closure.

Fig. 23 shows in schematic section an eighth embodiment of the proposed atomiser 1 in the transportation position, namely with the cover 10 closed. The eighth embodiment is a passive atomiser 1, like the one in the seventh embodiment. The opening and closing and actuating of the atomiser 1 by rotating or pivoting the cover 10 corresponds however, in principle, to the first to third embodiments.

In the eighth embodiment the reservoir 3 and connecting device 24 are constructed essentially as in the seventh embodiment. The connecting device 24 or the connecting element 34 thereof is axially movable by the opening and closing of the cover 10 by means of the gear (not shown in detail). In the transportation position, the connecting device 24 or the connecting element 34 thereof are moved axially away from the reservoir 3.

By opening the cover 10 (pivoting through preferably up to 180° approximately) first of all the reservoir 3 is advanced or further rotated and as the axial movement continues the next receptacle 4 is opened by the connecting de-

vice 24, particularly pierced or otherwise attached by the connecting element 34. Fig. 24 shows this activated state in schematic section.

When a user or patient (not shown) breathes in to inhale, a current of air is produced which is passed through the connecting element 34 through the receptacle 4 or the storage chamber 31, such as a blister pouch or the like, and in this way the formulation 2 contained in the receptacle 4 is expelled and delivered through the adjoining mouthpiece 8.

To permit a simple and inexpensive construction, the inlet 52 and outlet 53 are preferably formed by a common component, particularly the one-piece connecting element 34. Furthermore, the connecting element 34 preferably also has an outlet channel 65 adjacent to the outlet 53 and widening out in a funnel shape or other suitable manner, in particular. Thus, there is no need for a mouthpiece 8 in the conventional sense or an extension piece or the like as is often used with inhalers. Rather, it is sufficient to have a housing opening and if necessary a corresponding shaping of the housing 13, in order to form a compact, space-saving mouthpiece 8 for a user or patient (not shown).

Fig. 25 shows a schematic view which illustrates the transporting device 23 of the atomiser 1 according to the eighth embodiment. In particular, axial teeth 43 on the reservoir side and axially movable mating teeth 44 on the housing side – particularly together with the connecting device 24 – cooperate so as to achieve the desired stepwise advancing or further rotation of the reservoir 3 by one receptacle 4, with each axial movement of the mating teeth 44 relative to the teeth 43 associated with the opening of the cover 10. In particular, the ballpoint pen principle mentioned previously comes into play again.

However, other constructional solutions are also possible in order to achieve the desired stepwise advancing or further rotation of the reservoir 3 from the movement of the cover 10 that accompanies opening and/or closing, particularly the pivoting movement and/or an axial movement derived therefrom.

In contrast to the seventh embodiment, in the eighth embodiment the counter 59 is preferably arranged on the flat side or axial side of the atomiser 1, particularly with the window 61 being formed in the cover 10 and in the housing

13, so that the current status of the counter can preferably always be read off even when the cover 10 is closed.

In the eighth embodiment too, the reservoir 3 is again preferably provided with an annular carrier 55 for holding a blister arrangement, particularly a blister ring or the like. However, basically any desired type of reservoir 3 – even, in particular, a reservoir 3 with inserts 28 for forming the receptacles 4 – may be used here.

The eighth embodiment allows particularly easy operation as all that is required is to open the cover 10 in order to activate the atomiser 1, i.e. prepare it for atomisation or inhalation. Even after atomisation or inhalation, no other additional operations are required. Rather, it is necessary only to close the atomiser 1 or cover 10. When the cover 10 is closed the connecting device 24 or its connecting element 34 is moved axially away from the reservoir 3 or the receptacle 4 which was opened last, so that the transportation position shown in Fig. 23 is resumed.

Fig. 26 shows a highly schematic rudimentary representation of the concept of a ninth embodiment of the proposed atomiser 1. The ninth embodiment relates to an active atomiser 1 having a delivery device 5 and an energy or spring store which are preferably arranged within the annular arrangement of the reservoir 3 or the receptacles 4, which are merely indicated by receiving chambers 29 in Fig. 26.

In the ninth embodiment the delivery device 5 is again preferably constructed as a pump and is provided, in particular, with the bellows 7 which are preferably movable thereon in a radial direction for pumping, particularly are extendable and collapsible or compressible. The spring store or spring 14 is preferably arranged in this pumping direction behind the bellows 7, particularly on the side remote from the connecting device 24.

Fig. 26 shows the spring store or the spring 14 in the biased state with the bellows 7 extended. In this state ambient air has already been taken in by the delivery device 5 or the bellows 7.

The delivery device 5 with the spring store is preferably movable in the manner of a sled. In order to open the receptacle 4 which is to be used next, the delivery device 5 with the connecting device 24 or the connecting element 34 is first of all advanced radially so that the next receptacle 4 or the next insert 28 is radially pierced or connected by the delivery device 5 and moved radially outwards. This state is shown in the schematic representation in Fig. 27. Then actuation takes place. By relaxing the spring 14 in the radial direction the bellows 7 is compressed and the air contained therein flows through the connecting element 34 and the attached receptacle 4 – particularly the attached insert 28 – as a result of which the formulation 2 contained in the receptacle 4 or in the insert 28 is expelled. Then the delivery device 5 and/or the connecting device 24 can be radially withdrawn again, in particular by or radial movement. In addition, the spring 14 is biased once again due to the radial movement, wherein the bellows 7 is extended and the delivery medium, here air, is sucked into the bellows 7. The spring 14 is secured or latched in the biased position, in particular to the sled.

With the opposite radial movement, the next receptacle 4 or insert 28 can be pierced and, in particular, pushed radially outwardly to open its respective sealing. During this radial movement, the spring 24 remains compressed or tensioned and the bellows 7 remains extended. Thus, the activated state of the atomiser 1 is achieved.

Preferably with actuating of the actuating element (not shown), the spring 14 is released to compress the bellows 7, i.e. to actuate the pump, so that the compressed delivery medium, i.e. air, is forced through the insert 28 to deliver or discharge or atomise or de-agglomerate the respective dose of formulation 2 and to generate the desired spray of the formulation 2.

Part of the radial movement is preferably also used to index or move the reservoir 3 to the next receptegle 4, i.e. to actuate the transporting device 23.

The transporting device 23 in the ninth embodiment preferably engages internally on the reservoir 3, particularly via a pinion 66 which preferably engages in inner teeth 67 of the reservoir 3.

It has to be noted that the connecting device 24 and the pump 5 preferably form a unit or are interconnected.

The connecting element 34 is connected to the sled and/or pump 5 and/or bellows 7.

In the ninth embodiment, the receptacles 4 / receiving chambers 29 form preferably separate parts that are mounted on the preferably ring-like carrier 55, in particularly in a form-fit and/or rigid manner. The receiving chambers 29 or receptacles 4 are preferably separately or individually sealed by respective sealings and/or preferably at least on its outer circumferential periphery (not shown in Fig. 26 and 27).

Fig. 28 shows, in a similarly very schematic, rudimentary representation, a tenth embodiment of the proposed atomiser 1. The tenth embodiment is related to the ninth embodiment and in particular is similar to it, most preferably with respect to the arrangement and/or function of the delivery device 5 and connecting device 24, and therefore no explanation of these is required.

Fig. 29 shows the atomiser 1 according to the tenth embodiment in schematic section, in contrast to Fig. 28 with the housing 13 and the preferably rotatable or pivotable cover 10.

The tenth embodiment allows a pivoting or rotary movement, particularly of the cover 10, to be converted into a linear and/or radial movement in order to actuate the delivery device 5 and/or connecting device 24, most preferably in order to move the connecting element 34. In particular, a sliding and/or automatically geared coupling or control is obtained.

In the embodiment shown the atomiser 1 has at least one control element 68 which is constructed in particular in a manner of a disc (cf. Fig. 28). The control element 68 is preferably rotationally coupled to the cover 10 (in the embodiment shown via an axial engagement 69 as indicated in Fig. 29) or is formed by the cover element 10, for example.

Particularly preferably, the control element 68 forms a sliding guide or a number of sliding guides in order to actuate in particular both the delivery device 5 and the connecting device 24 or its connecting element 34 in the desired or necessary manner. However, it is theoretically also possible to use separate control elements 68, sliding guides and/or other geared connections to control and actuate the delivery device 5 on the one hand and the connecting device 24 or its connecting element 34 on the other hand and/or for different sections of the movements.

In the embodiment shown a first control cam or sliding guide 70 is provided for preferably linear or radial movement of the connecting device 24 or of the slide 79 formed by the delivery device 5 and/or connecting device 24. For this purpose, in particular, a first engaging element 71 engages in the first sliding guide 70. Preferably the first engaging element 71 is rigidly connected to the connecting device 24 or its connecting element 34, directly or indirectly.

The first sliding guide 70 is shown in Fig. 28 as an opening. However, it may also be a recess or groove or the like, in particular, as shown in Fig. 29.

The path of the first sliding guide 70 determines the geared coupling or the dependency of the linear movement which may also extend circumferentially and/or radially, on the rotary movement. In the embodiment shown the first sliding guide 70 comprises a first section 72, particularly extending over a circumference, an adjoining second, preferably linear section 73 and/or one which has a radial component, and/or a third section 74 which in particular again extends over a circumference.

Accordingly, during actuation, i.e. pivoting, of the cover 10 out of the position shown in Figs. 28 and 29 (closed position or transportation position) first of all in the course of the first section 72 there is no linear or radial movement of the connecting device 24 or slide 79. Only further along the second section 73 does a linear or radial movement take place, of the slide 79 or connecting device 24, in the embodiment shown, so that the connecting element 34 comes into contact with the next receptacle 4, particularly engages in the next receptacle 4 or the next insert 28, most preferably produced a fluidic connection between the delivery device 5 or the connecting element 34 and the storage

chamber 31, and optionally moves the insert 28 through the opening 30, particularly by radially advancing it, in order to open the opening 30. The atomiser 1 assumes the activated position.

During the transition from the closed state to the activated state the delivery device 5 or the spring store or the spring 14 was preferably already under tension. Therefore the actuating element 21 can now be actuated, so that the formulation 2 is delivered, particularly by deflecting a locking arm 20 and thereby releasing the spring 14 or the bellows 7 and compressing the pump chamber 6, as a result of which the formulation 2 is expelled or delivered and in particular atomised by the delivery medium in the desired manner, as explained previously.

In the embodiment shown the cover 10 or the control element 68 preferably serves simultaneously to actuate the delivery device 5, particularly to bias the spring store or the spring 14. The control element 68 comprises for this purpose a second control cam or sliding guide 75, with which a second engaging element 76 cooperates, in particular, which in the embodiment shown is associated with the delivery device 5 or spring store or spring 14 , particularly a radially or linearly movable abutment 77 of the spring 14, or is firmly connected thereto, either directly or indirectly.

Particularly preferably the abutment 77 is guided slidably or in the manner of a sled on the delivery device 5 or on the slide 79, which in turn is slidable in the manner of a sled in the direction of movement - in this case the radial direction - and in particular holds or carries the connecting device 24 or the connecting element 34 thereof.

Fig. 29 shows the spring 14 in the biased position (in this case the compressed state). The abutment 77 is held in the biased position by means of at least the locking arm 20. The second sliding guide 75 is preferably constructed in the embodiment shown such that in the closed position or transportation position the spring store or spring 14 is secured against unintentional relaxation, in particular by a shoulder 78 which blocks radial movement of the second engagement 76 in this position.

When the actuating element 21 is actuated the locking arm 20 is deflected out or the locking engagement is undone and the spring store or spring 14 is relaxed or the delivery device 5 is triggered. The spring 14 then compresses the bellows 7 or the pump chamber 6 in the manner described previously - in the embodiment shown - in linear fashion or in the radial direction. Accordingly the formulation 2 (not shown in Fig. 28 and 29) is then delivered and in particular atomised from the connected receptacle 4 or the connected insert 28, as already explained with reference to the other embodiments.

During the relaxation the second engaging element 76 moves, in particular, towards the centre of the atomiser 1 or control element 68 or towards the rotation axis of the cover 10, and optionally beyond. The second sliding guide 75 is correspondingly freely cut to allow this movement. In the embodiment shown this movement extends essentially along a radial section 80 of the second sliding guide 75.

In the embodiment shown, particularly during the closing or moving back of the cover 10, the control element 68 is turned back or the spring store or spring 14 is put under tension again.

As the control element 68 is moved back or turned back from the position in the activated state (preferably rotated through 90° to 180° relative to the position in Fig. 28 and 29) the abutment 77 is held back via the second engaging element 76 over a certain section of the opposing radial movement of the slide 79 or first engaging element 71 by a retaining section 81 of the second sliding guide 75, so that in this section of the movement the spring store or spring 14 is biased again and the bellows 7 is again extended in particular until latching takes place by means of the locking arm 20. During this movement, the connecting element 34 is preferably at least partly withdrawn at the same time from the attached receptacle 4 or the attached insert 28.

In the course of the further linear or radial movement, the delivery device 5, connecting device 24, connecting element 34 and the slide 79 together with the biased spring 14 are moved back into the starting position shown in Fig. 28 and 29.

The sequence of movements described above is carried out in the embodiment shown particularly by closing the cover 10 and, in association therewith, turning back the control element 68.

Fig. 29 in turn shows the preferably annular reservoir 3 in purely schematic form. In connection with this, reference may be made in particular to the remarks relating to the other embodiments.

During the opening movement and/or closing movement of the cover 10 or the rotation of the control element 68 the transporting device 23 not shown in the tenth embodiment can preferably be actuated in order to advance the reservoir 3 to the next receptacle 4. This is done in particular by means of a corresponding or suitable geared coupling or the like. For example, axial displacement of the reservoir 3 may be carried out for this purpose, as explained hereinbefore, the advance being carried out in the circumferential direction or in particular by means of a control cam 26 or the like preferably on the housing side. In particular or alternatively, a geared coupling, particularly by means of a thread, may be used as in the other embodiments.

Individual features and aspects of the individual embodiments may also be combined with one another as desired or used in other constructions of atomisers, inhalers, dispensers or the like.

In the present invention the term "atomiser" is preferably to be interpreted very broadly so as to include other delivery devices, dispensers or the like, while the formulation 2 or other medium or fluid need only be atomised if required and may optionally also be delivered in a different form.

Some preferred ingredients and/or compositions of the preferably medicinal formulation 2 are listed below. As already mentioned, they are in particular powders or liquids in the broadest sense. Particularly preferably the formulation 2 contains the following:

The compounds listed below may be used in the device according to the invention on their own or in combination. In the compounds mentioned below, **W** is a pharmacologically active substance and is selected (for example) from

among the betamimetics, anticholinergics, corticosteroids, PDE4-inhibitors, LTD4-antagonists, EGFR-inhibitors, dopamine agonists, H1-antihistamines, PAF-antagonists and PI3-kinase inhibitors. Moreover, double or triple combinations of **W** may be combined and used in the device according to the invention. Combinations of **W** might be, for example:

- **W** denotes a betamimetic, combined with an anticholinergic, corticosteroid, PDE4-inhibitor, EGFR-inhibitor or LTD4-antagonist,
- **W** denotes an anticholinergic, combined with a betamimetic, corticosteroid, PDE4-inhibitor, EGFR-inhibitor or LTD4-antagonist,
- **W** denotes a corticosteroid, combined with a PDE4-inhibitor, EGFR-inhibitor or LTD4-antagonist
- **W** denotes a PDE4-inhibitor, combined with an EGFR-inhibitor or LTD4-antagonist
- **W** denotes an EGFR-inhibitor, combined with an LTD4-antagonist.

The compounds used as betamimetics are preferably compounds selected from among albuterol, arformoterol, bambuterol, bitolterol, broxaterol, carbuterol, clenbuterol, fenoterol, formoterol, hexoprenaline, ibuterol, isoetharine, isoprenaline, levosalbutamol, mabuterol, meluadrine, metaproterenol, orciprenaline, pirbuterol, procaterol, reproterol, rimiterol, ritodrine, salmefamol, salmeterol, soterenol, sulphonterol, terbutaline, tiaramide, tolubuterol, zinterol, CHF-1035, HOKU-81, KUL-1248 and

- 3-(4-{6-[2-hydroxy-2-(4-hydroxy-3-hydroxymethyl-phenyl)-ethylamino]-hexyloxy}-butyl)-benzyl-sulphonamide
- 5-[2-(5.6-diethyl-indan-2-ylamino)-1-hydroxy-ethyl]-8-hydroxy-1H-quinolin-2-one
- 4-hydroxy-7-[2-{[2-{[3-(2-phenylethoxy)propyl]sulphonyl}ethyl]-amino}ethyl]-2(3H)-benzothiazolone
- 1-(2-fluoro-4-hydroxyphenyl)-2-[4-(1-benzimidazolyl)-2-methyl-2-butylamino]ethanol
- 1-[3-(4-methoxybenzyl-amino)-4-hydroxyphenyl]-2-[4-(1-benzimidazolyl)-2-methyl-2-butylamino]ethanol
- 1-[2H-5-hydroxy-3-oxo-4H-1,4-benzoxazin-8-yl]-2-[3-(4-N,N-dimethylaminophenyl)-2-methyl-2-propylamino]ethanol
- 1-[2H-5-hydroxy-3-oxo-4H-1,4-benzoxazin-8-yl]-2-[3-(4-methoxyphenyl)-2-methyl-2-propylamino]ethanol

- 1-[2H-5-hydroxy-3-oxo-4H-1,4-benzoxazin-8-yl]-2-[3-(4-n-butyloxyphenyl)-2-methyl-2-propylamino]ethanol
- 1-[2H-5-hydroxy-3-oxo-4H-1,4-benzoxazin-8-yl]-2-{4-[3-(4-methoxyphenyl)-1,2,4-triazol-3-yl]-2-methyl-2-butylamino}ethanol
- 5-hydroxy-8-(1-hydroxy-2-isopropylaminobutyl)-2H-1,4-benzoxazin-3-(4H)-one
- 1-(4-amino-3-chloro-5-trifluoromethylphenyl)-2-tert.-butylamino)ethanol
- 6-hydroxy-8-{1-hydroxy-2-[2-(4-methoxy-phenyl)-1,1-dimethyl-ethylamino]-ethyl}-4H-benzo[1,4]oxazin-3-one
- 6-hydroxy-8-{1-hydroxy-2-[2-(ethyl 4-phenoxy-acetate)-1,1-dimethyl-ethylamino]-ethyl}-4H-benzo[1,4]oxazin-3-one
- 6-hydroxy-8-{1-hydroxy-2-[2-(4-phenoxy-acetic acid)-1,1-dimethyl-ethylamino]-ethyl}-4H-benzo[1,4]oxazin-3-one
- 8-{2-[1,1-dimethyl-2-(2.4.6-trimethylphenyl)-ethylamino]-1-hydroxy-ethyl}-6-hydroxy-4H-benzo[1,4]oxazin-3-one
- 6-hydroxy-8-{1-hydroxy-2-[2-(4-hydroxy-phenyl)-1,1-dimethyl-ethylamino]-ethyl}-4H-benzo[1,4]oxazin-3-one
- 6-hydroxy-8-{1-hydroxy-2-[2-(4-isopropyl-phenyl)-1.1dimethyl-ethylamino]-ethyl}-4H-benzo[1,4]oxazin-3-one
- 8-{2-[2-(4-ethyl-phenyl)-1,1-dimethyl-ethylamino]-1-hydroxy-ethyl}-6-hydroxy-4H-benzo[1,4]oxazin-3-one
- 8-{2-[2-(4-ethoxy-phenyl)-1,1-dimethyl-ethylamino]-1-hydroxy-ethyl}-6-hydroxy-4H-benzo[1,4]oxazin-3-one
- 4-(4-{2-[2-hydroxy-2-(6-hydroxy-3-oxo-3.4-dihydro-2H-benzo[1,4]oxazin-8-yl)-ethylamino]-2-methyl-propyl}-phenoxy)-butyric acid
- 8-{2-[2-(3.4-difluoro-phenyl)-1,1-dimethyl-ethylamino]-1-hydroxy-ethyl}-6-hydroxy-4H-benzo[1,4]oxazin-3-one
- 1-(4-ethoxy-carbonylamino-3-cyano-5-fluorophenyl)-2-(tert-butylamino)ethanol
- 2-hydroxy-5-(1-hydroxy-2-{2-[4-(2-hydroxy-2-phenyl-ethylamino)-phenyl]-ethylamino}-ethyl)-benzaldehyde
- N-[2-hydroxy-5-(1-hydroxy-2-{2-[4-(2-hydroxy-2-phenyl-ethylamino)-phenyl]-ethylamino}-ethyl)-phenyl]-formamide
- 8-hydroxy-5-(1-hydroxy-2-{2-[4-(6-methoxy-biphenyl-3-ylamino)-phenyl]-ethylamino}-ethyl)-1H-quinolin-2-one

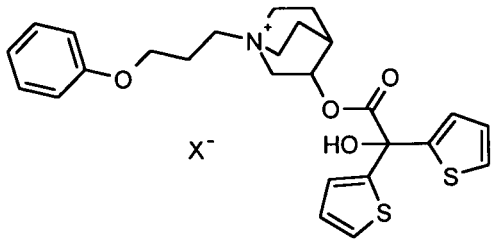
- 8-hydroxy-5-[1-hydroxy-2-(6-phenethylamino-hexylamino)-ethyl]-1H-quinolin-2-one
- 5-[2-(2-{4-[4-(2-amino-2-methyl-propoxy)-phenylamino]-phenyl}-ethylamino)-1-hydroxy-ethyl]-8-hydroxy-1H-quinolin-2-one
- [3-(4-{6-[2-hydroxy-2-(4-hydroxy-3-hydroxymethyl-phenyl)-ethylamino]-hexyloxy}-butyl)-5-methyl-phenyl]-urea
- 4-(2-{6-[2-(2.6-dichloro-benzyloxy)-ethoxy]-hexylamino}-1-hydroxy-ethyl)-2-hydroxymethyl-phenol
- 3-(4-{6-[2-hydroxy-2-(4-hydroxy-3-hydroxymethyl-phenyl)-ethylamino]-hexyloxy}-butyl)-benzylsulphonamide
- 3-(3-{7-[2-hydroxy-2-(4-hydroxy-3-hydroxymethyl-phenyl)-ethylamino]-heptyloxy}-propyl)-benzylsulphonamide
- 4-(2-{6-[4-(3-cyclopentanesulphonyl-phenyl)-butoxy]-hexylamino}-1-hydroxy-ethyl)-2-hydroxymethyl-phenol
- N-Adamantan-2-yl-2-(3-{2-[2-hydroxy-2-(4-hydroxy-3-hydroxymethyl-phenyl)-ethylamino]-propyl}-phenyl)-acetamide

optionally in the form of the racemates, enantiomers, diastereomers thereof and optionally in the form of the pharmacologically acceptable acid addition salts, solvates or hydrates thereof. According to the invention the acid addition salts of the betamimetics are preferably selected from among the hydrochloride, hydrobromide, hydriodide, hydrosulphate, hydrophosphate, hydromethanesulphonate, hydronitrate, hydromaleate, hydroacetate, hydrocitrate, hydrofumarate, hydrotartrate, hydroxalate, hydrosuccinate, hydrobenzoate and hydro-p-toluenesulphonate.

The anticholinergics used are preferably compounds selected from among the tiotropium salts, preferably the bromide salt, oxitropium salts, preferably the bromide salt, flutropium salts, preferably the bromide salt, ipratropium salts, preferably the bromide salt, glycopyrronium salts, preferably the bromide salt, trospium salts, preferably the chloride salt, tolterodine. In the above-mentioned salts the cations are the pharmacologically active constituents. As anions the above-mentioned salts may preferably contain the chloride, bromide, iodide, sulphate, phosphate, methanesulphonate, nitrate, maleate, acetate, citrate, fumarate, tartrate, oxalate, succinate, benzoate or p-toluenesulphonate, while chloride, bromide, iodide, sulphate, methanesulpho-

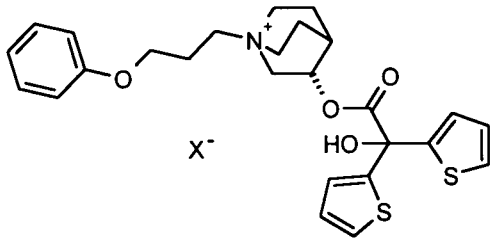
nate or p-toluenesulphonate are preferred as counter-ions. Of all the salts the chlorides, bromides, iodides and methanesulphonates are particularly preferred.

Other preferred anticholinergics are selected from among the salts of formula **AC-1**



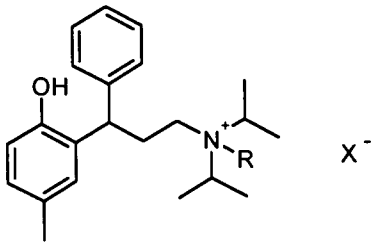
AC-1

wherein X^- denotes an anion with a single negative charge, preferably an anion selected from among the fluoride, chloride, bromide, iodide, sulphate, phosphate, methanesulphonate, nitrate, maleate, acetate, citrate, fumarate, tartrate, oxalate, succinate, benzoate and p-toluenesulphonate, preferably an anion with a single negative charge, particularly preferably an anion selected from among the fluoride, chloride, bromide, methanesulphonate and p-toluenesulphonate, particularly preferably bromide, optionally in the form of the racemates, enantiomers or hydrates thereof. Of particular importance are those pharmaceutical combinations which contain the enantiomers of formula **AC-1-en**



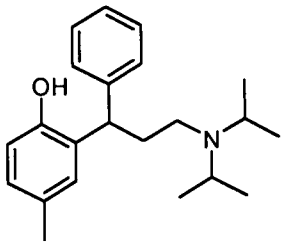
AC-1-en

wherein X^- may have the above-mentioned meanings. Other preferred anticholinergics are selected from the salts of formula **AC-2**



AC-2

wherein R denotes either methyl or ethyl and wherein X $^-$ may have the above-mentioned meanings. In an alternativen embodiment the compound of formula **AC-2** may also be present in the form of the free base **AC-2-base**.



AC-2-base

Other specified compounds are:

- tropenol 2,2-diphenylpropionate methobromide,
- scopine 2,2-diphenylpropionate methobromide,
- scopine 2-fluoro-2,2-diphenylacetate methobromide,
- tropenol 2-fluoro-2,2-diphenylacetate methobromide;
- tropenol 3,3',4,4'-tetrafluorobenzilate methobromide,
- scopine 3,3',4,4'-tetrafluorobenzilate methobromide,
- tropenol 4,4'-difluorobenzilate methobromide,
- scopine 4,4'-difluorobenzilate methobromide,
- tropenol 3,3'-difluorobenzilate methobromide,
- scopine 3,3'- difluorobenzilate methobromide;
- tropenol 9-hydroxy-fluorene-9-carboxylate methobromide;
- tropenol 9-fluoro-fluorene-9-carboxylate methobromide;
- scopine 9-hydroxy-fluorene-9- carboxylate methobromide;
- scopine 9-fluoro-fluorene-9- carboxylate methobromide;
- tropenol 9-methyl-fluorene-9- carboxylate methobromide;
- scopine 9-methyl-fluorene-9- carboxylate methobromide;
- cyclopropyltropine benzilate methobromide;
- cyclopropyltropine 2,2-diphenylpropionate methobromide;
- cyclopropyltropine 9-hydroxy-xanthene-9-carboxylate methobromide;

- cyclopropyltropine 9-methyl-fluorene-9-carboxylate methobromide;
- cyclopropyltropine 9-methyl-xanthene-9-carboxylate methobromide;
- cyclopropyltropine 9-hydroxy-fluorene-9-carboxylate methobromide;
- cyclopropyltropine methyl 4,4'-difluorobenzilate methobromide.
- tropenol 9-hydroxy-xanthene-9-carboxylate methobromide;
- scopine 9-hydroxy-xanthene-9-carboxylate methobromide;
- tropenol 9-methyl-xanthene-9-carboxylate -methobromide;
- scopine 9-methyl-xanthene-9-carboxylate -methobromide;
- tropenol 9-ethyl-xanthene-9-carboxylate methobromide;
- tropenol 9-difluoromethyl-xanthene-9-carboxylate methobromide;
- scopine 9-hydroxymethyl-xanthene-9-carboxylate methobromide,

The above-mentioned compounds may also be used as salts within the scope of the present invention, wherein instead of the methobromide the salts metho-X are used, wherein X may have the meanings given hereinbefore for X^-.

As corticosteroids it is preferable to use compounds selected from among beclomethasone, betamethasone, budesonide, butixocort, ciclesonide, deflazacort, dexamethasone, etiprednol, flunisolide, fluticasone, loteprednol, mometasone, prednisolone, prednisone, rofleponide, triamcinolone, RPR-106541, NS-126, ST-26 and

- (S)-fluoromethyl 6,9-difluoro-17-[(2-furanylcarbonyl)oxy]-11-hydroxy-16-methyl-3-oxo-androsta-1,4-diene-17-carbothionate
- (S)-(2-oxo-tetrahydro-furan-3S-yl)6,9-difluoro-11-hydroxy-16-methyl-3-oxo-17-propionyloxy-androsta-1,4-diene-17-carbothionate,
- cyanomethyl 6α,9α-difluoro-11β-hydroxy-16α-methyl-3-oxo-17α-(2,2,3,3-tertamethylcyclopropylcarbonyl)oxy-androsta-1,4-diene-17β-carboxylate

optionally in the form of the racemates, enantiomers or diastereomers thereof and optionally in the form of the salts and derivatives thereof, the solvates and/or hydrates thereof. Any reference to steroids includes a reference to any salts or derivatives, hydrates or solvates thereof which may exist. Examples of possible salts and derivatives of the steroids may be: alkali metal salts, such as for example sodium or potassium salts, sulphobenzoates, phosphates, isonicotinates, acetates, dichloroacetates, propionates, dihydrogen phosphates, palmitates, pivalates or furoates.

PDE4-inhibitors which may be used are preferably compounds selected from among enprofyllin, theophyllin, roflumilast, ariflo (cilomilast), tofimilast, pumafentrin, lirimilast, arofyllin, atizoram, D-4418, Bay-198004, BY343, CP-325.366, D-4396 (Sch-351591), AWD-12-281 (GW-842470), NCS-613, CDP-840, D-4418, PD-168787, T-440, T-2585, V-11294A, Cl-1018, CDC-801, CDC-3052, D-22888, YM-58997, Z-15370 and

- N-(3,5-dichloro-1-oxo-pyridin-4-yl)-4-difluoromethoxy-3-cyclopropylmethoxybenzamide
- (-)p-[(4*a*R*,10*b*S*)-9-ethoxy-1,2,3,4,4a,10b-hexahydro-8-methoxy-2-methylbenzo[s][1,6]naphthyridin-6-yl]-N,N-diisopropylbenzamide
- (R)-(+)-1-(4-bromobenzyl)-4-[(3-cyclopentyloxy)-4-methoxyphenyl]-2-pyrrolidone
- 3-(cyclopentyloxy-4-methoxyphenyl)-1-(4-N'-[N-2-cyano-S-methyl-isothioureido]benzyl)-2-pyrrolidone
- cis[4-cyano-4-(3-cyclopentyloxy-4-methoxyphenyl)cyclohexane-1-carboxylic acid]
- 2-carbomethoxy-4-cyano-4-(3-cyclopropylmethoxy-4-difluoromethoxy-phenyl)cyclohexan-1-one
- cis[4-cyano-4-(3-cyclopropylmethoxy-4-difluoromethoxyphenyl)cyclohexan-1-ol]
- (R)-(+)-ethyl[4-(3-cyclopentyloxy-4-methoxyphenyl)pyrrolidin-2-ylidene]acetate
- (S)-(-)-ethyl[4-(3-cyclopentyloxy-4-methoxyphenyl)pyrrolidin-2-ylidene]acetate
- 9-cyclopentyl-5,6-dihydro-7-ethyl-3-(2-thienyl)-9*H*-pyrazolo[3.4-c]-1,2,4-triazolo[4.3-a]pyridine
- 9-cyclopentyl-5,6-dihydro-7-ethyl-3-(*tert*-butyl)-9*H*-pyrazolo[3.4-c]-1,2,4-triazolo[4.3-a]pyridine

optionally in the form of the racemates, enantiomers or diastereomers thereof and optionally in the form of the pharmacologically acceptable acid addition salts thereof, the solvates and/or hydrates thereof. According to the invention the acid addition salts of the betamimetics are preferably selected from among the hydrochloride, hydrobromide, hydriodide, hydrosulphate, hydrophosphate, hydromethanesulphonate, hydronitrate, hydromaleate, hydroacetate, hy-

drocitrate, hydrofumarate, hydrotartrate, hydroxalate, hydrosuccinate, hydrobenzoate and hydro-p-toluenesulphonate.

The LTD4-antagonists used are preferably compounds selected from among montelukast, pranlukast, zafirlukast, MCC-847 (ZD-3523), MN-001, MEN-91507 (LM-1507), VUF-5078, VUF-K-8707, L-733321 and

- 1-(((R)-(3-(2-(6,7-difluoro-2-quinolinyl)ethenyl)phenyl)-3-(2-(2- hydroxy-2-propyl)phenyl)thio)methylcyclopropane-acetic acid,
- 1-(((1(R)-3(3-(2-(2,3-dichlorothieno[3,2-b]pyridin-5-yI)-(E)-ethenyl)phenyl)-3-(2-(1-hydroxy-1-methylethyl)phenyl)-propyl)thio)methyl)cyclopropaneacetic acid
- [2-[[2-(4-tert-butyl-2-thiazolyl)-5-benzofuranyl]oxymethyl]phenyl]acetic acid

optionally in the form of the racemates, enantiomers or diastereomers thereof and optionally in the form of the pharmacologically acceptable acid addition salts, solvates and/or hydrates thereof. According to the invention the acid addition salts of the betamimetics are preferably selected from among the hydrochloride, hydrobromide, hydroiodide, hydrosulphate, hydrophosphate, hydromethanesulphonate, hydronitrate, hydromaleate, hydroacetate, hydrocitrate, hydrofumarate, hydrotartrate, hydroxalate, hydrosuccinate, hydrobenzoate and hydro-p-toluenesulphonate. By salts or derivatives which the LTD4-antagonists may optionally be capable of forming are meant, for example: alkali metal salts, such as for example sodium or potassium salts, alkaline earth metal salts, sulphobenzoates, phosphates, isonicotinates, acetates, propionates, dihydrogen phosphates, palmitates, pivalates or furoates.

EGFR-inhibitors which may be used are preferably compounds selected from among cetuximab, trastuzumab, ABX-EGF, Mab ICR-62 and

- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(morpholin-4-yl)-1-oxo-2-buten-1-yl]amino}-7-cyclopropylmethoxy-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(N,N-diethylamino)-1-oxo-2-buten-1-yl]amino}-7-cyclopropylmethoxy-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(N,N-dimethylamino)-1-oxo-2-buten-1-yl]amino}-7-cyclopropylmethoxy-quinazoline
- 4-[(R)-(1-phenyl-ethyl)amino]-6-{[4-(morpholin-4-yl)-1-oxo-2-buten-1-yl]amino}-7-cyclopentyloxy-quinazoline

- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{[4-((R)-6-methyl-2-oxo-morpholin-4-yl)-1-oxo-2-buten-1-yl]amino}-7-cyclopropylmethoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{[4-((R)-6-methyl-2-oxo-morpholin-4-yl)-1-oxo-2-buten-1-yl]amino}-7-[(S)-(tetrahydrofuran-3-yl)oxy]-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{[4-((R)-2-methoxymethyl-6-oxo-morpholin-4-yl)-1-oxo-2-buten-1-yl]amino}-7-cyclopropylmethoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[2-((S)-6-methyl-2-oxo-morpholin-4-yl)-ethoxy]-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-({4-[N-(2-methoxy-ethyl)-N-methyl-amino]-1-oxo-2-buten-1-yl}amino)-7-cyclopropylmethoxy-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(N,N-dimethylamino)-1-oxo-2-buten-1-yl]amino}-7-cyclopentyloxy-quinazoline
- 4-[(R)-(1-phenyl-ethyl)amino]-6-{[4-(N,N-to-(2-methoxy-ethyl)-amino)-1-oxo-2-buten-1-yl]amino}-7-cyclopropylmethoxy-quinazoline
- 4-[(R)-(1-phenyl-ethyl)amino]-6-({4-[N-(2-methoxy-ethyl)-N-ethyl-amino]-1-oxo-2-buten-1-yl}amino)-7-cyclopropylmethoxy-quinazoline
- 4-[(R)-(1-phenyl-ethyl)amino]-6-({4-[N-(2-methoxy-ethyl)-N-methyl-amino]-1-oxo-2-buten-1-yl}amino)-7-cyclopropylmethoxy-quinazoline
- 4-[(R)-(1-phenyl-ethyl)amino]-6-({4-[N-(tetrahydropyran-4-yl)-N-methyl-amino]-1-oxo-2-buten-1-yl}amino)-7-cyclopropylmethoxy-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(N,N-dimethylamino)-1-oxo-2-buten-1-yl]amino}-7-((R)-tetrahydrofuran-3-yloxy)-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(N,N-dimethylamino)-1-oxo-2-buten-1-yl]amino}-7-((S)-tetrahydrofuran-3-yloxy)-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-({4-[N-(2-methoxy-ethyl)-N-methyl-amino]-1-oxo-2-buten-1-yl}amino)-7-cyclopentyloxy-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(N-cyclopropyl-N-methyl-amino)-1-oxo-2-buten-1-yl]amino}-7-cyclopentyloxy-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(N,N-dimethylamino)-1-oxo-2-buten-1-yl]amino}-7-[(R)-(tetrahydrofuran-2-yl)methoxy]-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(N,N-dimethylamino)-1-oxo-2-buten-1-yl]amino}-7-[(S)-(tetrahydrofuran-2-yl)methoxy]-quinazoline

- 4-[(3-ethynyl-phenyl)amino]-6.7-to-(2-methoxy-ethoxy)-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-7-[3-(morpholin-4-yl)-propyloxy]-6-[(vinylcarbonyl)amino]-quinazoline
- 4-[(R)-(1-phenyl-ethyl)amino]-6-(4-hydroxy-phenyl)-7H-pyrrolo[2,3-d]pyrimidine
- 3-cyano-4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(N,N-dimethylamino)-1-oxo-2-buten-1-yl]amino}-7-ethoxy-quinoline
- 4-{[3-chloro-4-(3-fluoro-benzyloxy)-phenyl]amino}-6-(5-{[(2-methanesulphonyl-ethyl)amino]methyl}-furan-2-yl)quinazoline
- 4-[(R)-(1-phenyl-ethyl)amino]-6-{[4-((R)-6-methyl-2-oxo-morpholin-4-yl)-1-oxo-2-buten-1-yl]amino}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-{[4-(morpholin-4-yl)-1-oxo-2-buten-1-yl]amino}-7-[(tetrahydrofuran-2-yl)methoxy]-quinazoline
- 4-[(3-chloro-4-fluorophenyl)amino]-6-({4-[N,N-to-(2-methoxy-ethyl)-amino]-1-oxo-2-buten-1-yl}amino)-7-[(tetrahydrofuran-2-yl)methoxy]-quinazoline
- 4-[(3-ethynyl-phenyl)amino]-6-{[4-(5.5-dimethyl-2-oxo-morpholin-4-yl)-1-oxo-2-buten-1-yl]amino}-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[2-(2,2-dimethyl-6-oxo-morpholin-4-yl)-ethoxy]-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[2-(2,2-dimethyl-6-oxo-morpholin-4-yl)-ethoxy]-7-[(R)-(tetrahydrofuran-2-yl)methoxy]-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-7-[2-(2,2-dimethyl-6-oxo-morpholin-4-yl)-ethoxy]-6-[(S)-(tetrahydrofuran-2-yl)methoxy]-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{2-[4-(2-oxo-morpholin-4-yl)-piperidin-1-yl]-ethoxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[1-(tert.-butyloxycarbonyl)-piperidin-4-yloxy]-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(trans-4-amino-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(trans-4-methanesulphonylamino-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(tetrahydropyran-3-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(1-methyl-piperidin-4-yloxy)-7-methoxy-quinazoline

- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(morpholin-4-yl)carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(methoxymethyl)carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(piperidin-3-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[1-(2-acetylamino-ethyl)-piperidin-4-yloxy]-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(tetrahydropyran-4-yloxy)-7-ethoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-((S)-tetrahydrofuran-3-yloxy)-7-hydroxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(tetrahydropyran-4-yloxy)-7-(2-methoxy-ethoxy)-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{trans-4-[(dimethylamino)sulphonylamino]-cyclohexan-1-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{trans-4-[(morpholin-4-yl)carbonylamino]-cyclohexan-1-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{trans-4-[(morpholin-4-yl)sulphonylamino]-cyclohexan-1-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(tetrahydropyran-4-yloxy)-7-(2-acetylamino-ethoxy)-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(tetrahydropyran-4-yloxy)-7-(2-methanesulphonylamino-ethoxy)-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(piperidin-1-yl)carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(1-aminocarbonylmethyl-piperidin-4-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(cis-4-{N-[(tetrahydropyran-4-yl)carbonyl]-N-methyl-amino}-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(cis-4-{N-[(morpholin-4-yl)carbonyl]-N-methyl-amino}-cyclohexan-1-yloxy)-7-methoxy-quinazoline

- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(cis-4-{N-[(morpholin-4-yl)sulphonyl]-N-methyl-amino}-cyclohexan-1-yloxy)-7-methoxy- quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(trans-4-ethanesulphonylamino-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(1-methanesulphonyl-piperidin-4-yloxy)-7-ethoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(1-methanesulphonyl-piperidin-4-yloxy)-7-(2-methoxy-ethoxy)-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[1-(2-methoxy-acetyl)-piperidin-4-yloxy]-7-(2-methoxy-ethoxy)-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(cis-4-acetylamino-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-ethynyl-phenyl)amino]-6-[1-(tert.-butyloxycarbonyl)-piperidin-4-yloxy]-7-methoxy-quinazoline
- 4-[(3-ethynyl-phenyl)amino]-6-(tetrahydropyran-4-yloxy]-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(cis-4-{N-[(piperidin-1-yl)carbonyl]-N-methyl-amino}-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(cis-4-{N-[(4-methyl-piperazin-1-yl)carbonyl]-N-methyl-amino}-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{cis-4-[(morpholin-4-yl)carbonylamino]-cyclohexan-1-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[2-(2-oxopyrrolidin-1-yl)ethyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(morpholin-4-yl)carbonyl]-piperidin-4-yloxy}-7-(2-methoxy-ethoxy)-quinazoline
- 4-[(3-ethynyl-phenyl)amino]-6-(1-acetyl-piperidin-4-yloxy)-7-methoxy-quinazoline
- 4-[(3-ethynyl-phenyl)amino]-6-(1-methyl-piperidin-4-yloxy)-7-methoxy-quinazoline
- 4-[(3-ethynyl-phenyl)amino]-6-(1-methanesulphonyl-piperidin-4-yloxy)-7-methoxy-quinazoline

- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(1-methyl-piperidin-4-yloxy)-7(2-methoxy-ethoxy)-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(1-isopropyloxycarbonyl-piperidin-4-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(cis-4-methylamino-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{cis-4-[N-(2-methoxy-acetyl)-N-methyl-amino]-cyclohexan-1-yloxy}-7-methoxy-quinazoline
- 4-[(3-ethynyl-phenyl)amino]-6-(piperidin-4-yloxy)-7-methoxy-quinazoline
- 4-[(3-ethynyl-phenyl)amino]-6-[1-(2-methoxy-acetyl)-piperidin-4-yloxy]-7-methoxy-quinazoline
- 4-[(3-ethynyl-phenyl)amino]-6-{1-[(morpholin-4-yl)carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(cis-2,6-dimethyl-morpholin-4-yl)carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(2-methyl-morpholin-4-yl)carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(S,S)-(2-oxa-5-aza-bicyclo[2,2,1]hept-5-yl)carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(N-methyl-N-2-methoxyethyl-amino)carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(1-ethyl-piperidin-4-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(2-methoxyethyl)carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-{1-[(3-methoxypropyl-amino)-carbonyl]-piperidin-4-yloxy}-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[cis-4-(N-methanesulphonyl-N-methyl-amino)-cyclohexan-1-yloxy]-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[cis-4-(N-acetyl-N-methyl-amino)-cyclohexan-1-yloxy]-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(trans-4-methylamino-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[trans-4-(N-methanesulphonyl-N-methyl-amino)-cyclohexan-1-yloxy]-7-methoxy-quinazoline

- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(trans-4-dimethylamino-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(trans-4-{N-[(morpholin-4-yl)carbonyl]-N-methyl-amino}-cyclohexan-1-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-[2-(2,2-dimethyl-6-oxo-morpholin-4-yl)-ethoxy]-7-[(S)-(tetrahydrofuran-2-yl)methoxy]-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(1-methanesulphonyl-piperidin-4-yloxy)-7-methoxy-quinazoline
- 4-[(3-chloro-4-fluoro-phenyl)amino]-6-(1-cyano-piperidin-4-yloxy)-7-methoxy-quinazoline

optionally in the form of the racemates, enantiomers, diastereomers thereof and optionally in the form of the pharmacologically acceptable acid addition salts, solvates or hydrates thereof. According to the invention the acid addition salts of the betamimetics are preferably selected from among the hydrochloride, hydrobromide, hydriodide, hydrosulphate, hydrophosphate, hydromethanesulphonate, hydronitrate, hydromaleate, hydroacetate, hydrocitrate, hydrofumarate, hydrotartrate, hydroxalate, hydrosuccinate, hydrobenzoate and hydro-p-toluenesulphonate.

The dopamine agonists used are preferably compounds selected from among bromocriptin, cabergoline, alpha-dihydroergocryptine, lisuride, pergolide, pramipexol, roxindol, ropinirol, talipexol, tergurid and viozan, optionally in the form of the racemates, enantiomers, diastereomers thereof and optionally in the form of the pharmacologically acceptable acid addition salts, solvates or hydrates thereof. According to the invention the acid addition salts of the betamimetics are preferably selected from among the hydrochloride, hydrobromide, hydriodide, hydrosulphate, hydrophosphate, hydromethanesulphonate, hydronitrate, hydromaleate, hydroacetate, hydrocitrate, hydrofumarate, hydrotartrate, hydrooxalate, hydrosuccinate, hydrobenzoate and hydro-p-toluenesulphonate.

H1-Antihistamines which may be used are preferably compounds selected from among epinastine, cetirizine, azelastine, fexofenadine, levocabastine, loratadine, mizolastine, ketotifen, emedastine, dimetindene, clemastine, bamipine, cexchlorpheniramine, pheniramine, doxylamine, chlorophenoxam-

ine, dimenhydrinate, diphenhydramine, promethazine, ebastine, desloratidine and meclozine, optionally in the form of the racemates, enantiomers, diastereomers thereof and optionally in the form of the pharmacologically acceptable acid addition salts, solvates or hydrates thereof. According to the invention the acid addition salts of the betamimetics are preferably selected from among the hydrochloride, hydrobromide, hydriodide, hydrosulphate, hydrophosphate, hydromethanesulphonate, hydronitrate, hydromaleate, hydroacetate, hydrocitrate, hydrofumarate, hydrotartrate, hydroxalate, hydrosuccinate, hydrobenzoate and hydro-p-toluenesulphonate.

It is also possible to use inhalable macromolecules, as disclosed in EP 1 003 478 A1 or CA 2297174 A1.

In addition, the compounds may come from the groups of ergot alkaloid derivatives, the triptans, the CGRP-inhibitors, the phosphodiesterase-V inhibitors, optionally in the form of the racemates, enantiomers or diastereomers thereof, optionally in the form of the pharmacologically acceptable acid addition salts, the solvates and/or hydrates thereof.

Examples of ergot alkaloid derivatives are dihydroergotamine and ergotamine.

List of reference numerals:

1 atomiser
2 formulation
3 reservoir
4 receptacle
5 delivery device
6 pump chamber
7 bellows
8 mouthpiece
9 grid
10 cover
11 direction of delivery
12 axis
13 housing
14 spring
15 gear
16 threaded sleeve
17 internal thread
18 external thread
19 inner engagement member
20 locking arm
21 actuating element
22 engaging element
23 transporting device
24 connecting device
25 outer engagement member
26 control cam
27 projection
27a ratchet
27b transporting arm
28 insert
29 receiving chamber
30 opening
31 storage chamber
32 channel
33 finger
34 connecting element
35 delivery channel
36 rotation stop
37 locking device
38 latch
39 control ring

40a locking arm
40b locking arm (housing)
40c stop
40d stop arm
40e sliding surface
41 inner part
42 carrier
43 teeth
44 mating teeth
45 peripheral opening
46 release mechanism
47 upper housing part
48 lower housing part
49 spring element
50 snap-fit hook
51 annular shoulder
52 inlet
53 outlet
54 arrow
55 annular carrier
56 recess
57 blocking device
58 abutment
59 counter
60 scale
61 window
62 recess
63 clock
64 lid
65 connecting channel
66 pinion
67 internal teeth
68 control element
69 axial engagement
70 first sliding guide
71 first engaging element
72 first section
73 second section
74 third section
75 second sliding guide
76 second engaging element
77 abutment
78 shoulder

79 slide
80 radial portion
81 holding portion

Claims:

1. Atomiser (1) for delivering a formulation (2) from a reservoir (3) having a preferably annular arrangement of a plurality of receptacles (4), each of which contains a dose of the formulation (2),

having a delivery device (5) for a delivery medium, in particular air, for delivering the formulation (2), and/or an energy store, in particular a spring store,

in particular having a connecting device (24) for successively connecting the receptacles (4) to the delivery device (5) and/or opening them, particularly piercing them, for inhalation of the respective dose,

characterised in

that the delivery device (5), the energy store and/or the connecting device (24) is or are arranged inside the annular arrangement, and/or

that the delivery device (5), the energy store and/or the connecting device (24) is or are movable in linear, radial and/or sliding manner and/or are movable together, and/or

that the atomiser (1) is constructed so that the delivery medium can be put under pressure by the energy or spring store in order to deliver the formulation (2).

2. Atomiser according to claim 1, characterised in that the direction (11) of connection, opening, piercing and/or delivery extend(s) radially.

3. Atomiser according to one of the preceding claims, characterised in that the delivery device (5) comprises or forms a pump.

4. Atomiser according to one of the preceding claims, characterised in that the delivery device (5) comprises a bellows (7) for conveying, particularly pumping, the delivery medium.

5. Atomiser according to one of the preceding claims, characterised in that the energy store is associated with the delivery device (5) or forms part of it.

6. Atomiser according to one of the preceding claims, characterised in that the energy store or spring store surrounds the delivery device (5) or is arranged or integrated therein or is located behind a pump bellows (7).

7. Atomiser according to one of the preceding claims, characterised in that the atomiser (1) is constructed so that the delivery medium can be put under pressure by the energy store or spring store in order to deliver the formulation (2).

8. Atomiser according to one of the preceding claims, characterised in that the atomiser (1) comprises a transporting device (23) for preferably stepwise advancing of the reservoir (3), in order to be able to empty the receptacles (4) one after another so as to atomise the respective dose.

9. Atomiser according to claim 8, characterised in that the reservoir (3) has teeth in which the transporting device (23) engages for movement or rotation of the reservoir (3) in order to advance the receptacles (4).

10. Atomiser according to one of the preceding claims, characterised in that the reservoir (3) is constructed as a rigid ring.

11. Atomiser according to one of the preceding claims, characterised in that the atomiser (2) comprises a preferably fixed and/or radially directed endpiece or mouthpiece (8) for delivering the formulation (2), in particular as an aerosol.

12. Atomiser according to one of the preceding claims, characterised in that the atomiser (1) has a central and/or in particular axially pressable actuating element (21) for triggering a delivery of a dose of the formulation (2).

13. Atomiser according to one of the preceding claims, characterised in that the atomiser (1) has a counter (59), in particular for indicating the doses already dispensed or those still available.

14. Atomiser according to one of the preceding claims, characterised in that the delivery device (5) and/or connecting device (24) is or are movable, particularly slidable, by means of a sliding guide (70, 75).

15. Atomiser according to one of the preceding claims, characterised in that a radial movement causes the reservoir (3) to rotate or advance to the next receptacle (4).

16. Atomiser according to claim 15, characterized in that the radial movement also moves delivery the device (5), a pump and/or a connecting device (24).

17. Atomiser according to one of the preceding claims, characterised in that the atomiser (1) is constructed as a preferably portable inhaler, particularly preferably as a powder inhaler, in particular for medicinal aerosol therapy.

18. Atomiser according to one of the preceding claims, characterised in that the atomiser (1) is flat, in particular disc-shaped, in construction.

19. Atomiser for delivering a formulation (2) from a reservoir (3) with a preferably annular arrangement of a plurality of receptacles (4), each of which contains one dose of the formulation (2), particularly according to one of the preceding claims,

characterised in

that the reservoir (3) is constructed according to one of claims 20 to 31.

20. Reservoir (3) for an atomiser (1), with a preferably annular arrangement of a plurality of receptacles (4) or receiving chambers (29), each of which contains one dose of the formulation (2),

characterised in

that the receptacles (4) or receiving chambers (29) each comprise an insert (28) with the respective dose, the receptacles (4) or receiving chambers (29) being constructed as separate parts and/or being arranged on a common or annular carrier (55) and/or being sealed separately and/or on its outer cirumferential periphery.

21. Reservoir according to claim 20, characterized in that the formulation (2) is a powder.

22. Reservoir according to claim 20 or 21, characterized in that each receptacle (4) or receiving chamber (29) is sealed by a preferably metallic or plastic foil.

23. Reservoir according to any one of claims 20 to 22, characterized in that each receptacle (4) or receiving chamber (29) has two, preferably opposed openings (30).

24. Reservoir according to claim 23, characterized in that each insert (28) can be connected through one opening (30) for supply of pressurized gas and can dispense the respective dose through the other opening (30) or can be pushed at least partially out of the receptacle (4) through the other opening (30).

25. Reservoir according to any one of claims 20 to 24, characterized in that each insert (28) can be pushed through a respective sealing of the associated receptacle (4) or receiving chamber (29) for opening the sealing.

26. Reservoir according to any one of claims 20 to 25, characterized in that each insert (28) can be moved or pushed at least partially out of the respective receptacle (4), in particular in a direction radial, tangential, axial or transversal to the longitudinal direction or circular extension of the carrier (55) or to a row of the inserts (28).

27. Reservoir according to any one of claims 20 to 26, characterised in that the reservoir (3) or carrier (55) is constructed as a rigid ring and/or is a molded element.

28. Reservoir according to any one of claims 20 to 27, characterized in that each receptacle (4) forms a preferably stiff guide for the respective insert (28).

29. Reservoir according to any one of claims 20 to 28, characterized in that each insert (28) is a molded element, a cartridge, a blister, a capsule or a container.

30. Reservoir according to any one of claims 20 to 29, characterized in that each insert (28) comprises a storage chamber (31) containing the respective dose.

31. Reservoir according to any one of claims 20 to 30, characterized in that each insert (28) comprises at least one duct or channel (32), preferably wherein only the duct or channel (32) directly ejects the atomized formulation (2) during use.

32. Method of delivering a formulation (2) from a reservoir (3) with a preferably annular arrangement of a plurality of receptacles (4), each of which contains one dose of the formulation (2),

the formulation (2) being expelled by a delivery medium, particularly air, which is conveyed under pressure through the respective receptacle (4) in particular by means of a pump as delivery device (5),

characterised in

that the delivery medium is compressed and/or conveyed through the respective receptacle (4) by the force of a spring store, and/or

that a spring store is put under tension and/or the delivery medium is sucked into the pump, the next receptacle (4) and a connecting element (34) are aligned relative to one another, and the aligned receptacle (4) is pierced by the connecting element (4) for supplying the delivery medium.

33. Method according to claim 32, characterized in that each dose is contained in an insert (28) located in an associated receptacle (4), wherein the inserts (28) are respectively aligned relative to the connecting element (34) and/or pierced and/or pushed outwardly for opening and/or discharging the respective dose of formulation (2).