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(54) Titre : NOUVELLES COMPOSITIONS DE MEDICAMENT A BASE D'ANTICHOLINERGIQUES, DE
 CORTICOSTEROIDES ET D'AGENTS BETA-MIMETIQUES
 (54) Title: NEW PHARMACEUTICAL COMPOSITIONS BASED ON ANTICHOLINERGICS, CORTICOSTEROIDS AND
 BETAMIMETICS

(57) **Abrégé/Abstract:**

The invention relates to novel pharmaceutical compositions based on anticholinergic agents, corticosteroids and betamimetic agents, to methods for the production thereof and to the use of the same for treating respiratory tract diseases.

ABSTRACT

The invention relates to novel pharmaceutical compositions based on anticholinergic agents, corticosteroids and betamimetic agents, to methods for the production thereof and to the use of the same for treating respiratory tract diseases.

- 1 -

**New pharmaceutical compositions based on anticholinergics, corticosteroids
and betamimetics**

5 The present invention relates to novel pharmaceutical compositions based on anticholinergics, corticosteroids and betamimetics, processes for preparing them and their use in the treatment of respiratory diseases.

Description of the invention

10 The present invention relates to novel pharmaceutical compositions based on anticholinergics, corticosteroids and betamimetics, processes for preparing them and their use in the treatment of respiratory diseases.

Surprisingly, an unexpectedly beneficial therapeutic effect, particularly a synergistic effect can be observed in the treatment of inflammatory or obstructive diseases of the respiratory tract if one or more, preferably one, anticholinergic is used with one or more corticosteroids and with one or more betamimetics. In view of this synergistic effect the pharmaceutical combinations according to the invention can be used in smaller doses than would be the case with the individual compounds used in monotherapy in the usual way. Furthermore, this reduces unwanted side effects such as may occur when corticosteroids and betamimetics are administered, for example.

The effects mentioned above may be observed both when the three active substances are administered simultaneously in a single active substance formulation and when they are administered successively in separate formulations. According to the invention, it is preferable to administer the active substance ingredients simultaneously in a single formulation.

Within the scope of the present invention the term anticholinergics 1 denotes salts which are preferably selected from among tiotropium salts, oxitropium salts and ipratropium salts, most preferably tiotropium salts. In the above-mentioned salts the cations tiotropium, oxitropium and ipratropium are the pharmacologically active ingredients. Within the scope of the present patent application, an explicit reference to the above cations is indicated by the use of the number 1. Any reference to compounds 1 naturally also includes a reference to the ingredients 1 (tiotropium, oxitropium or ipratropium).

By the salts 1 which may be used within the scope of the present invention are meant the compounds which contain, in addition to tiotropium, oxitropium or ipratropium as counter-ion (anion), chloride, bromide, iodide, sulphate, methanesulphonate or para-toluenesulphonate. Within the scope of the present invention, the
 5 methanesulphonate, chloride, bromide and iodide are preferred of all the salts 1, the methanesulphonate and bromide being of particular importance. Of outstanding importance according to the invention are salts 1 selected from among tiotropium bromide, oxitropium bromide and ipratropium bromide. Tiotropium bromide is particularly preferred.

10 Within the scope of the present invention, the word corticosteroids (hereinafter 2) denotes compounds selected from among flunisolide, beclomethasone, triamcinolone, budesonide, fluticasone, mometasone, ciclesonide, rofleponide, GW 215864, KSR 592, ST-126 and dexamethasone. Preferably, compound 2 is selected from among flunisolide, beclomethasone, triamcinolone, budesonide,
 15 fluticasone, mometasone, ciclesonide and dexamethasone. Most preferably, compound 2 is selected from among budesonide, fluticasone, mometasone and ciclesonide. In some cases, within the scope of the present patent application, the term steroids 2 may also be used on its own instead of the word corticosteroids 2.

Any reference to steroids 2 within the scope of the present invention includes a
 20 reference to salts or derivatives 2' which may be formed from the steroids. Examples of possible salts or derivatives 2' include: sodium salts, sulphobenzoates, phosphates, isonicotinate, acetates, propionates, dihydrogen phosphates, palmitates, pivalates or furoates. In some cases the compounds of formula 2 may also occur in the form of their hydrates.

25 Examples of betamimetics 3 which may be used according to the invention include bambuterol, bitolterol, carbuterol, clenbuterol, fenoterol, formoterol, hexoprenaline, ibuterol, pirbuterol, procaterol, reproterol, salmeterol, sulphonterol, terbutaline, tolubuterol, 4-hydroxy-7-[2-[[2-[[3-(2-phenylethoxy)propyl]sulphonyl}ethyl]-
 30 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-
 35 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,
 5 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 or
 1-(4-ethoxycarbonylamino-3-cyano-5-fluorophenyl)-2-(tert.-butylamino)ethanol.

10

According to the invention the following betamimetics 3 are preferably used in the active substance combination: formoterol, salmeterol,

4-hydroxy-7-[2-[[2-[[3-(2-phenylethoxy)propyl]sulphonyl]ethyl]-amino]ethyl]-2(3H)-benzothiazolone,

15

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,

20

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 or

25

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.

30

Salmeterol salts or formoterol salts are preferably used as the long-acting betamimetics 3 according to the invention. Any reference to the term betamimetics 3 also includes a reference to the relevant enantiomers or mixtures thereof. For example, any reference to the preferred compounds 3 according to the invention, the salts of salmeterol and formoterol, also includes the relevant enantiomeric salts of *R*-salmeterol, *S*-salmeterol, *R,R*-formoterol, *S,S*-formoterol, *R,S*-formoterol, *S,R*-formoterol and the mixtures thereof, while the enantiomeric salts of *R*-salmeterol and *R,R*-formoterol are of particular importance. The compounds 3 may also be present according to the invention in the form of the hydrates or solvates thereof.

35

Within the scope of the present invention any reference to compounds 3 is to be understood as being a reference to physiologically acceptable acid addition salts. By physiologically acceptable acid addition salts of the betamimetics 3 are meant

according to the invention pharmaceutically acceptable salts which are selected from the salts of hydrochloric acid, hydrobromic acid, sulphuric acid, phosphoric acid, methanesulphonic acid, acetic acid, fumaric acid, succinic acid, lactic acid, citric acid, tartaric acid, 1-hydroxy-2-naphthalenecarboxylic acid or maleic acid. If desired,
5 mixtures of the abovementioned acids may be used to prepare the salts 3.

According to the invention the salts of the betamimetics 3 selected from among the hydrochloride, hydrobromide, sulphate, phosphate, fumarate, methanesulphonate and xinafoate are preferred. Particularly preferred are the salts of 3 in the case of
10 salmeterol selected from hydrochloride, sulphate and xinafoate, of which the sulphates and xinafoates are especially preferred. According to the invention salmeterol x $\frac{1}{2}$ H₂SO₄ and salmeterol xinafoate are of exceptional importance.

Particularly preferred are the salts of 3 in the case of formoterol selected from the hydrochloride, sulphate and fumarate, of which the hydrochloride and fumarate are
15 particularly preferred. According to the invention formoterol fumarate is of exceptional importance.

If, within the scope of the present invention, there is a reference to betamimetics which are not in the salt form, this can be taken to mean a reference to compounds
20 3'. For example, the preferred betamimetics 3' according to the invention which are not in salt form are the free base of formoterol or salmeterol, whereas the particularly preferred compounds 3 according to the invention are, for example, salmeterol xinafoate, salmeterol x $\frac{1}{2}$ H₂SO₄ or formoterol fumarate.

25 Within the scope of the present invention the betamimetics 3 are optionally also referred to as sympathomimetics or beta-2-receptor agonists (β_2 -agonists). All these names can be regarded as equivalent within the scope of the present invention.

The pharmaceutical combinations of 1, 2 and 3 according to the invention are
30 preferably administered by inhalation. Suitable inhalable powders packed into suitable capsules (inhalettes) may be administered using suitable powder inhalers. Alternatively, the drug may be inhaled by the application of suitable inhalation aerosols. These also include inhalation aerosols which contain HFA134a, HFA227 or a mixture thereof as propellant gas, for example. The drug may also be inhaled
35 using suitable solutions of the pharmaceutical combination consisting of 1, 2 and 3.

In one aspect, therefore, the invention relates to a pharmaceutical composition which contains a combination of 1, 2 and 3.

In another aspect the present invention relates to a pharmaceutical composition which contains one or more salts 1, one or more compounds 2 and one or more compounds 3, optionally in the form of their solvates or hydrates. The active substances may be combined in a single preparation or contained in two or three separate formulations. Pharmaceutical compositions which contain the active substances 1, 2 and 3 in a single preparation are preferred according to the invention.

In another aspect the present invention relates to a pharmaceutical composition which contains, in addition to therapeutically effective quantities of 1, 2 and 3, a pharmaceutically acceptable excipient. In another aspect the present invention relates to a pharmaceutical composition which does not contain any pharmaceutically acceptable excipient in addition to therapeutically effective quantities of 1, 2 and 3.

The present invention also relates to the use of 1, 2 and 3 for preparing a pharmaceutical composition containing therapeutically effective quantities of 1, 2 and 3 for treating inflammatory and/or obstructive diseases of the respiratory tract, particularly asthma and/or chronic obstructive pulmonary disease (COPD), by simultaneous or successive administration. In addition the pharmaceutical combinations according to the invention may be used to prepare a drug for treating cystic fibrosis or allergic alveolitis (farmer's lung), for example, by simultaneous or successive administration. The combinations of active substances according to the invention will not be used only if treatment with one of the pharmaceutically active ingredients is contraindicated.

The present invention also relates to the simultaneous or successive use of therapeutically effective doses of the combination of the above pharmaceutical compositions 1, 2 and 3 for treating inflammatory and/or obstructive diseases of the respiratory tract, particularly asthma or chronic obstructive pulmonary disease (COPD), provided that treatment with steroids or betamimetics is not contraindicated from a therapeutic point of view, by simultaneous or successive administration. The invention further relates to the simultaneous or successive use of therapeutically effective doses of the combination of the above pharmaceutical compositions 1, 2 and 3 for treating cystic fibrosis or allergic alveolitis (farmer's lung).

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In accordance with one aspect of the invention, there is provided a pharmaceutical composition comprising at least one tiotropium salt (1), ciclesonide (2), at least one betamimetic (3), optionally in the form of the enantiomers, mixtures of the enantiomers or in the form of the racemates thereof, 5 optionally in the form of the solvates or hydrates and optionally together with a pharmaceutically acceptable excipient.

In the active substance combinations of 1, 2 and 3 according to the invention, ingredients 1, 2 and 3 may be present in the form of their enantiomers, mixtures of enantiomers or in the form of racemates.

The proportions in which the active substances 1, 2 and 3 may be used in the active substance combinations according to the invention are variable. Active substances 1, 2 and 3 may possibly be present in the form of their solvates or hydrates. Depending on the choice of the compounds 1, 2 and 3, the weight ratios which may be used within the scope of the present invention vary on the basis of the different molecular weights of the various compounds and their different potencies. As a rule, the pharmaceutical combinations according to the invention may contain compounds 1 and 2 in ratios by weight ranging from 1:300 to 50:1, preferably from 1:250 to 40:1. At the same time the ratio of 1 to 3 may be 1:300 to 30:1, preferably from 1:230 to 20:1, more preferably from 1:150 to 10:1, more preferably from 1:50 to 5:1, most preferably from 1:35 to 2:1.

15

In the particularly preferred pharmaceutical combinations which contain tiotropium salt as compound 1 and a compound selected from among budesonide, fluticasone, mometasone and ciclesonide as steroid 2, the weight ratios of 1 to 2 are most preferably in a range in which tiotropium 1' and 2 are present in proportions of 1:150 to 30:1, more preferably from 1:50 to 20:1. In these particularly preferred pharmaceutical combinations, formoterol or salmeterol is preferably used as the betamimetic 3. In this particularly preferred pharmaceutical combinations the ratio of tiotropium 1' and 3' is particularly preferably in the range from 1:25 to 1:1, preferably in a range from 1:10 to 1:2, more preferably in the range from 1:5 to 1:2.5.

25

For example, without restricting the scope of the invention thereto, preferred combinations of 1, 2 and 3 according to the invention may contain tiotropium 1', budesonide or fluticasone 2 as well as salmeterol or formoterol 3' in the following proportions by weight: 1:25:20; 1:24:20; 1:23:20; 1:22:20; 1:21:20; 1:20:20; 1:19:20; 1:18:20; 1:17:20; 1:16:20; 1:15:20; 1:14:20; 1:13:20; 1:12:20; 1:11:20; 1:10:20; 1:9:20; 1:8:20; 1:7:20; 1:6:20; 1:5:20; 1:4:20; 1:3:20; 1:2:20; 1:1:20; 2:1:20; 3:1:20; 4:1:20; 5:1:20; 6:1:20; 7:1:20; 8:1:20; 9:1:20; 10:1:20; 1:25:15; 1:24:15; 1:23:15; 1:22:15; 1:21:15; 1:20:15; 1:19:15; 1:18:15; 1:17:15; 1:16:15; 1:15:15; 1:14:15; 1:13:15; 1:12:15; 1:11:15; 1:10:15; 1:9:15; 1:8:15; 1:7:15; 1:6:15; 1:5:15; 1:4:15; 1:3:15; 1:2:15; 1:1:15; 2:1:15; 3:1:15; 4:1:15; 5:1:15; 6:1:15; 7:1:15; 8:1:15; 9:1:15; 10:1:15; 1:25:10; 1:24:10; 1:23:10; 1:22:10; 1:21:10; 1:20:10; 1:19:10; 1:18:10;

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1:17:10; 1:16:10; 1:15:10; 1:14:10; 1:13:10; 1:12:10; 1:11:10; 1:10:10; 1:9:10; 1:8:10;
 1:7:10; 1:6:10; 1:5:10; 1:4:10; 1:3:10; 1:2:10; 1:1:10; 2:1:10; 3:1:10; 4:1:10; 5:1:10;
 6:1:10; 7:1:10; 8:1:10; 9:1:10; 10:1:10; 1:25:5; 1:24:5; 1:23:5; 1:22:5; 1:21:5; 1:20:5;
 1:19:5; 1:18:5; 1:17:5; 1:16:5; 1:15:5; 1:14:5; 1:13:5; 1:12:5; 1:11:5; 1:10:5; 1:9:5;
 5 1:8:5; 1:7:5; 1:6:5; 1:5:5; 1:4:5; 1:3:5; 1:2:5; 1:1:5; 2:1:5; 3:1:5; 4:1:5; 5:1:5; 6:1:5;
 7:1:5; 8:1:5; 9:1:5; 10:1:5; 1:25:1; 1:24:1; 1:23:1; 1:22:1; 1:21:1; 1:20:1; 1:19:1;
 1:18:1; 1:17:1; 1:16:1; 1:15:1; 1:14:1; 1:13:1; 1:12:1; 1:11:1; 1:10:1; 1:9:1; 1:8:1;
 1:7:1; 1:6:1; 1:5:1; 1:4:1; 1:3:1; 1:2:1; 1:1:1; 2:1:1; 3:1:1; 4:1:1; 5:1:1; 6:1:1; 7:1:1;
 8:1:1; 9:1:1; 10:1:1; 1:25:0.75; 1:24:0.75; 1:23:0.75; 1:22:0.75; 1:21:0.75; 1:20:0.75;
 10 1:19:0.75; 1:18:0.75; 1:17:0.75; 1:16:0.75; 1:15:0.75; 1:14:0.75; 1:13:0.75; 1:12:0.75;
 1:11:0.75; 1:10:0.75; 1:9:0.75; 1:8:0.75; 1:7:0.75; 1:6:0.75; 1:5:0.75; 1:4:0.75;
 1:3:0.75; 1:2:0.75; 1:1:0.75; 2:1:0.75; 3:1:0.75; 4:1:0.75; 5:1:0.75; 6:1:0.75; 7:1:0.75;
 8:1:0.75; 9:1:0.75; 10:1:0.75; 1:25:0.5; 1:24:0.5; 1:23:0.5; 1:22:0.5; 1:21:0.5;
 1:20:0.5; 1:19:0.5; 1:18:0.5; 1:17:0.5; 1:16:0.5; 1:15:0.5; 1:14:0.5; 1:13:0.5; 1:12:0.5;
 15 1:11:0.5; 1:10:0.5; 1:9:0.5; 1:8:0.5; 1:7:0.5; 1:6:0.5; 1:5:0.5; 1:4:0.5; 1:3:0.5; 1:2:0.5;
 1:1:0.5; 2:1:0.5; 3:1:0.5; 4:1:0.5; 5:1:0.5; 6:1:0.5; 7:1:0.5; 8:1:0.5; 9:1:0.5; 10:1:0.5.

The pharmaceutical compositions according to the invention containing the combinations of 1, 2 and 3 are normally administered so that 1, 2 and 3 are present
 20 together in doses of 1 to 10000µg, preferably from 10 to 2000µg, more preferably from 50 to 1000µg, even more preferably from 60 to 750µg, preferably according to the invention from 70 to 500µg, preferably from 100 to 350µg per single dose. For example, combinations of 1, 2 and 3 according to the invention contain a quantity of tiotropium 1', budesonide or fluticasone 2 and salmeterol or formoterol 3' such that
 25 the total dosage per single dose is about 140µg, 145µg, 150µg, 155µg, 160µg, 165µg, 170µg, 175µg, 180µg, 185µg, 190µg, 195µg, 200µg, 205µg, 210µg, 215µg, 220µg, 225µg, 230µg, 235µg, 240µg, 245µg, 250µg, 255µg, 260µg, 265µg, 270µg, 275µg, 280µg, 285µg, 290µg, 295µg, 300µg, 305µg, 310µg, 315µg, 320µg or the like. In these dosage ranges the active substances 1', 2 and 3' may be present in the
 30 weight ratios described above.

For example and without restricting the scope of the invention thereto, the combinations of 1, 2 and 3 according to the invention may contain an amount of tiotropium 1', budesonide or fluticasone 2 and salmeterol or formoterol 3' such that in
 35 each single dose 5µg of 1' and 25µg of 2 and 25µg of 3', 5µg of 1' and 50µg of 2 and 25µg of 3', 5µg of 1' and 100µg of 2 and 25µg of 3', 5µg of 1' and 125µg of 2 and 25µg of 3', 5µg of 1' and 200µg of 2 and 25µg of 3', 5µg of 1' and 250µg of 2 and 25µg of 3', 10µg of 1' and 25µg of 2 and 25µg of 3', 10µg of 1' and 50µg of 2 and 25µg of 3', 10µg of 1' and 100µg of 2 and 25µg of 3', 10µg of 1' and 125µg of 2 and

25µg of 3', 10µg of 1' and 200µg of 2 and 25µg of 3', 10µg of 1' and 250µg of 2 and
 25µg of 3', 18µg of 1' and 25µg of 2 and 25µg of 3', 18µg of 1' and 50µg of 2 and
 25µg of 3', 18µg of 1' and 100µg of 2 and 25µg of 3', 18µg of 1' and 125µg of 2 and
 25µg of 3', 18µg of 1' and 200µg of 2 and 25µg of 3', 18µg of 1' and 250µg of 2 and
 5 25µg of 3', 20µg of 1' and 25µg of 2 and 25µg of 3', 20µg of 1' and 50µg of 2 and
 25µg of 3', 20µg of 1' and 100µg of 2 and 25µg of 3', 20µg of 1' and 125µg of 2 and
 25µg of 3', 20µg of 1' and 200µg of 2 and 25µg of 3', 20µg of 1' and 250µg of 2 and
 25µg of 3', 36µg of 1' and 25µg of 2 and 25µg of 3', 36µg of 1' and 50µg of 2 and
 25µg of 3', 36µg of 1' and 100µg of 2 and 25µg of 3', 36µg of 1' and 125µg of 2 and
 10 25µg of 3', 36µg of 1' and 200µg of 2 and 25µg of 3', 36µg of 1' and 250µg of 2 and
 25µg of 3', 40µg of 1' and 25µg of 2 and 25µg of 3', 40µg of 1' and 50µg of 2 and
 25µg of 3', 40µg of 1' and 100µg of 2 and 25µg of 3', 40µg of 1' and 125µg of 2 and
 25µg of 3', 40µg of 1' and 200µg of 2 and 25µg of 3', 40µg of 1' and 250µg of 2 and
 25µg of 3', 5µg of 1' and 25µg of 2 and 50µg of 3', 5µg of 1' and 50µg of 2 and 50µg
 15 of 3', 5µg of 1' and 100µg of 2 and 50µg of 3', 5µg of 1' and 125µg of 2 and 50µg of
3', 5µg of 1' and 200µg of 2 and 50µg of 3', 5µg of 1' and 250µg of 2 and 50µg of 3',
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 20 18µg of 1' and 25µg of 2 and 50µg of 3', 18µg of 1' and 50µg of 2 and 50µg of 3',
 18µg of 1' and 100µg of 2 and 50µg of 3', 18µg of 1' and 125µg of 2 and 50µg of 3',
 18µg of 1' and 200µg of 2 and 50µg of 3', 18µg of 1' and 250µg of 2 and 50µg of 3',
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 25 20µg of 1' and 200µg of 2 and 50µg of 3', 20µg of 1' and 250µg of 2 and 50µg of 3',
 36µg of 1' and 25µg of 2 and 50µg of 3', 36µg of 1' and 50µg of 2 and 50µg of 3',
 36µg of 1' and 100µg of 2 and 50µg of 3', 36µg of 1' and 125µg of 2 and 50µg of 3',
 36µg of 1' and 200µg of 2 and 50µg of 3', 36µg of 1' and 250µg of 2 and 50µg of 3',
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 30 40µg of 1' and 100µg of 2 and 50µg of 3', 40µg of 1' and 125µg of 2 and 50µg of 3',
 40µg of 1' and 200µg of 2 and 50µg of 3', 40µg of 1' and 250µg of 2 and 50µg of 3',
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 of 1' and 200µg of 2 and 100µg of 3', 5µg of 1' and 250µg of 2 and 100µg of 3', 10µg
 35 of 1' and 25µg of 2 and 100µg of 3', 10µg of 1' and 50µg of 2 and 100µg of 3', 10µg
 of 1' and 100µg of 2 and 100µg of 3', 10µg of 1' and 125µg of 2 and 100µg of 3',
 10µg of 1' and 200µg of 2 and 100µg of 3', 10µg of 1' and 250µg of 2 and 100µg of
3', 18µg of 1' and 25µg of 2 and 100µg of 3', 18µg of 1' and 50µg of 2 and 100µg of
3', 18µg of 1' and 100µg of 2 and 100µg of 3', 18µg of 1' and 125µg of 2 and 100µg

of 3', 18µg of 1' and 200µg of 2 and 100µg of 3', 18µg of 1' and 250µg of 2 and 100µg of 3', 20µg of 1' and 25µg of 2 and 100µg of 3', 20µg of 1' and 50µg of 2 and 100µg of 3', 20µg of 1' and 100µg of 2 and 100µg of 3', 20µg of 1' and 125µg of 2 and 100µg of 3', 20µg of 1' and 200µg of 2 and 100µg of 3', 20µg of 1' and 250µg of 2 and 100µg of 3', 36µg of 1' and 25µg of 2 and 100µg of 3', 36µg of 1' and 50µg of 2 and 100µg of 3', 36µg of 1' and 100µg of 2 and 100µg of 3', 36µg of 1' and 125µg of 2 and 100µg of 3', 36µg of 1' and 200µg of 2 and 100µg of 3', 36µg of 1' and 250µg of 2 and 100µg of 3', 40µg of 1' and 25µg of 2 and 100µg of 3', 40µg of 1' and 50µg of 2 and 100µg of 3', 40µg of 1' and 100µg of 2 and 100µg of 3', 40µg of 1' and 125µg of 2 and 100µg of 3' are administered.

Particularly preferred pharmaceutical combinations according to the invention contain 5-30µg of tiotropium 1', 125-250 µg of budesonide or fluticasone 2 and 10 to 40µg of salmeterol or formoterol 3'.

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If the active substance combinations wherein 1 denotes tiotropium bromide and wherein 3 denotes salmeterol x ½H₂SO₄, for example, are used as one of the preferred combinations of 1, 2 and 3 according to the invention, the quantities of active substances 1', 2 and 3' administered per single dose as mentioned above by way of example correspond to the following quantities of 1, 2 and 3 administered per single dose:

20

6µg of 1 and 25µg of 2 and 27.9µg of 3, 6µg of 1 and 50µg of 2 and 27.9µg of 3, 6µg of 1 and 100µg of 2 and 27.9µg of 3, 6µg of 1 and 125µg of 2 and 27.9µg of 3, 6µg of 1 and 200µg of 2 and 27.9µg of 3, 6µg of 1 and 250µg of 2 and 27.9µg of 3, 12µg of 1 and 25µg of 2 and 27.9µg of 3, 12µg of 1 and 50µg of 2 and 27.9µg of 3, 12µg of 1 and 100µg of 2 and 27.9µg of 3, 12µg of 1 and 125µg of 2 and 27.9µg of 3, 12µg of 1 and 200µg of 2 and 27.9µg of 3, 12µg of 1 and 250µg of 2 and 27.9µg of 3, 21.7µg of 1 and 25µg of 2 and 27.9µg of 3, 21.7µg of 1 and 50µg of 2 and 27.9µg of 3, 21.7µg of 1 and 100µg of 2 and 27.9µg of 3, 21.7µg of 1 and 125µg of 2 and 27.9µg of 3, 21.7µg of 1 and 200µg of 2 and 27.9µg of 3, 21.7µg of 1 and 250µg of 2 and 27.9µg of 3, 24.1µg of 1 and 25µg of 2 and 27.9µg of 3, 24.1µg of 1 and 50µg of 2 and 27.9µg of 3, 24.1µg of 1 and 100µg of 2 and 27.9µg of 3, 24.1µg of 1 and 125µg of 2 and 27.9µg of 3, 24.1µg of 1 and 200µg of 2 and 27.9µg of 3, 24.1µg of 1 and 250µg of 2 and 27.9µg of 3, 43.3µg of 1 and 25µg of 2 and 27.9µg of 3, 43.3µg of 1 and 50µg of 2 and 27.9µg of 3, 43.3µg of 1 and 100µg of 2 and 27.9µg of 3, 43.3µg of 1 and 125µg of 2 and 27.9µg of 3, 43.3µg of 1 and 200µg of 2 and 27.9µg of 3, 43.3µg of 1 and 250µg of 2 and 27.9µg of 3, 48.1µg of 1 and 25µg of 2 and 27.9µg of 3, 48.1µg of 1 and 50µg of 2 and 27.9µg of 3, 48.1µg of 1 and 100µg of 2 and 27.9µg of 3, 48.1µg of 1 and 125µg of 2 and 27.9µg of 3, 48.1µg of 1 and 200µg of 2 and

35

27.9µg of 3, 48.1µg of 1 and 250µg of 2 and 27.9µg of 3, 6µg of 1 and 25µg of 2 and
55.9µg of 3, 6µg of 1 and 50µg of 2 and 55.9µg of 3, 6µg of 1 and 100µg of 2 and
55.9µg of 3, 6µg of 1 and 125µg of 2 and 55.9µg of 3, 6µg of 1 and 200µg of 2 and
55.9µg of 3, 6µg of 1 and 250µg of 2 and 55.9µg of 3, 12µg of 1 and 25µg of 2 and
5 55.9µg of 3, 12µg of 1 and 50µg of 2 and 55.9µg of 3, 12µg of 1 and 100µg of 2 and
55.9µg of 3, 12µg of 1 and 125µg of 2 and 55.9µg of 3, 12µg of 1 and 200µg of 2 and
55.9µg of 3, 12µg of 1 and 250µg of 2 and 55.9µg of 3, 21.7µg of 1 and 25µg of 2
and 55.9µg of 3, 21.7µg of 1 and 50µg of 2 and 55.9µg of 3, 21.7µg of 1 and 100µg
of 2 and 55.9µg of 3, 21.7µg of 1 and 125µg of 2 and 55.9µg of 3, 21.7µg of 1 and
10 200µg of 2 and 55.9µg of 3, 21.7µg of 1 and 250µg of 2 and 55.9µg of 3, 24.1µg of 1
and 25µg of 2 and 55.9µg of 3, 24.1µg of 1 and 50µg of 2 and 55.9µg of 3, 24.1µg of
1 and 100µg of 2 and 55.9µg of 3, 24.1µg of 1 and 125µg of 2 and 55.9µg of 3,
24.1µg of 1 and 200µg of 2 and 55.9µg of 3, 24.1µg of 1 and 250µg of 2 and 55.9µg
of 3, 43.3µg of 1 and 25µg of 2 and 55.9µg of 3, 43.3µg of 1 and 50µg of 2 and
15 55.9µg of 3, 43.3µg of 1 and 100µg of 2 and 55.9µg of 3, 43.3µg of 1 and 125µg of 2
and 55.9µg of 3, 43.3µg of 1 and 200µg of 2 and 55.9µg of 3, 43.3µg of 1 and 250µg
of 2 and 55.9µg of 3, 48.1µg of 1 and 25µg of 2 and 55.9µg of 3, 48.1µg of 1 and
50µg of 2 and 55.9µg of 3, 48.1µg of 1 and 100µg of 2 and 55.9µg of 3, 48.1µg of 1
and 125µg of 2 and 55.9µg of 3, 48.1µg of 1 and 200µg of 2 and 55.9µg of 3, 48.1µg
20 of 1 and 250µg of 2 and 55.9µg of 3, 6µg of 1 and 25µg of 2 and 111.8µg of 3, 6µg of
1 and 50µg of 2 and 111.8µg of 3, 6µg of 1 and 100µg of 2 and 111.8µg of 3, 6µg of
1 and 125µg of 2 and 111.8µg of 3, 6µg of 1 and 200µg of 2 and 111.8µg of 3, 6µg of
1 and 250µg of 2 and 111.8µg of 3, 12µg of 1 and 25µg of 2 and 111.8µg of 3, 12µg
of 1 and 50µg of 2 and 111.8µg of 3, 12µg of 1 and 100µg of 2 and 111.8µg of 3,
25 12µg of 1 and 125µg of 2 and 111.8µg of 3, 12µg of 1 and 200µg of 2 and 111.8µg of
3, 12µg of 1 and 250µg of 2 and 111.8µg of 3, 21.7µg of 1 and 25µg of 2 and
111.8µg of 3, 21.7µg of 1 and 50µg of 2 and 111.8µg of 3, 21.7µg of 1 and 100µg of
2 and 111.8µg of 3, 21.7µg of 1 and 125µg of 2 and 111.8µg of 3, 21.7µg of 1 and
200µg of 2 and 111.8µg of 3, 21.7µg of 1 and 250µg of 2 and 111.8µg of 3, 24.1µg of
30 1 and 25µg of 2 and 111.8µg of 3, 24.1µg of 1 and 50µg of 2 and 111.8µg of 3,
24.1µg of 1 and 100µg of 2 and 111.8µg of 3, 24.1µg of 1 and 125µg of 2 and
111.8µg of 3, 24.1µg of 1 and 200µg of 2 and 111.8µg of 3, 24.1µg of 1 and 250µg of
2 and 111.8µg of 3, 43.3µg of 1 and 25µg of 2 and 111.8µg of 3, 43.3µg of 1 and
50µg of 2 and 111.8µg of 3, 43.3µg of 1 and 100µg of 2 and 111.8µg of 3, 43.3µg of
35 1 and 125µg of 2 and 111.8µg of 3, 43.3µg of 1 and 200µg of 2 and 111.8µg of 3,
43.3µg of 1 and 250µg of 2 and 111.8µg of 3, 48.1µg of 1 and 25µg of 2 and 111.8µg
of 3, 48.1µg of 1 and 50µg of 2 and 111.8µg of 3, 48.1µg of 1 and 100µg of 2 and
111.8µg of 3, 48.1µg of 1 and 125µg of 2 and 111.8µg of 3, 48.1µg of 1 and 200µg of
2 and 111.8µg of 3, 48.1µg of 1 and 250µg of 2 and 111.8µg of 3.

If the active substance combinations wherein 1 denotes tiotropium bromide monohydrate and wherein 3 denotes formoterol fumarate, for example, are used as one of the preferred combinations of 1, 2 and 3 according to the invention, the quantities of active substances 1', 2 and 3' administered per single dose as mentioned above by way of example correspond to the following quantities of 1, 2 and 3 administered per single dose:

6.2µg of 1 and 25µg of 2 and 29.2µg of 3, 6.2µg of 1 and 50µg of 2 and 29.2µg of 3, 6.2µg of 1 and 100µg of 2 and 29.2µg of 3, 6.2µg of 1 and 125µg of 2 and 29.2µg of 3, 6.2µg of 1 and 200µg of 2 and 29.2µg of 3, 6.2µg of 1 and 250µg of 2 and 29.2µg of 3, 12.5µg of 1 and 25µg of 2 and 29.2µg of 3, 12.5µg of 1 and 50µg of 2 and 29.2µg of 3, 12.5µg of 1 and 100µg of 2 and 29.2µg of 3, 12.5µg of 1 and 125µg of 2 and 29.2µg of 3, 12.5µg of 1 and 200µg of 2 and 29.2µg of 3, 12.5µg of 1 and 250µg of 2 and 29.2µg of 3, 22.5µg of 1 and 25µg of 2 and 29.2µg of 3, 22.5µg of 1 and 50µg of 2 and 29.2µg of 3, 22.5µg of 1 and 100µg of 2 and 29.2µg of 3, 22.5µg of 1 and 125µg of 2 and 29.2µg of 3, 22.5µg of 1 and 200µg of 2 and 29.2µg of 3, 22.5µg of 1 and 250µg of 2 and 29.2µg of 3, 25µg of 1 and 25µg of 2 and 29.2µg of 3, 25µg of 1 and 50µg of 2 and 29.2µg of 3, 25µg of 1 and 100µg of 2 and 29.2µg of 3, 25µg of 1 and 125µg of 2 and 29.2µg of 3, 25µg of 1 and 200µg of 2 and 29.2µg of 3, 25µg of 1 and 250µg of 2 and 29.2µg of 3, 45µg of 1 and 25µg of 2 and 29.2µg of 3, 45µg of 1 and 50µg of 2 and 29.2µg of 3, 45µg of 1 and 100µg of 2 and 29.2µg of 3, 45µg of 1 and 125µg of 2 and 29.2µg of 3, 45µg of 1 and 200µg of 2 and 29.2µg of 3, 45µg of 1 and 250µg of 2 and 29.2µg of 3, 50µg of 1 and 25µg of 2 and 29.2µg of 3, 50µg of 1 and 50µg of 2 and 29.2µg of 3, 50µg of 1 and 100µg of 2 and 29.2µg of 3, 50µg of 1 and 125µg of 2 and 29.2µg of 3, 50µg of 1 and 200µg of 2 and 29.2µg of 3, 50µg of 1 and 250µg of 2 and 29.2µg of 3, 6.2µg of 1 and 25µg of 2 and 58.4µg of 3, 6.2µg of 1 and 50µg of 2 and 58.4µg of 3, 6.2µg of 1 and 100µg of 2 and 58.4µg of 3, 6.2µg of 1 and 125µg of 2 and 58.4µg of 3, 6.2µg of 1 and 200µg of 2 and 58.4µg of 3, 6.2µg of 1 and 250µg of 2 and 58.4µg of 3, 12.5µg of 1 and 25µg of 2 and 58.4µg of 3, 12.5µg of 1 and 50µg of 2 and 58.4µg of 3, 12.5µg of 1 and 100µg of 2 and 58.4µg of 3, 12.5µg of 1 and 125µg of 2 and 58.4µg of 3, 12.5µg of 1 and 200µg of 2 and 58.4µg of 3, 12.5µg of 1 and 250µg of 2 and 58.4µg of 3, 22.5µg of 1 and 25µg of 2 and 58.4µg of 3, 22.5µg of 1 and 50µg of 2 and 58.4µg of 3, 22.5µg of 1 and 100µg of 2 and 58.4µg of 3, 22.5µg of 1 and 125µg of 2 and 58.4µg of 3, 22.5µg of 1 and 200µg of 2 and 58.4µg of 3, 22.5µg of 1 and 250µg of 2 and 58.4µg of 3, 25µg of 1 and 25µg of 2 and 58.4µg of 3, 25µg of 1 and 50µg of 2 and 58.4µg of 3, 25µg of 1 and 100µg of 2 and 58.4µg of 3, 25µg of 1 and 125µg of 2 and 58.4µg of 3, 25µg of 1 and 200µg of 2 and 58.4µg of 3, 25µg of 1 and 250µg of 2 and 58.4µg of 3, 45µg of 1 and 25µg of 2 and 58.4µg of 3, 45µg of 1 and 50µg of 2 and 58.4µg of 3, 45µg of 1

and 100µg of 2 and 58.4µg of 3, 45µg of 1 and 125µg of 2 and 58.4µg of 3, 45µg of 1
and 200µg of 2 and 58.4µg of 3, 45µg of 1 and 250µg of 2 and 58.4µg of 3, 50µg of 1
and 25µg of 2 and 58.4µg of 3, 50µg of 1 and 50µg of 2 and 58.4µg of 3, 50µg of 1
and 100µg of 2 and 58.4µg of 3, 50µg of 1 and 125µg of 2 and 58.4µg of 3, 50µg of 1
and 200µg of 2 and 58.4µg of 3, 50µg of 1 and 250µg of 2 and 58.4µg of 3, 6.2µg of
5 1 and 25µg of 2 and 116.9µg of 3, 6.2µg of 1 and 50µg of 2 and 116.9µg of 3, 6.2µg
of 1 and 100µg of 2 and 116.9µg of 3, 6.2µg of 1 and 125µg of 2 and 116.9µg of 3,
6.2µg of 1 and 200µg of 2 and 116.9µg of 3, 6.2µg of 1 and 250µg of 2 and 116.9µg
of 3, 12.5µg of 1 and 25µg of 2 and 116.9µg of 3, 12.5µg of 1 and 50µg of 2 and
10 116.9µg of 3, 12.5µg of 1 and 100µg of 2 and 116.9µg of 3, 12.5µg of 1 and 125µg of
2 and 116.9µg of 3, 12.5µg of 1 and 200µg of 2 and 116.9µg of 3, 12.5µg of 1 and
250µg of 2 and 116.9µg of 3, 22.5µg of 1 and 25µg of 2 and 116.9µg of 3, 22.5µg of
1 and 50µg of 2 and 116.9µg of 3, 22.5µg of 1 and 100µg of 2 and 116.9µg of 3,
22.5µg of 1 and 125µg of 2 and 116.9µg of 3, 22.5µg of 1 and 200µg of 2 and
15 116.9µg of 3, 22.5µg of 1 and 250µg of 2 and 116.9µg of 3, 25µg of 1 and 25µg of 2
and 116.9µg of 3, 25µg of 1 and 50µg of 2 and 116.9µg of 3, 25µg of 1 and 100µg of
2 and 116.9µg of 3, 25µg of 1 and 125µg of 2 and 116.9µg of 3, 25µg of 1 and 200µg
of 2 and 116.9µg of 3, 25µg of 1 and 250µg of 2 and 116.9µg of 3, 45µg of 1 and
25µg of 2 and 116.9µg of 3, 45µg of 1 and 50µg of 2 and 116.9µg of 3, 45µg of 1 and
20 100µg of 2 and 116.9µg of 3, 45µg of 1 and 125µg of 2 and 116.9µg of 3, 45µg of 1
and 200µg of 2 and 116.9µg of 3, 45µg of 1 and 250µg of 2 and 116.9µg of 3, 50µg
of 1 and 25µg of 2 and 116.9µg of 3, 50µg of 1 and 50µg of 2 and 116.9µg of 3, 50µg
of 1 and 100µg of 2 and 116.9µg of 3, 50µg of 1 and 125µg of 2 and 116.9µg of 3,
50µg of 1 and 200µg of 2 and 116.9µg of 3, 50µg of 1 and 250µg of 2 and 116.9µg of
25 3.

The active substance combinations of 1 , 2 and 3 according to the invention are
preferably administered by inhalation. For this purpose, ingredients 1 , 2 and 3 have
to be made available in forms suitable for inhalation. Inhalable preparations include
30 inhalable powders, propellant-containing metering aerosols or propellant-free
inhalable solutions. Inhalable powders according to the invention containing the
combination of active substances 1 , 2 and 3 may consist of the active substances on
their own or of a mixture of the active substances with physiologically acceptable
excipients. Within the scope of the present invention the term carrier may optionally
35 be used instead of the term excipient. Within the scope of the present invention, the
term propellant-free inhalable solutions also includes concentrates or sterile inhalable
solutions ready for use. The preparations according to the invention may contain the
combination of active substances 1 , 2 and 3 either together in one formulation or in
two or three separate formulations. These formulations which may be used within

the scope of the present invention are described in more detail in the next part of the specification.

A) Inhalable powder containing the combinations of active substances 1 , 2 and 3 according to the invention:

5 The inhalable powders according to the invention may contain 1 , 2 and 3 either on their own or in admixture with suitable physiologically acceptable excipients.

If the active substances 1 , 2 and 3 are present in admixture with physiologically acceptable excipients, the following physiologically acceptable excipients may be used to prepare these inhalable powders according to the invention:

10 monosaccharides (e.g. glucose or arabinose), disaccharides (e.g. lactose, saccharose, maltose), oligo- and polysaccharides (e.g. dextran), polyalcohols (e.g. sorbitol, mannitol, xylitol), salts (e.g. sodium chloride, calcium carbonate) or mixtures of these excipients. Preferably, mono- or disaccharides are used, while the use of lactose or glucose is preferred, particularly, but not exclusively, in the form of their
15 hydrates. For the purposes of the invention, lactose is the particularly preferred excipient, while lactose monohydrate is most particularly preferred.

Within the scope of the inhalable powders according to the invention the excipients have a maximum average particle size of up to 250µm, preferably between 10 and 150µm, most preferably between 15 and 80µm. It may sometimes seem appropriate
20 to add finer excipient fractions with an average particle size of 1 to 9µm to the excipient mentioned above. These finer excipients are also selected from the group of possible excipients listed hereinbefore. Finally, in order to prepare the inhalable powders according to the invention, micronised active substance 1 , 2 and 3, preferably with an average particle size of 0.5 to 10µm, more preferably from 1 to
25 5µm, is added to the excipient mixture. Processes for producing the inhalable powders according to the invention by grinding and micronising and by finally mixing the ingredients together are known from the prior art. The inhalable powders according to the invention may be prepared and administered either in the form of a single powder mixture which contains both 1 and 2 and 3 or in the form of separate
30 inhalable powders which contain only 1 , 2 or 3.

The inhalable powders according to the invention may be administered using inhalers known from the prior art. Inhalable powders according to the invention which contain a physiologically acceptable excipient in addition to 1 , 2 and 3 may be administered, for example, by means of inhalers which deliver a single dose from a supply using a
35 measuring chamber as described in US 4570630A, or by other means as described

in DE 36 25 685 A. Preferably, the inhalable powders according to the invention which contain physiologically acceptable excipients in addition to 1, 2 and 3 are packed into capsules (to produce so-called inhalettes) which are used in inhalers as described, for example, in WO 94/28958.

- 5 A particularly preferred inhaler for using the pharmaceutical combination according to the invention in inhalettes is shown in Figure 1.

This inhaler (Handyhaler) for inhaling powdered pharmaceutical compositions from capsules is characterised by a housing 1 containing two windows 2, a deck 3 in which there are air inlet ports and which is provided with a screen 5 secured via a
10 screen housing 4, an inhalation chamber 6 connected to the deck 3 on which there is a push button 9 provided with two sharpened pins 7 and movable counter to a spring 8, and a mouthpiece 12 which is connected to the housing 1, the deck 3 and a cover 11 via a spindle 10 to enable it to be flipped open or shut.

If the inhalable powders according to the invention are packed into capsules
15 (inhalers) for the preferred use described above, the quantities packed into each capsule should be 1 to 30mg, preferably 3 to 20mg, more particularly 5 to 10mg of inhalable powder per capsule. These capsules contain, according to the invention, either together or separately, the doses of 1, 2 and 3 mentioned hereinbefore for each single dose.

20 **B) Propellant gas-driven inhalation aerosols containing the combinations of active substances 1, 2 and 3:**

Inhalation aerosols containing propellant gas according to the invention may contain substances 1, 2 and 3 dissolved in the propellant gas or in dispersed form. 1, 2 and 3 may be present in separate formulations or in a single preparation, in which 1, 2
25 and 3 are either each dissolved, dispersed or only one or two of the components is or are dissolved and the other or others is or are dispersed. The propellant gases which may be used to prepare the inhalation aerosols according to the invention are known from the prior art. Suitable propellant gases are selected from among hydrocarbons such as n-propane, n-butane or isobutane and halohydrocarbons such as fluorinated
30 derivatives of methane, ethane, propane, butane, cyclopropane or cyclobutane. The propellant gases mentioned above may be used on their own or in mixtures thereof. Particularly preferred propellant gases are halogenated alkane derivatives selected from TG134a, TG227 and mixtures thereof.

The propellant-driven inhalation aerosols according to the invention may also contain other ingredients such as co-solvents, stabilisers, surfactants, antioxidants, lubricants and pH adjusters. All these ingredients are known in the art.

5 The inhalation aerosols containing propellant gas according to the invention may contain up to 5 wt.-% of active substance 1 , 2 and/or 3. Aerosols according to the invention contain, for example, 0.002 to 5 wt.-%, 0.01 to 3 wt.-%, 0.015 to 2 wt.-%, 0.1 to 2 wt.-%, 0.5 to 2 wt.-% or 0.5 to 1 wt.-% of active substance 1 , 2 and/or 3.

10 If the active substances 1 , 2 and/or 3 are present in dispersed form, the particles of active substance preferably have an average particle size of up to 10 μ m, preferably from 0.1 to 5 μ m, more preferably from 1 to 5 μ m.

The propellant-driven inhalation aerosols according to the invention mentioned above may be administered using inhalers known in the art (MDIs = metered dose inhalers). Accordingly, in another aspect, the present invention relates to pharmaceutical compositions in the form of propellant-driven aerosols as hereinbefore described
15 combined with one or more inhalers suitable for administering these aerosols. In addition, the present invention relates to inhalers which are characterised in that they contain the propellant gas-containing aerosols described above according to the invention. The present invention also relates to cartridges which are fitted with a suitable valve and can be used in a suitable inhaler and which contain one of the
20 above-mentioned propellant gas-containing inhalation aerosols according to the invention. Suitable cartridges and methods of filling these cartridges with the inhalable aerosols containing propellant gas according to the invention are known from the prior art.

C) Propellant-free inhalable solutions or suspensions containing the combinations of active substances 1 , 2 and 3 according to the invention:

25 It is particularly preferred to use the active substance combination according to the invention in the form of propellant-free inhalable solutions and suspensions. The solvent used may be an aqueous or alcoholic, preferably an ethanolic solution. The solvent may be water on its own or a mixture of water and ethanol. The relative
30 proportion of ethanol compared with water is not limited but the maximum is up to 70 percent by volume, more particularly up to 60 percent by volume and most preferably up to 30 percent by volume. The remainder of the volume is made up of water. The solutions or suspensions containing 1 , 2 and 3, separately or together, are adjusted to a pH of 2 to 7, preferably 2 to 5, using suitable acids. The pH may be adjusted
35 using acids selected from inorganic or organic acids. Examples of suitable inorganic

acids include hydrochloric acid, hydrobromic acid, nitric acid, sulphuric acid and/or phosphoric acid. Examples of particularly suitable organic acids include ascorbic acid, citric acid, malic acid, tartaric acid, maleic acid, succinic acid, fumaric acid, acetic acid, formic acid and/or propionic acid etc. Preferred inorganic acids are hydrochloric and sulphuric acids. It is also possible to use the acids which have already formed an acid addition salt with one of the active substances. Of the organic acids, ascorbic acid, fumaric acid and citric acid are preferred. If desired, mixtures of the above acids may be used, particularly in the case of acids which have other properties in addition to their acidifying qualities, e.g. as flavourings, antioxidants or complexing agents, such as citric acid or ascorbic acid, for example. According to the invention, it is particularly preferred to use hydrochloric acid to adjust the pH.

According to the invention, the addition of editic acid (EDTA) or one of the known salts thereof, sodium edetate, as stabiliser or complexing agent is unnecessary in the present formulation. Other embodiments may contain this compound or these compounds. In a preferred embodiment the content based on sodium edetate is less than 100 mg/100ml, preferably less than 50mg/100ml, more preferably less than 20mg/100ml. Generally, inhalable solutions in which the content of sodium edetate is from 0 to 10mg/100ml are preferred.

Co-solvents and/or other excipients may be added to the propellant-free inhalable solutions according to the invention. Preferred co-solvents are those which contain hydroxyl groups or other polar groups, e.g. alcohols - particularly isopropyl alcohol, glycols - particularly propyleneglycol, polyethyleneglycol, polypropyleneglycol, glycolether, glycerol, polyoxyethylene alcohols and polyoxyethylene fatty acid esters. The terms excipients and additives in this context denote any pharmacologically acceptable substance which is not an active substance but which can be formulated with the active substance or substances in the physiologically suitable solvent in order to improve the qualitative properties of the active substance formulation. Preferably, these substances have no pharmacological effect or, in connection with the desired therapy, no appreciable or at least no undesirable pharmacological effect. The excipients and additives include, for example, surfactants such as soya lecithin, oleic acid, sorbitan esters, such as polysorbates, polyvinylpyrrolidone, other stabilisers, complexing agents, antioxidants and/or preservatives which guarantee or prolong the shelf life of the finished pharmaceutical formulation, flavourings, vitamins and/or other additives known in the art. The additives also include physiologically acceptable salts such as sodium chloride as isotonic agents.

The preferred excipients include antioxidants such as ascorbic acid, for example, provided that it has not already been used to adjust the pH, vitamin A, vitamin E, tocopherols and similar vitamins and provitamins occurring in the human body.

5 Preservatives may be used to protect the formulation from contamination with pathogens. Suitable preservatives are those which are known in the art, particularly cetyl pyridinium chloride, benzalkonium chloride or benzoic acid or benzoates such as sodium benzoate in the concentration known from the prior art. The preservatives mentioned above are preferably present in concentrations of up to 50mg/100ml, more preferably between 5 and 20mg/100ml.

10 Preferred formulations contain, in addition to the solvent water and the combination of active substances 1, 2 and 3, only benzalkonium chloride and sodium edetate. In another preferred embodiment, no sodium edetate is present.

The propellant-free inhalable solutions according to the invention are administered in particular using inhalers of the kind which are capable of nebulising a small amount
15 of a liquid formulation in the required therapeutic dose within a few seconds to produce an aerosol suitable for therapeutic inhalation. Within the scope of the present invention, preferred nebulisers are those in which a quantity of less than 100µL, preferably less than 50µL, more preferably between 20 and 30µL of active substance solution can be nebulised in preferably one spray action to form an
20 aerosol with an average particle size of less than 20µm, preferably less than 10µm, in such a way that the inhalable part of the aerosol corresponds to the therapeutically effective quantity.

An apparatus of this kind for propellant-free delivery of a metered quantity of a liquid pharmaceutical composition for inhalation is described for example in International
25 Patent Application WO 91/14468 and also in WO 97/12687 (cf. in particular Figures 6a and 6b). The nebulisers (devices) described therein are known by the name Respimat®.

This nebuliser (Respimat®) can advantageously be used to produce the inhalable aerosols according to the invention containing the combination of active substances
30 1, 2 and 3. Because of its cylindrical shape and handy size of less than 9 to 15 cm long and 2 to 4 cm wide, this device can be carried at all times by the patient. The nebuliser sprays a defined volume of pharmaceutical formulation using high pressures through small nozzles so as to produce inhalable aerosols.

The preferred atomiser essentially consists of an upper housing part, a pump housing, a nozzle, a locking mechanism, a spring housing, a spring and a storage container, characterised by

- a pump housing which is secured in the upper housing part and which
5 comprises at one end a nozzle body with the nozzle or nozzle arrangement,
- a hollow plunger with valve body,
- a power takeoff flange in which the hollow plunger is secured and which is located in the upper housing part,
- a locking mechanism situated in the upper housing part,
- 10 - a spring housing with the spring contained therein, which is rotatably mounted on the upper housing part by means of a rotary bearing,
- a lower housing part which is fitted onto the spring housing in the axial direction.

15 The hollow plunger with valve body corresponds to a device disclosed in WO 97/12687. It projects partially into the cylinder of the pump housing and is axially movable within the cylinder. Reference is made in particular to Figures 1 to 4, especially Figure 3, and the relevant parts of the description. The hollow plunger with valve body exerts a pressure of 5 to 60 Mpa (about 50 to 600 bar), preferably 10 to
20 60 Mpa (about 100 to 600 bar) on the fluid, the measured amount of active substance solution, at its high pressure end at the moment when the spring is actuated. Volumes of 10 to 50 microlitres are preferred, while volumes of 10 to 20 microlitres are particularly preferred and a volume of 15 microlitres per spray is most particularly preferred.

25

The valve body is preferably mounted at the end of the hollow plunger facing the valve body.

The nozzle in the nozzle body is preferably microstructured, i.e. produced by
30 microtechnology. Microstructured valve bodies are disclosed for example in WO-94/07607; reference is hereby made to the contents of this specification, particularly Figure 1 therein and the associated description.

The nozzle body consists for example of two sheets of glass and/or silicon firmly joined together, at least one of which has one or more microstructured channels
35 which connect the nozzle inlet end to the nozzle outlet end. At the nozzle outlet end there is at least one round or non-round opening 2 to 10 microns deep and 5 to 15 microns wide, the depth preferably being 4.5 to 6.5 microns while the length is preferably 7 to 9 microns.

In the case of a plurality of nozzle openings, preferably two, the directions of spraying of the nozzles in the nozzle body may extend parallel to one another or may be inclined relative to one another in the direction of the nozzle opening. In a nozzle body with at least two nozzle openings at the outlet end the directions of spraying
5 may be at an angle of 20 to 160° to one another, preferably 60 to 150°, most preferably 80 to 100°. The nozzle openings are preferably arranged at a spacing of 10 to 200 microns, more preferably at a spacing of 10 to 100 microns, most preferably 30 to 70 microns. Spacings of 50 microns are most preferred. The directions of spraying will therefore meet in the vicinity of the nozzle openings.

10

The liquid pharmaceutical preparation strikes the nozzle body with an entry pressure of up to 600 bar, preferably 200 to 300 bar, and is atomised into an inhalable aerosol through the nozzle openings. The preferred particle or droplet sizes of the aerosol are up to 20 microns, preferably 3 to 10 microns.

15 The locking mechanism contains a spring, preferably a cylindrical helical compression spring, as a store for the mechanical energy. The spring acts on the power takeoff flange as an actuating member the movement of which is determined by the position of a locking member. The travel of the power takeoff flange is precisely limited by an upper and lower stop. The spring is preferably biased, via a
20 power step-up gear, e.g. a helical thrust gear, by an external torque which is produced when the upper housing part is rotated counter to the spring housing in the lower housing part. In this case, the upper housing part and the power takeoff flange have a single or multiple V-shaped gear.

The locking member with engaging locking surfaces is arranged in a ring around the
25 power takeoff flange. It consists, for example, of a ring of plastic or metal which is inherently radially elastically deformable. The ring is arranged in a plane at right angles to the atomiser axis. After the biasing of the spring, the locking surfaces of the locking member move into the path of the power takeoff flange and prevent the spring from relaxing. The locking member is actuated by means of a button. The
30 actuating button is connected or coupled to the locking member. In order to actuate the locking mechanism, the actuating button is moved parallel to the annular plane, preferably into the atomiser; this causes the deformable ring to deform in the annular plane. Details of the construction of the locking mechanism are given in WO 97/20590.

The lower housing part is pushed axially over the spring housing and covers the mounting, the drive of the spindle and the storage container for the fluid.

When the atomiser is actuated the upper housing part is rotated relative to the lower housing part, the lower housing part taking the spring housing with it. The spring is
5 thereby compressed and biased by means of the helical thrust gear and the locking mechanism engages automatically. The angle of rotation is preferably a whole-number fraction of 360 degrees, e.g. 180 degrees. At the same time as the spring is biased, the power takeoff part in the upper housing part is moved along by a given distance, the hollow plunger is withdrawn inside the cylinder in the pump housing, as
10 a result of which some of the fluid is sucked out of the storage container and into the high pressure chamber in front of the nozzle.

If desired, a number of exchangeable storage containers which contain the fluid to be atomised may be pushed into the atomiser one after another and used in succession. The storage container contains the aqueous aerosol preparation according to the
15 invention.

The atomising process is initiated by pressing gently on the actuating button. As a result, the locking mechanism opens up the path for the power takeoff member. The biased spring pushes the plunger into the cylinder of the pump housing. The fluid leaves the nozzle of the atomiser in atomised form.

20 Further details of construction are disclosed in PCT Applications WO 97/12683 and WO 97/20590, to which reference is hereby made.

The components of the atomiser (nebuliser) are made of a material which is suitable for its purpose. The housing of the atomiser and, if its operation permits, other parts as well, are preferably made of plastics, e.g. by injection moulding. For medicinal
25 purposes, physiologically safe materials are used.

Figures 2a/b attached to this patent application, which are identical to Figures 6a/b of WO 97/12687, show the nebuliser (Respimat®) which can advantageously be used for inhaling the aqueous aerosol preparations according to the invention.

Figure 2a shows a longitudinal section through the atomiser with the spring biased
30 while Figure 2b shows a longitudinal section through the atomiser with the spring relaxed.

The upper housing part (51) contains the pump housing (52) on the end of which is mounted the holder (53) for the atomiser nozzle. In the holder is the nozzle body (54) and a filter (55). The hollow plunger (57) fixed in the power takeoff flange (56) of the locking mechanism projects partially into the cylinder of the pump housing. At its end
5 the hollow plunger carries the valve body (58). The hollow plunger is sealed off by means of the seal (59). Inside the upper housing part is the stop (60) on which the power takeoff flange abuts when the spring is relaxed. On the power takeoff flange is the stop (61) on which the power takeoff flange abuts when the spring is biased. After the biasing of the spring the locking member (62) moves between the stop (61)
10 and a support (63) in the upper housing part. The actuating button (64) is connected to the locking member. The upper housing part ends in the mouthpiece (65) and is sealed off by means of the protective cover (66) which can be placed thereon.

The spring housing (67) with compression spring (68) is rotatably mounted on the upper housing part by means of the snap-in lugs (69) and rotary bearing. The lower
15 housing part (70) is pushed over the spring housing. Inside the spring housing is the exchangeable storage container (71) for the fluid (72) which is to be atomised. The storage container is sealed off by the stopper (73) through which the hollow plunger projects into the storage container and is immersed at its end in the fluid (supply of active substance solution).

20 The spindle (74) for the mechanical counter is mounted in the covering of the spring housing. At the end of the spindle facing the upper housing part is the drive pinion (75). The slider (76) sits on the spindle.

The nebuliser described above is suitable for nebulising the aerosol preparations according to the invention to produce an aerosol suitable for inhalation.

25 If the formulation according to the invention is nebulised using the method described above (Respimat®) the quantity delivered should correspond to a defined quantity with a tolerance of not more than 25%, preferably 20% of this amount in at least 97%, preferably at least 98% of all operations of the inhaler (spray actuations). Preferably, between 5 and 30 mg of formulation, most preferably between 5 and 20 mg of
30 formulation are delivered as a defined mass on each actuation.

However, the formulation according to the invention may also be nebulised by means of inhalers other than those described above, e.g. jet stream inhalers.

Accordingly, in a further aspect, the invention relates to pharmaceutical formulations in the form of propellant-free inhalable solutions or suspensions as described above combined with a device suitable for administering these formulations, preferably in conjunction with the Respimat®. Preferably, the invention relates to propellant-free inhalable solutions or suspensions characterised by the combination of active substances 1, 2 and 3 according to the invention in conjunction with the device known by the name Respimat®. In addition, the present invention relates to the above-mentioned devices for inhalation, preferably the Respimat®, characterised in that they contain the propellant-free inhalable solutions or suspensions according to the invention as described hereinbefore.

The propellant-free inhalable solutions or suspensions according to the invention may take the form of concentrates or sterile inhalable solutions or suspensions ready for use, as well as the above-mentioned solutions and suspensions designed for use in a Respimat®. Formulations ready for use may be produced from the concentrates, for example, by the addition of isotonic saline solutions. Sterile formulations ready for use may be administered using energy-operated fixed or portable nebulisers which produce inhalable aerosols by means of ultrasound or compressed air by the Venturi principle or other principles.

Accordingly, in another aspect, the present invention relates to pharmaceutical compositions in the form of propellant-free inhalable solutions or suspensions as described hereinbefore which take the form of concentrates or sterile formulations ready for use, combined with a device suitable for administering these solutions, characterised in that the device is an energy-operated free-standing or portable nebuliser which produces inhalable aerosols by means of ultrasound or compressed air by the Venturi principle or other methods.

The Examples which follow serve to illustrate the present invention in more detail without restricting the scope of the invention to the following embodiments by way of example.

Starting materials

30 Tiotropium bromide:

The tiotropium bromide used in the following formulation examples may be obtained as described in European Patent Application 418 716 A1.

In order to prepare the inhalable powders according to the invention, crystalline tiotropium bromide monohydrate may also be used. This crystalline tiotropium bromide monohydrate may be obtained by the method described below.

15.0 kg of tiotropium bromide are placed in 25.7 kg of water in a suitable reaction
5 vessel. The mixture is heated to 80-90°C and stirred at constant temperature until a
clear solution is formed. Activated charcoal (0.8 kg) moistened with water is
suspended in 4.4 kg of water, this mixture is added to the solution containing the
tiotropium bromide and the resulting mixture is rinsed with 4.3 kg of water. The
10 mixture thus obtained is stirred for at least 15 minutes at 80-90°C and then filtered
through a heated filter into an apparatus preheated to an external temperature of
70°C. The filter is rinsed with 8.6 kg of water. The contents of the apparatus are
cooled at 3-5°C for every 20 minutes to a temperature of 20-25°C. The apparatus is
cooled further to 10-15°C using cold water and crystallisation is completed by stirring
15 for at least another hour. The crystals are isolated using a suction filter dryer, the
crystal slurry isolated is washed with 9 litres of cold water (10-15°C) and cold
acetone (10-15°C). The crystals obtained are dried at 25°C in a nitrogen current over
a period of 2 hours.

Yield: 13.4 kg of tiotropium bromide monohydrate (86% of theory).

The crystalline tiotropium bromide monohydrate thus obtained is micronised by
20 known methods in order to prepare the active substance in the form of the average
particle size corresponding to the specifications according to the invention.

Examples of Formulations**A) Inhalable powders:**

1)

Ingredients	µg per capsule
tiotropium bromide monohydrate	22.5
budesonide	200
salmeterol x ½ H ₂ SO ₄	55.9
lactose	4721.6
Total	5000

5

2)

Ingredients	µg per capsule
tiotropium bromide monohydrate	22.5
fluticasone propionate	125
salmeterol xinafoate	50
lactose	4802.5
Total	5000

3)

Ingredients	µg per capsule
tiotropium bromide monohydrate	22.5
mometasone furoate	250
formoterol fumarate dihydrate	12
lactose	4715.5
Total	5000

10

4)

Ingredients	µg per capsule
tiotropium bromide monohydrate	22.5
fluticasone propionate	250
formoterol fumarate dihydrate	12
lactose	4715.5
Total	5000

5)

Ingredients	µg per capsule
ipratropium bromide	200
formoterol fumarate dihydrate	12
fluticasone propionate	250
lactose	24538
Total	25000

B) Inhalable aerosols containing propellant gas:

5

1) Suspension aerosol:

Ingredients	Wt-%
tiotropium bromide	0.029
budesonide	0.4
salmeterol x ½ H ₂ SO ₄	0.066
soya lecithin	0.2
TG 134a : TG227 = 2:3	ad 100

2) Suspension aerosol:

Ingredients	Wt-%
tiotropium bromide	0.029
fluticasone propionate	0.3
salmeterol xinafoate	0.033
isopropyl myristate	0.1
TG 227	ad 100

10 3) Suspension aerosol:

Ingredients	Wt-%
tiotropium bromide	0.029
mometasone furoate	0.6
salmeterol x ½ H ₂ SO ₄	0.066
isopropyl myristate	0.1
TG 227	ad 100

4) Suspension aerosol:

Ingredients	Wt-%
ipratropium bromide	0.020
fluticasone propionate	0.3
salmeterol x ½ H ₂ SO ₄	0.066
soya lecithin	0.2
TG 11 : TG12 = 2:3	ad 100

5) Suspension aerosol:

Ingredients	Wt-%
ipratropium bromide	0.039
salmeterol xinafoate	0.033
budesonide	0.4
absolute ethanol	0.5
isopropyl myristate	0.1
TG 227	ad 100

5 3) Solution aerosol:

Ingredients	Wt-%
ipratropium bromide	0.117
budesonide	0.4
salmeterol x ½ H ₂ SO ₄	0.047
absolute ethanol	30
purified water	1.5
anhydrous citric acid	0.002
TG 134a	ad 100

CLAIMS:

1. A pharmaceutical composition comprising at least one tiotropium salt (1), ciclesonide (2), at least one betamimetic (3), optionally in the form of the enantiomers, mixtures of the enantiomers or in the form of the racemates thereof, optionally in the form of the solvates or hydrates and optionally together with a pharmaceutically acceptable excipient.
2. The pharmaceutical composition according to claim 1, wherein (1), (2) and (3) are present either together in a single formulation or in two separate formulations.
3. The pharmaceutical composition according to claim 1 or 2, wherein (1) is present in the form of a chloride, bromide, iodide, methanesulphonate, paratoluene sulphonate or methyl sulphate salt.
4. The pharmaceutical composition according to claim 3, wherein (1) is in the form of a bromide salt.
5. The pharmaceutical composition according to any one of claims 1 to 4, wherein (3) is bambuterol, bitolterol, carbuterol, clenbuterol, fenoterol, formoterol, hexoprenaline, ibuterol, pirbuterol, procaterol, reproterol, salmeterol, sulphonterol, terbutaline, tolubuterol, 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 or 1-(4-ethoxycarbonylamino-3-cyano-5-fluorophenyl)-2-(tert-butylamino)ethanol,

or an enantiomer, mixture of enantiomers, racemic mixture, or solvate or hydrate thereof.

5 6. The pharmaceutical composition according to claim 5, wherein (3) is formoterol, salmeterol,

4-hydroxy-7-[2-[[2-[[3-(2-phenylethoxy)propyl]sulphonyl]ethyl]-amino]ethyl]-2(3H)-benzothiazolone,

10 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,

15 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 or

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,

20 or an enantiomer, mixture of enantiomers, racemic mixture, or solvate or hydrate thereof.

7. The pharmaceutical composition according to any one of claims 1 to 6, wherein the weight ratio of (1) to (2) is in the range of 1:300 to 50:1.

25 8. The pharmaceutical composition according to any one of claims 1 to 6, wherein the weight ratio of (1) to (2) is in the range of 1:250 to 40:1.

9. The pharmaceutical composition according to any one of claims 1 to 6, wherein the weight ratio of (1) to (3) is in the range of 1:300 to 30:1.
10. The pharmaceutical composition according to any one of claims 1 to 6, wherein the weight ratio of (1) to (3) is in the range of 1:230 to 20:1.
- 5 11. The pharmaceutical composition according to any one of claims 1 to 6, wherein the weight ratio of (1) to (3) is in the range of 1:150 to 10:1.
12. The pharmaceutical composition according to any one of claims 1 to 11, which is an inhalable powder, propellant-containing metering aerosol, propellant-free inhalable solution or suspension.
- 10 13. The pharmaceutical composition according to claim 12, which is an inhalable powder which contains (1), (2) and (3) in admixture with a suitable physiologically acceptable excipient which is a monosaccharide, disaccharide, oligo- or polysaccharide, polyalcohol, or salt, or a mixture of these excipients.
14. The pharmaceutical composition according to claim 13, wherein the
15 excipient has a maximum average particle size of up to 250 µm.
15. The pharmaceutical composition according to claim 13 or 14, wherein the excipient has a maximum average particle size of between 10 and 150 µm.
16. The pharmaceutical composition according to claim 12, which is an
20 inhalable powder which contains only (1), (2) and (3).
17. The pharmaceutical composition according to claim 12, which is a propellant-containing inhalable aerosol which contains (1), (2) and (3) in dissolved or dispersed form.
18. The pharmaceutical composition according to claim 17, comprising a
25 hydrocarbon as propellant gas.
19. The pharmaceutical composition according to claim 18, wherein the hydrocarbon is propane, n-butane, isobutane or a haloalkane.

20. The pharmaceutical composition according to claim 19, wherein the halohydrocarbon is a chlorinated or fluorinated derivative of methane, ethane, propane, butane, cyclopropane or cyclobutane.

21. The pharmaceutical composition according to claim 18, wherein the
5 halohydrocarbon is TG134a, TG227 or a mixture thereof.

22. The pharmaceutical composition according to claim 12, which is a propellant-free inhalable solution or suspension which contains water, ethanol or a mixture of water and ethanol as solvent.

23. The pharmaceutical composition according to any one of claims 1
10 to 22 for use in the treatment of an inflammatory or obstructive disease of the respiratory tract.

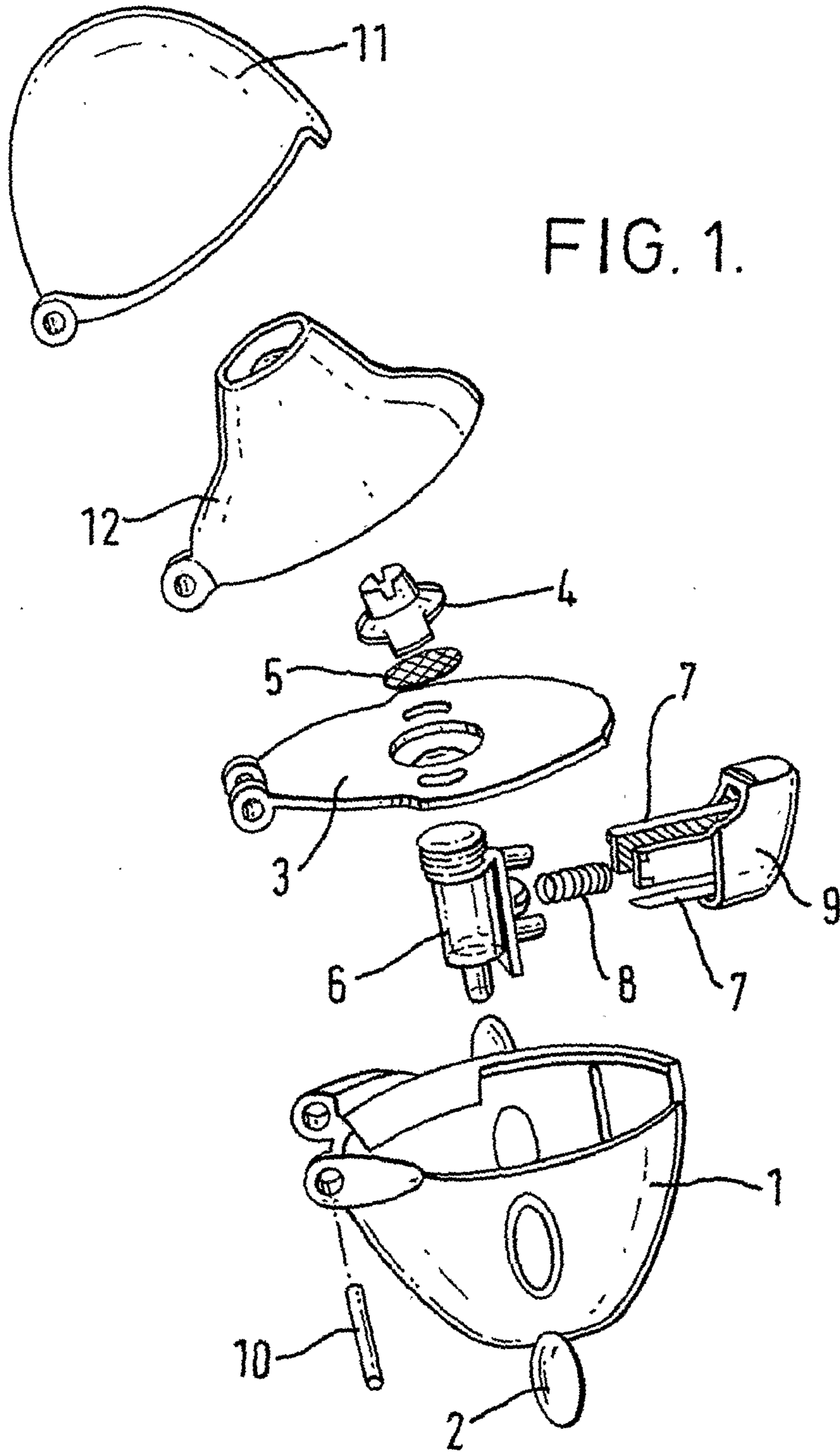
24. Use of the composition as defined in any one of claims 1 to 23 in the preparation of a medicament for the treatment of an inflammatory or obstructive disease of the respiratory tract.

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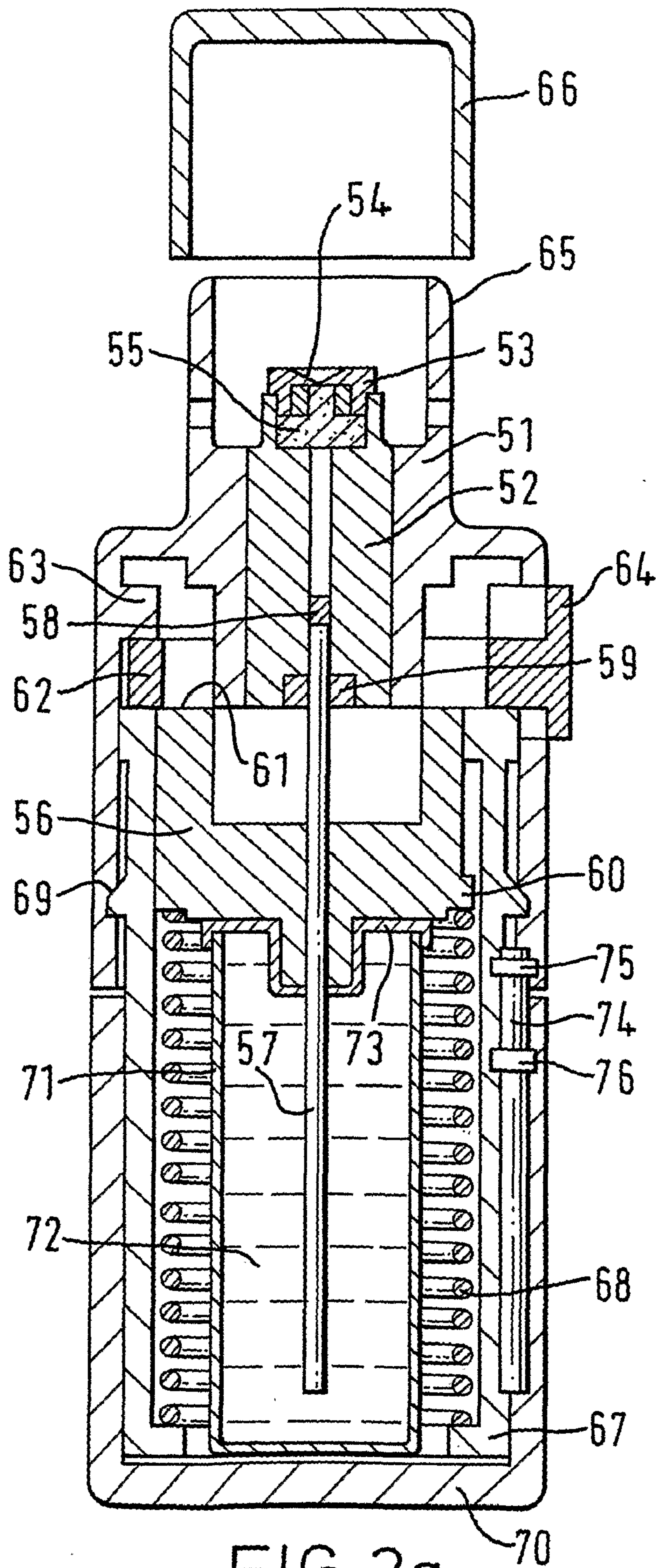
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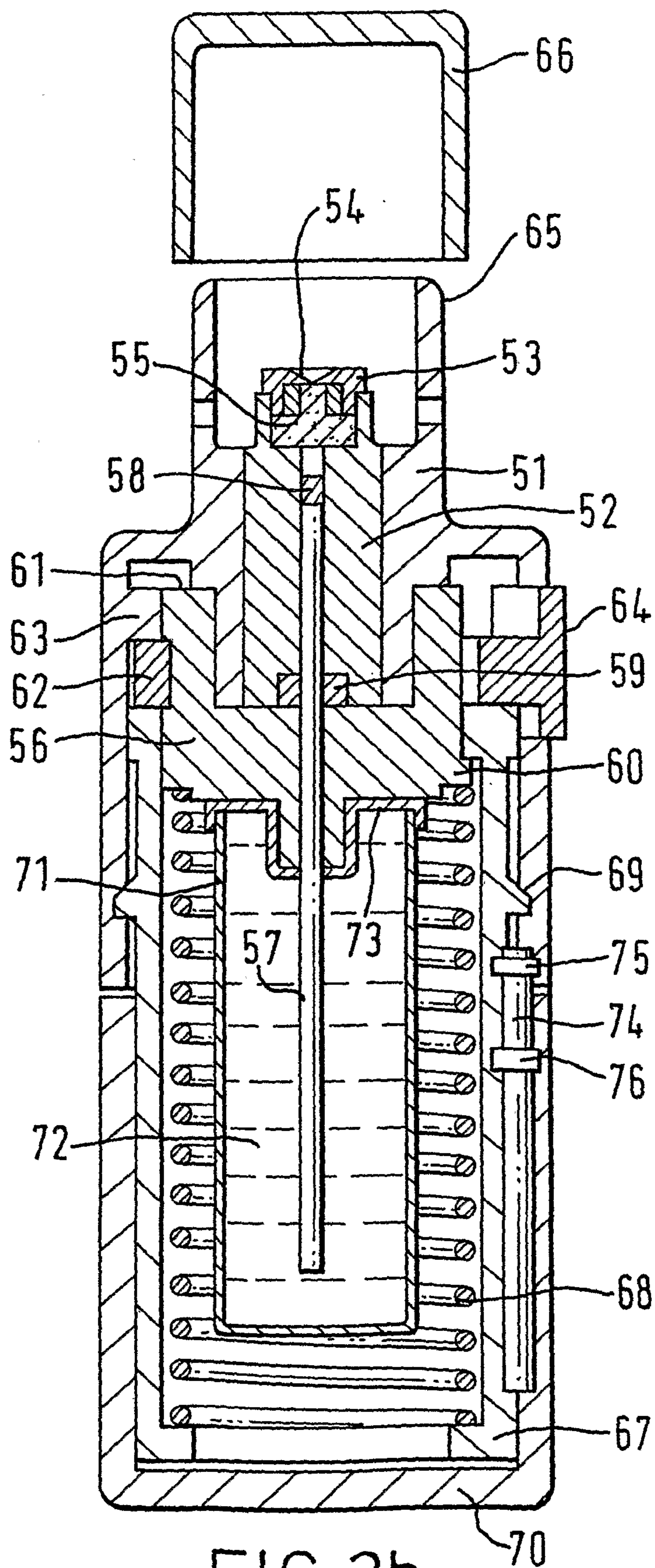


FIG. 2b.