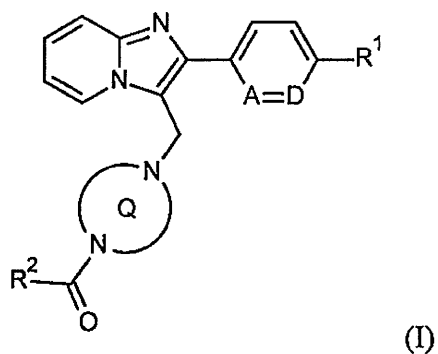


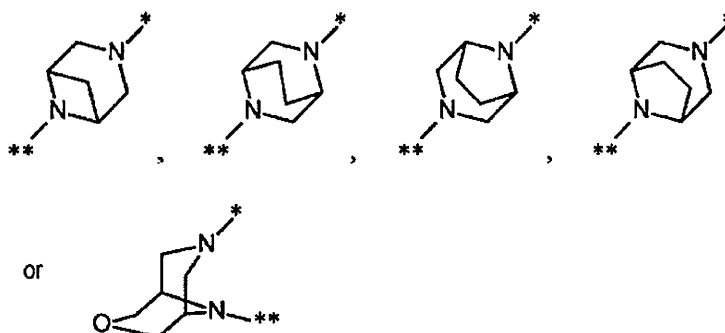
Claims

1. Compound of the formula (I)



in which

- 5 the ring Q is a diazaheterobicyclic system of the formula



in which * denotes the bond to the adjoining methylene group and ** the bond to the carbonyl group,

A and D are each CH or one of these ring members is CH and the other is N,

- 10 R^1 is halogen, cyano, (C_1-C_4) -alkyl, cyclopropyl or cyclobutyl

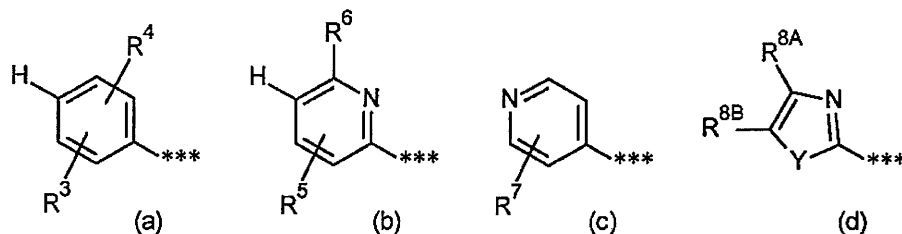
where (C_1-C_4) -alkyl may be up to trisubstituted by fluorine and cyclopropyl and cyclobutyl may be up to disubstituted by fluorine,

and

R^2 is (C_4-C_6) -cycloalkyl in which a ring CH_2 group may be replaced by -O-,

- 15 or

R^2 is a phenyl group of the formula (a), a pyridyl group of the formula (b) or (c) or an azole group of the formula (d)



in which *** marks the bond to the adjacent carbonyl group and

5 R^3 is hydrogen, fluorine, chlorine, bromine or methyl,

R^4 is hydrogen, fluorine, chlorine, bromine, cyano, (C₁-C₃)-alkyl or (C₁-C₃)-alkoxy,

where (C₁-C₃)-alkyl and (C₁-C₃)-alkoxy may be up to trisubstituted by fluorine,

10 R^5 is hydrogen, fluorine, chlorine, bromine or methyl,

R^6 is hydrogen, (C₁-C₃)-alkoxy, cyclobutyloxy, oxetan-3-yloxy, tetrahydrofuran-3-yloxy or tetrahydro-2H-pyran-4-yloxy,

where (C₁-C₃)-alkoxy may be up to trisubstituted by fluorine,

15 R^7 is hydrogen, fluorine, chlorine, bromine, (C₁-C₃)-alkyl or (C₁-C₃)-alkoxy,

R^{8A} and R^{8B} are the same or different and are independently hydrogen or (C₁-C₃)-alkyl

and

Y is N(R⁹), O or S, in which

20 R^9 is hydrogen or (C₁-C₃)-alkyl,

or

R^2 is an -OR¹⁰ or -NR¹¹R¹² group in which

R^{10} is (C₁-C₄)-alkyl or (C₄-C₆)-cycloalkyl,

R^{11} is hydrogen or (C₁-C₃)-alkyl

and

R^{12} is (C₁-C₆)-alkyl, (C₃-C₆)-cycloalkyl, phenyl or benzyl,

5 where (C₁-C₆)-alkyl may be up to trisubstituted by fluorine,

and

where phenyl and the phenyl group in benzyl may be up to disubstituted, identically or differently, by a radical selected from the group of fluorine, chlorine, methyl, ethyl and trifluoromethyl,

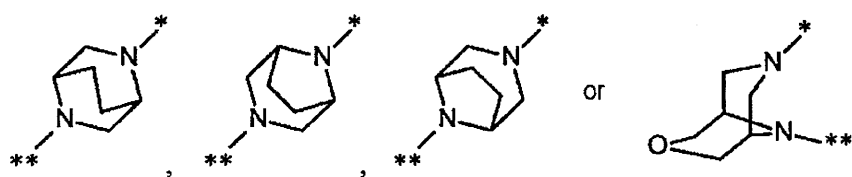
10 or

R^{11} and R^{12} are joined to one another and, together with the nitrogen atom to which they are bonded, form a pyrrolidine, piperidine, morpholine or thiomorpholine ring,

and the salts, solvates and solvates of the salts thereof.

15 2. Compound of the formula (I) according to Claim 1 in which

the ring Q is a diazaheterobicyclic system of the formula



in which * denotes the bond to the adjoining methylene group and ** the bond to the carbonyl group,

20 A and D are each CH or one of these ring members is CH and the other is N,

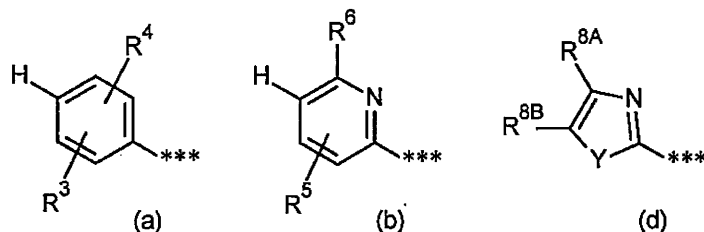
R^1 is fluorine, chlorine, bromine, methyl, isopropyl, *tert*-butyl, cyclopropyl or cyclobutyl

and

R^2 is cyclobutyl, cyclopentyl or cyclohexyl

or

R^2 is a phenyl group of the formula (a), a pyridyl group of the formula (b) or an azole group of the formula (d)



5

in which *** marks the bond to the adjacent carbonyl group and

R^3 is hydrogen, fluorine or chlorine,

R^4 is fluorine, chlorine, cyano, (C_1-C_3) -alkyl, (C_1-C_3) -alkoxy or trifluoromethoxy,

10

R^5 is hydrogen, fluorine, chlorine, bromine or methyl,

R^6 is (C_1-C_3) -alkoxy which may be up to trisubstituted by fluorine, or cyclobutyloxy,

R^{8A} and R^{8B} are independently hydrogen or methyl

and

15

Y is $N(CH_3)$, O or S,

or

R^2 is a $-NR^{11}R^{12}$ group in which

R^{11} is hydrogen or (C_1-C_3) -alkyl

and

20

R^{12} is (C_1-C_6) -alkyl or phenyl,

where phenyl may be up to disubstituted, identically or differently,
by a radical selected from the group of fluorine, chlorine, methyl,
ethyl and trifluoromethyl,

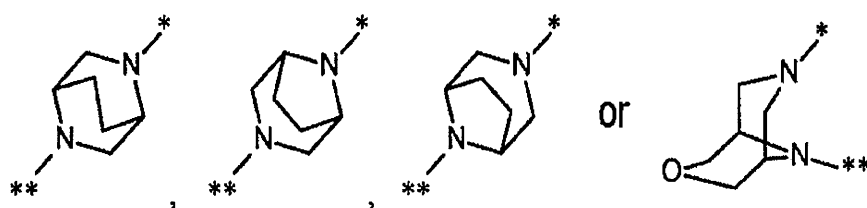
or

5 R^{11} and R^{12} are joined to one another and, together with the nitrogen atom to
which they are bonded, form a pyrrolidine, piperidine or
thiomorpholine ring,

and the salts, solvates and solvates of the salts thereof.

3. Compound of the formula (I) according to Claim 1 or 2 in which

10 the ring Q is a diazaheterobicyclic system of the formula



in which * denotes the bond to the adjoining methylene group and ** the bond to
the carbonyl group,

A is CH or N,

15 D is CH,

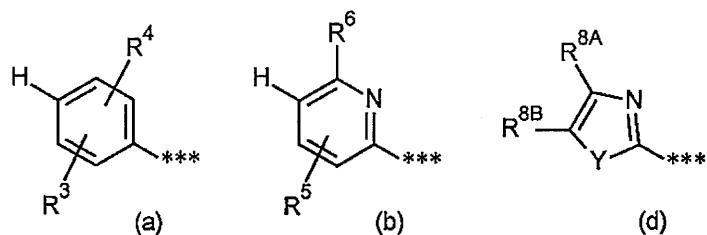
R^1 is fluorine, chlorine, bromine, methyl, isopropyl, *tert*-butyl, cyclopropyl or
cyclobutyl

and

R^2 is cyclobutyl, cyclopentyl or cyclohexyl

20 or

R^2 is a phenyl group of the formula (a), a pyridyl group of the formula (b) or an azole
group of the formula (d)



in which *** marks the bond to the adjacent carbonyl group and

R³ is hydrogen, fluorine or chlorine,

5 R⁴ is fluorine, chlorine, cyano, (C₁-C₃)-alkyl, (C₁-C₃)-alkoxy or trifluoromethoxy,

R⁵ is hydrogen, fluorine, chlorine, bromine or methyl,

R⁶ is (C₁-C₃)-alkoxy which may be up to trisubstituted by fluorine, or cyclobutyloxy,

R^{8A} and R^{8B} are independently hydrogen or methyl

10 and

Y is N(CH₃), O or S,

or

R² is a -NR¹¹R¹² group in which

R¹¹ is hydrogen or (C₁-C₃)-alkyl

15 and

R¹² is (C₁-C₆)-alkyl or phenyl,

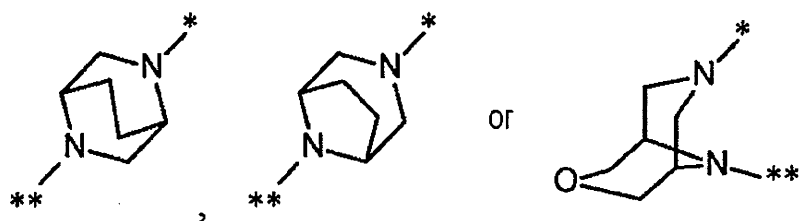
where phenyl may be up to disubstituted, identically or differently, by a radical selected from the group of fluorine, chlorine, methyl, ethyl and trifluoromethyl,

20 or

R^{11} and R^{12} are joined to one another and, together with the nitrogen atom to which they are bonded, form a pyrrolidine, piperidine or thiomorpholine ring, and the salts, solvates and solvates of the salts thereof.

4. Compound of the formula (I) according to Claim 1 or 2 in which

5 the ring Q is a diazaheterobicyclic system of the formula



in which * denotes the bond to the adjoining methylene group and ** the bond to the carbonyl group,

A and D are each CH or one of these ring members is CH and the other is N,

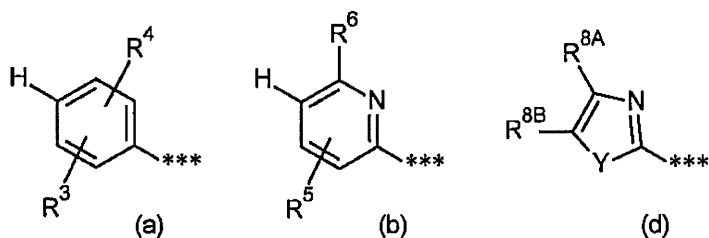
10 R^1 is chlorine, bromine, isopropyl or cyclopropyl

and

R^2 is cyclobutyl, cyclopentyl or cyclohexyl

or

15 R^2 is a phenyl group of the formula (a), a pyridyl group of the formula (b) or an azole group of the formula (d)



in which *** marks the bond to the adjacent carbonyl group and

R^3 is hydrogen, fluorine or chlorine,

R^4 is fluorine, chlorine, methyl, isopropyl, methoxy or ethoxy,

R^5 is hydrogen, fluorine, chlorine, bromine or methyl,

R^6 is methoxy, difluoromethoxy, trifluoromethoxy, isopropoxy or cyclobutyloxy,

R^{8A} and R^{8B} are each hydrogen

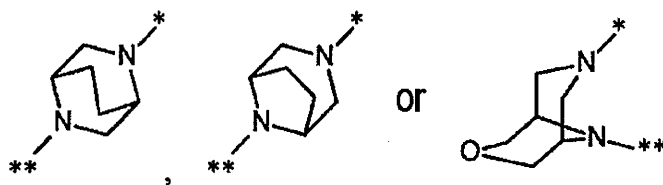
5 and

Y is $N(CH_3)$,

and the salts, solvates and solvates of the salts thereof.

5. Compound of the formula (I) according to Claim 1, 2, 3 or 4 in which

the ring Q is a diazaheterobicyclic system of the formula



in which * denotes the bond to the adjoining methylene group and ** the bond to the carbonyl group,

A is CH or N,

D is CH,

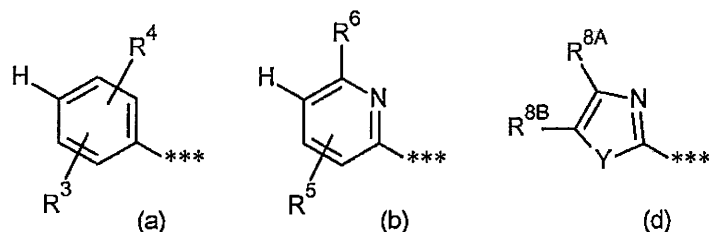
15 R^1 is chlorine, bromine, isopropyl or cyclopropyl

and

R^2 is cyclobutyl, cyclopentyl or cyclohexyl

or

20 R^2 is a phenyl group of the formula (a), a pyridyl group of the formula (b) or an azole group of the formula (d)



in which *** marks the bond to the adjacent carbonyl group and

R³ is hydrogen, fluorine or chlorine,

R⁴ is fluorine, chlorine, methyl, isopropyl, methoxy or ethoxy,

5 R⁵ is hydrogen, fluorine, chlorine, bromine or methyl,

R⁶ is methoxy, difluoromethoxy, trifluoromethoxy, isopropoxy or cyclobutyloxy,

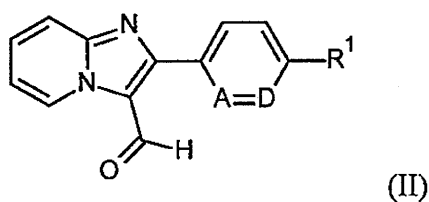
R^{8A} and R^{8B} are each hydrogen

and

10 Y is N(CH₃),

and the salts, solvates and solvates of the salts thereof.

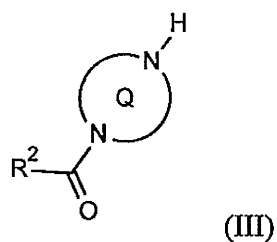
6. Process for preparing a compound of the formula (I) as defined in any of Claims 1 to 5, characterized in that a compound of the formula (II)



15 in which A, D and R¹ have the definitions given in Claims 1 to 5

is reacted in the presence of a suitable reducing agent either

[A] with a compound of the formula (III)

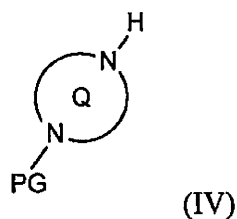


in which R² and the ring Q have the definitions given in Claims 1 to 5

to give a compound of the formula (I)

or

5 [B] with a protected diazaheterobicyclic system of the formula (IV)

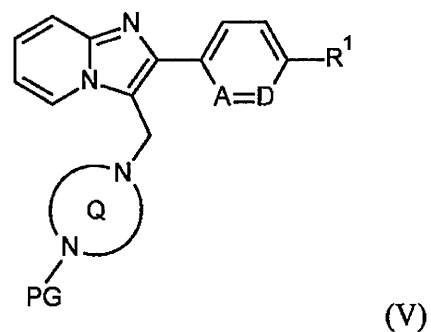


in which the ring Q has the definition given in Claims 1 to 5

and

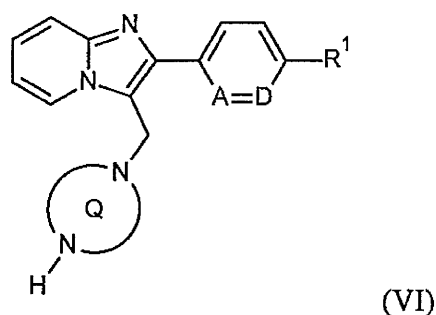
PG is a suitable amino protecting group, for example *tert*-butoxycarbonyl,
 10 benzyloxycarbonyl or (9*H*-fluoren-9-ylmethoxy)carbonyl

at first to give a compound of the formula (V)



in which A, D, PG, R¹ and the ring Q have the definitions given above,

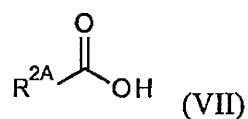
then the protecting group PG is removed and the resulting compound of the
 15 formula (VI)



in which A, D, R¹ and the ring Q have the definitions given above

is then reacted, depending on the specific definition of the R² radical,

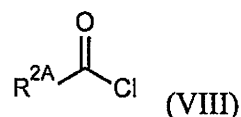
[B-1] with a carboxylic acid of the formula (VII)



in which

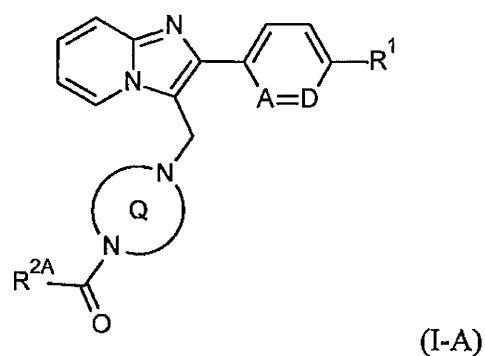
R^{2A} is (C₄-C₆)-cycloalkyl in which a ring CH₂ group may be replaced by -O-, or is a phenyl group of the formula (a), a pyridyl group of the formula (b) or (c) or an azole group of the formula (d) as described in Claims 1 to 5,

with activation of the carboxylic acid function in (VII), or is reacted with the corresponding acid chloride of the formula (VIII)



in which R^{2A} has the definition given above

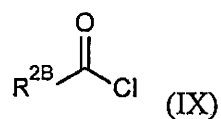
to give a compound of the formula (I-A)



in which A, D, R¹, R^{2A} and the ring Q have the definitions given above

or

[B-2] with a chloroformate or carbamoyl chloride of the formula (IX)



in which

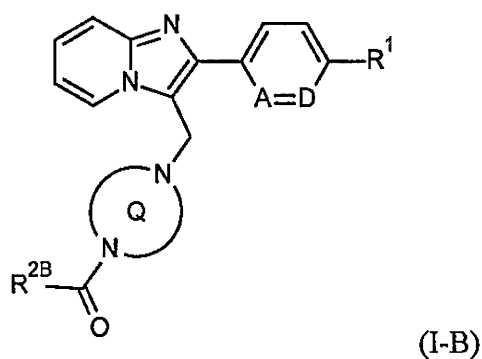
R^{2B} is the -OR¹⁰ or -NR^{11A}R¹² group in which

R¹⁰ and R¹² have the definitions given in Claims 1 to 5

and

R^{11A} has the definition of R¹¹ given in Claims 1 to 5, but is not hydrogen,

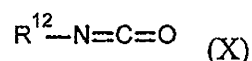
to give a compound of the formula (I-B)



in which A, D, R¹, R^{2B} and the ring Q have the definitions given above

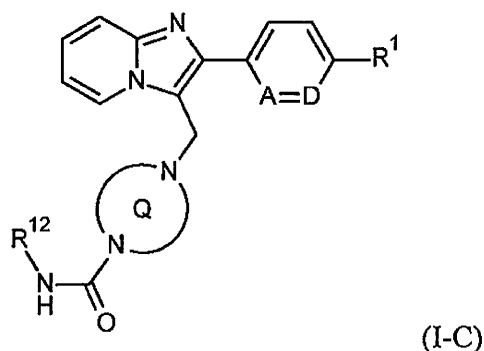
or

[B-3] with an isocyanate of the formula (X)



in which R^{12} has the meaning given in Claims 1 to 5

5 to give a compound of the formula (I-C)



in which A, D, R^1 , R^{12} and the ring Q have the definitions given above

and the compounds of the formulae (I), (I-A), (I-B) or (I-C) thus obtained are optionally separated into their enantiomers and/or diastereomers and/or optionally converted with the appropriate (i) solvents and/or (ii) acids to the solvates, salts and/or solvates of the salts thereof.

- 10 7. Method of discovering a compound having TASK-1- and/or TASK-3-blocking properties, wherein the method comprises subjecting at least one compound to at least one assay selected from the group consisting of:
- 15
- determining the inhibitory concentration (IC_{50}) in relation to the K^+ conductivity of a TASK-1 or TASK-3 channel,
 - determining the washout rate
- and
- determining the maximum possible bioavailability after administration (" F_{max} well-stirred"),
- 20

and optionally at least one further assay selected from the group consisting of:

- determining the brain/plasma concentration ratio C_{br}/C_p ,
 - determining cLogD [pH 7.5] and/or cLogP and/or tPSA,
 - determining the selectivity for TASK-1 and/or TASK-3 with respect to other K^+ channels,
 - 5 • determining passive apparent permeability (cPAPP, passive)
and
 - determining blood clearance (CL_{blood}).
8. Method of producing a compound having TASK-1- and/or TASK-3-blocking properties and suitability for nasal administration, wherein the method comprises:
- 10 • producing and/or providing a library of compounds,- testing at least one compound from this library in an assay according to Claim 7,
- isolating at least one compound after this step,
and optionally
- converting the at least one compound to a pharmaceutical formulation suitable
15 for nasal administration.

9. Method according to either of Claims 7 and 8, wherein the compound has to fulfil at least one of the conditions fixed in the following group:

a) the inhibitory concentration (IC_{50}) in relation to the K^+ conductivity of the TASK-1 or TASK-3 channel is ≤ 200 nM, measured by the two-electrode

20 voltage clamp technique (TEVC) in *Xenopus laevis* oocytes that have been injected with TASK-1 cRNA or TASK-3 cRNA;

b) the washout rate is $\leq 50\% h^{-1}$, measured by the two-electrode voltage clamp technique (TEVC) in *Xenopus laevis* oocytes that have been injected with TASK-1 cRNA or TASK-3 cRNA;

25 c) the maximum possible bioavailability (" F_{max} well-stirred") is $\leq 40\%$, measured by means of the hepatocyte *in vitro* clearance test described herein;

- d) the brain/plasma concentration ratio C_{br}/C_p is ≤ 1 , measured after nasal and/or intravenous administration of the compound to rats and subsequent LC-MS/MS analysis of processed plasma and brain tissue samples;
- e) cLogD [pH 7.5] is between ≥ 2.5 and ≤ 5 ;
- 5 f) cLogP is between ≥ 1 and ≤ 5 ;
- g) tPSA is between ≥ 25 and $\leq 100 \text{ \AA}^2$;
- h) the inhibitory concentration (IC_{50}) relating to the K^+ conductivity of the TASK-1 or TASK-3 channel is at least 10^3 times less than that relating to the cardiac hERG K^+ channel, measured by the two-electrode voltage clamp technique (TEVC) in *Xenopus laevis* oocytes;
- 10 i) cPAPP, passive is ≥ 100 , measured in Caco-2 cells based on the determination of apparent permeability (PAPP);
- j) blood clearance (CL_{blood}) is $\geq 60\%$ of the species-specific liver perfusion;
- k) oral bioavailability is $\leq 40\%$, expressed as the quotient of $AUC_{standard}$ (peroral administration)/ $AUC_{standard}$ (intravenous administration).
- 15
10. Method according to any of Claims 7 to 9, wherein the compound is optionally
- suitable for the prevention or treatment of obstructive sleep apnoea (OSA) or of one or more symptoms associated therewith,
 - suitable for nasal administration
- 20 and/or
- brings about inhibition of the collapsibility of the upper respiratory tract in a pig model for OSA, where the duration of inhibition of the collapsibility of the upper respiratory tract in the OSA pig model, preferably after intranasal administration of between 0.3 and 300 μg of the compound, is more than 240
- 25 min, measured at a reduced pressure of 100 cm water column.
11. Compound having TASK-1- and/or TASK-3-blocking properties, obtainable by the method according to any of Claims 7 to 10, wherein the compound preferably has at least one functional feature selected from the following group:

- a) the inhibitory concentration (IC_{50}) relating to the K^+ conductivity of the TASK-1 or TASK-3 channel is ≤ 200 nM,
- b) the washout rate is $\leq 50\% h^{-1}$,
- c) the maximum possible bioavailability (" F_{max} well-stirred") is $\leq 40\%$,
- 5 and optionally has at least one of the further features according to any of Claims 7 to 10.
12. Compound according to Claim 11, wherein the compound is an (imidazo[1,2-a]pyridin-3-yl)methyl-substituted diazaheterobicyclic compound and/or a compound with the proviso that the compounds disclosed in EP patent application 10 15199270.8 and in EP patent application 15199268.2 are not included.
13. Compound according to either of Claims 11 and 12, wherein the washout rate of the compound is preferably $\leq 40\% h^{-1}$, more preferably $\leq 30\% h^{-1}$ and most preferably $\leq 20\% h^{-1}$.
14. Compound that competes with a compound according to any of Claims 11 to 13 for 15 interaction with TASK-1 and/or TASK-3, where the term "interaction" preferably relates to at least one feature from the group consisting of:
- reduction in the K^+ conductivity of the TASK-1 or TASK-3 channel,
 - binding to one or more epitopes and/or domains of TASK-1 and/or TASK-3.
15. Compound as defined in any of Claims 1 to 5 and 11 to 14 for treatment and/or 20 prevention of diseases.
16. Compound as defined in any of Claims 1 to 5 and 11 to 14 for use in a method of treatment and/or prevention of respiratory disorders, sleep-related respiratory disorders, obstructive sleep apnoea, central sleep apnoea, snoring, cardiac arrhythmias, neurodegenerative disorders, neuroinflammatory disorders and 25 neuroimmunological disorders.
17. Use of a compound as defined in any of Claims 1 to 5 and 11 to 14 for production of a medicament for treatment and/or prevention of respiratory disorders, sleep-related respiratory disorders, obstructive sleep apnoea, central sleep apnoea,

snoring, cardiac arrhythmias, neurodegenerative disorders, neuroinflammatory disorders and neuroimmunological disorders.

18. Medicament comprising a compound as defined in any of Claims 1 to 5 and 11 to 14 in combination with one or more inert, nontoxic, pharmaceutically suitable excipients.
19. Medicament comprising a compound as defined in any of Claims 1 to 5 and 11 to 14 in combination with one or more further active ingredients selected from the group consisting of respiratory stimulants, psychostimulating compounds, serotonin reuptake inhibitors, noradrenergic, serotonergic and tricyclic antidepressants, sGC stimulators, mineralocorticoid receptor antagonists, antiinflammatory drugs, immunomodulators, immunosuppressants and cytotoxic drugs.
20. Medicament according to Claim 18 or 19 for treatment and/or prevention of respiratory disorders, sleep-related respiratory disorders, obstructive sleep apnoea, central sleep apnoea, snoring, cardiac arrhythmias, neurodegenerative disorders, neuroinflammatory disorders and neuroimmunological disorders.