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(72) MILUTINOVIC, SANDRA GINETTE, GB

(72) SIMMONDS, ROBIN GEORGE, GB

(72) TUPPER, DAVID EDWARD, GB

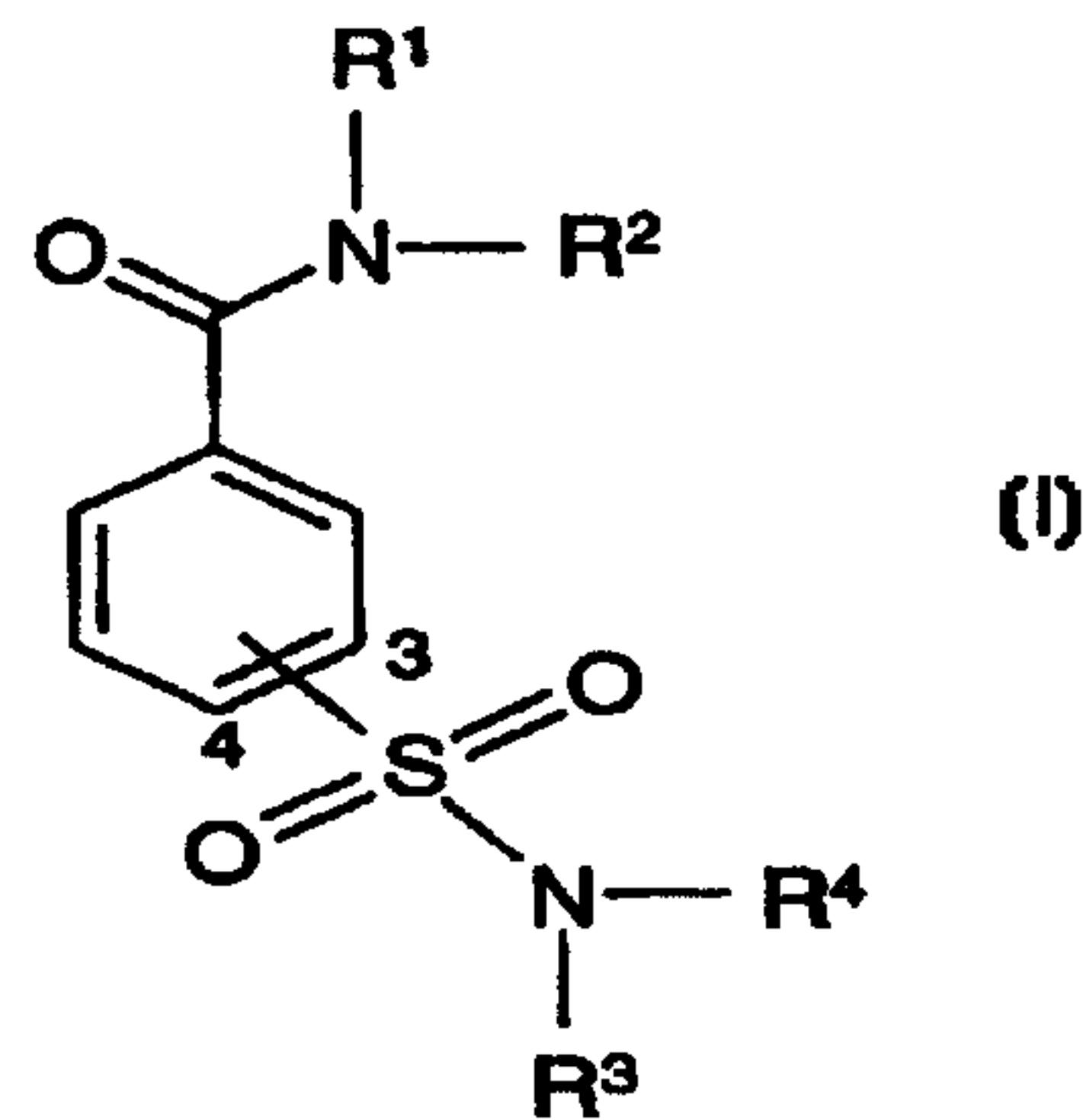
(71) ELI LILLY AND COMPANY LIMITED, GB

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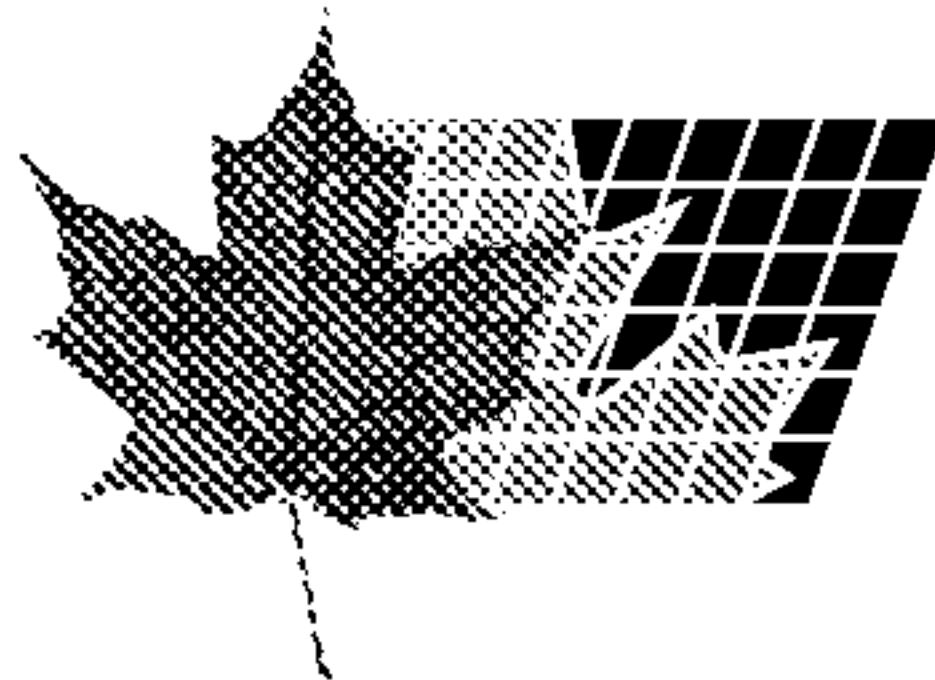
(54) **DERIVES AMINOSULPHONYLBENZAMIDES UTILISES
COMME INHIBITEURS DE L'ACTIVITE DES CANAUX
CALCIUM NEURONNAUX**

(54) **AMINOSULPHONYLBENZAMIDE DERIVATIVES AS
MODULATORS OF THE ACTIVITY OF NEURONAL
CALCIUM CHANNELS**



(57) L'invention se rapporte à un composé pharmaceutique représenté par la formule (I) dans laquelle le groupe aminosulfonyle est attaché en position 3 ou 4 et où R¹ est hydrogène, alkyle C₁-C₆, cycloalkyle C₃-C₁₀, cycloalkyle C₃-C₁₀-alkyle C₁-C₄ ou phényle-alkyle C₁-C₄, R² est alkyle C₁-C₆, cycloalkyle C₃-C₁₀, cycloalkyle C₃-C₁₀-alkyle C₁-C₄ ou phényle-alkyle C₁-C₄ ou (CH₂)₂NR⁵R⁶ où R⁵ et R⁶ sont chacun hydrogène ou alkyle C₁-C₆, et R³ et R⁴ sont chacun alkyle C₁-C₆, cycloalkyle C₃-C₁₀, cycloalkyle C₃-C₁₀-alkyle C₁-C₄, alcényle C₃-C₆, phényle éventuellement substitué ou phényle-alkyle C₁-C₄ éventuellement substitué, ou bien R¹ et R², ou R³ et R⁴, ou R⁵ et R⁶ forment conjointement à l'atome d'azote auquel ils sont

(57) A pharmaceutical compound of formula (I) in which the aminosulfonyl group is attached at the 3- or 4-position, and in which R¹ is hydrogen, C₁₋₆ Alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl or optionally substituted phenyl-C₁₋₄ alkyl, R² is C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl, optionally substituted phenyl-C₁₋₄ alkyl or -(CH₂)₂NR⁵R⁶ where R⁵ and R⁶ are each hydrogen or C₁₋₆ alkyl, and R³ and R⁴ are each C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl, C₃₋₆ alkenyl, optionally substituted phenyl or optionally substituted phenyl-C₁₋₄ alkyl, or R¹ and R², or R³ and R⁴, or R⁵ and R⁶, together with the nitrogen atom to which they are attached, form a carbocyclic group containing 4 to 7



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attachés, un groupe carbocyclique contenant 4 à 7 atomes de carbone éventuellement substitués par un à trois groupes méthyle ou éthyle et contenant éventuellement un atome d'oxygène ou un autre atome d'azote, ledit groupe carbocyclique étant éventuellement fusionné à un groupe phényle éventuellement substitué. L'invention se rapporte également à un sel de ce composé.

carbon atoms optionally substituted with one to three methyl or ethyl groups and optionally containing an oxygen atom or a further nitrogen atom, said carbocyclic group being optionally fused to an optionally substituted phenyl group; or a salt thereof.

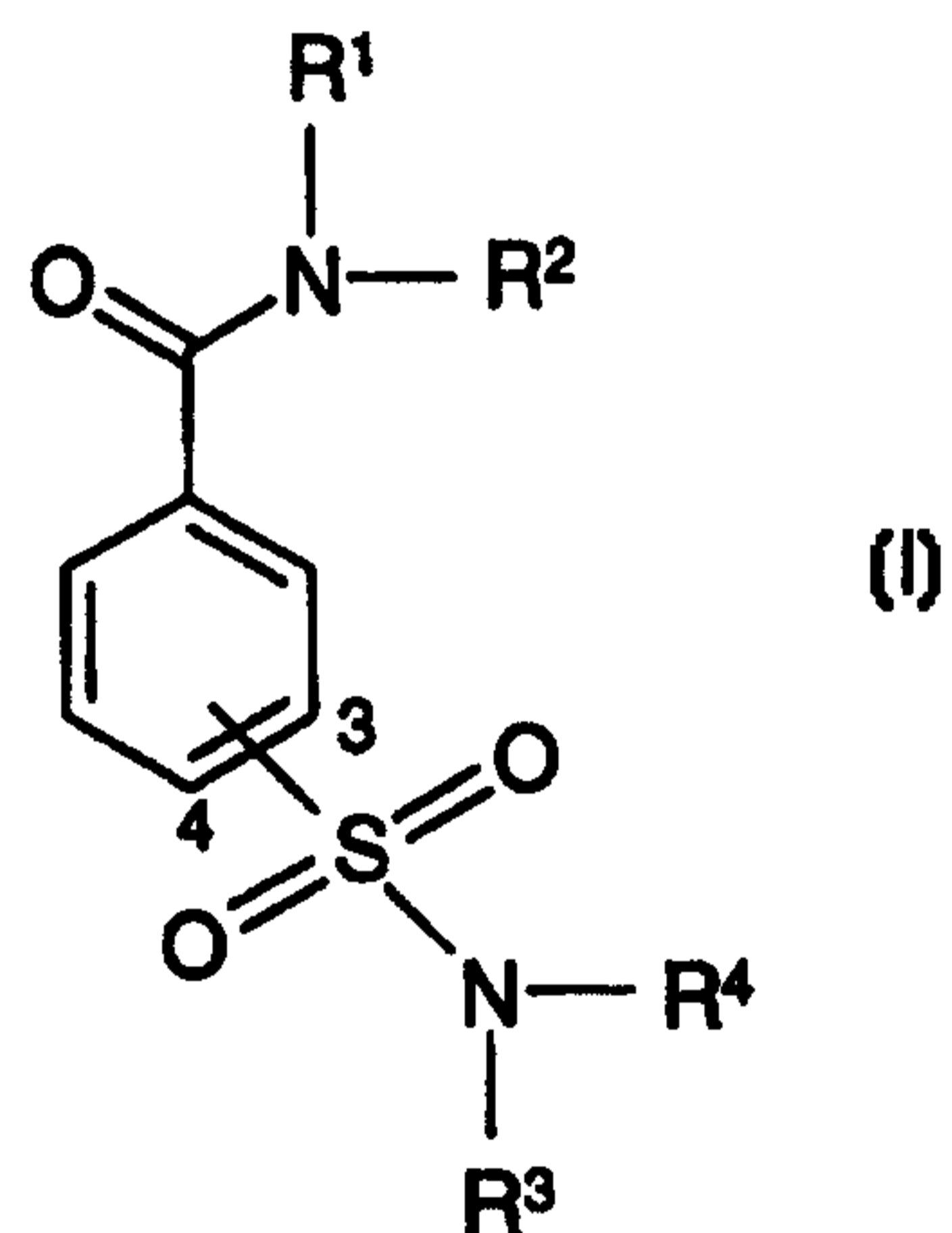
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| (71) Applicant (for all designated States except US): | ELI LILLY AND COMPANY LIMITED [GB/GB]; Kingsclere Road, Basingstoke, Hampshire RG21 6XA (GB). | | |
| (72) Inventors; and | | | |
| (75) Inventors/Applicants (for US only): | MILUTINOVIC, Sandra [GB/GB]; 39 Devonshire Park, Reading, Berkshire RG2 7DX (GB). SIMMONDS, Robin, George [GB/GB]; 2 Plover Close, Wokingham, Berkshire RG41 3JD (GB). TUPPER, David, Edward [GB/GB]; 8 Mildenhall Close, Lower Earley, Reading, Berkshire RG6 3AT (GB). | | |
| (74) Agent: | HUDSON, Christopher, Mark; Eli Lilly and Company Limited, Lilly Research Centre, Erl Wood Manor, Windlesham, Surrey GU20 6PH (GB). | | |

(54) Title: AMINOSULPHONYLBENZAMIDE DERIVATIVES AS MODULATORS OF THE ACTIVITY OF NEURONAL CALCIUM CHANNELS



(57) Abstract

A pharmaceutical compound of formula (I) in which the aminosulfonyl group is attached at the 3- or 4-position, and in which R¹ is hydrogen, C₁₋₆ Alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl or optionally substituted phenyl-C₁₋₄ alkyl, R² is C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl, optionally substituted phenyl-C₁₋₄ alkyl or -(CH₂)₂NR⁵R⁶ where R⁵ and R⁶ are each hydrogen or C₁₋₆ alkyl, and R³ and R⁴ are each C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl, C₃₋₆ alkenyl, optionally substituted phenyl or optionally substituted phenyl-C₁₋₄ alkyl, or R¹ and R², or R³ and R⁴, or R⁵ and R⁶, together with the nitrogen atom to which they are attached, form a carbocyclic group containing 4 to 7 carbon atoms optionally substituted with one to three methyl or ethyl groups and optionally containing an oxygen atom or a further nitrogen atom, said carbocyclic group being optionally fused to an optionally substituted phenyl group; or a salt thereof.

AMINOSULPHONYLBENZAMIDE DERIVATIVES AS MODULATORS OF THE ACTIVITY OF NEURONAL CALCIUM CHANNELS

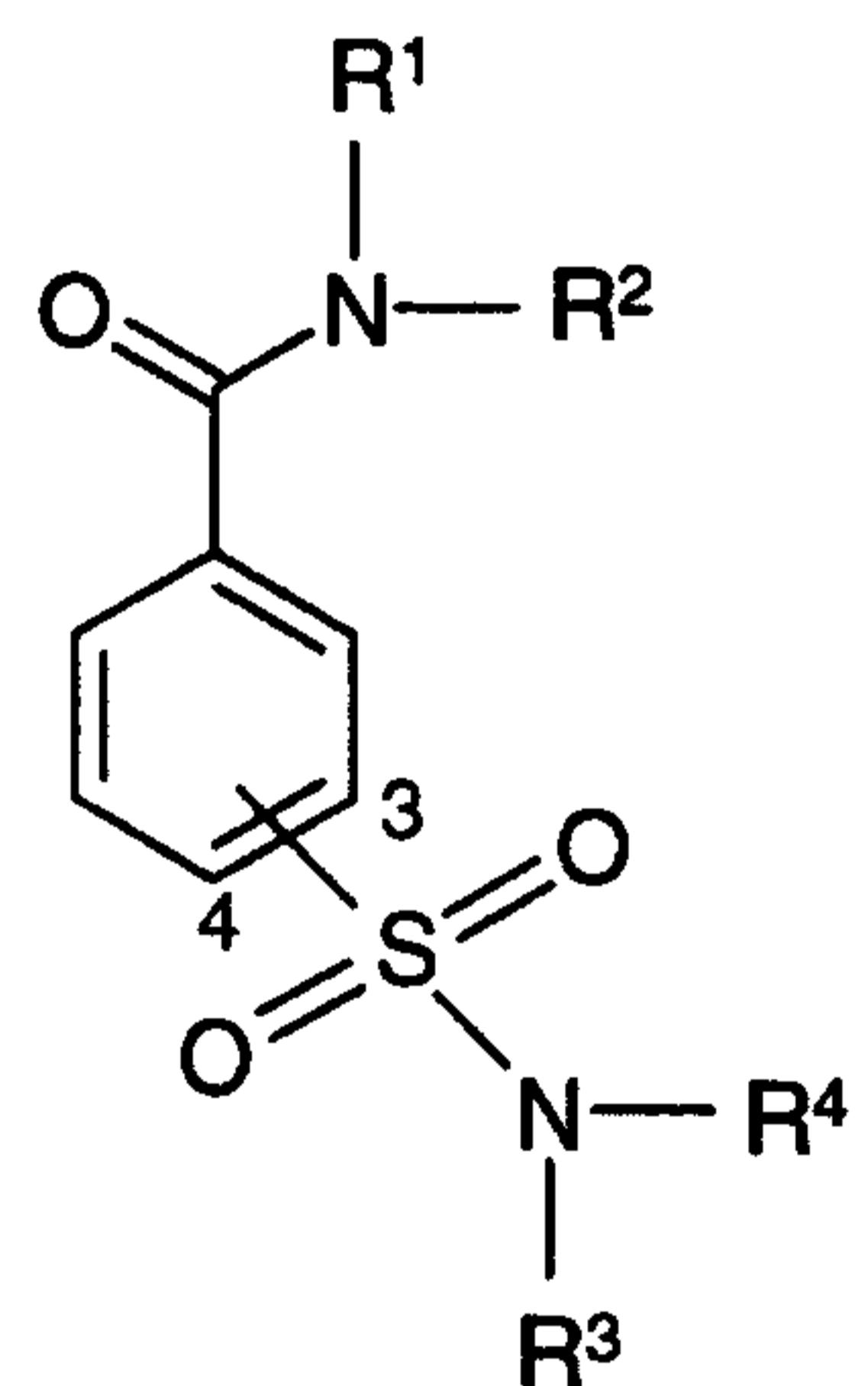
This invention relates to novel chemical compounds and their use as pharmaceuticals.

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It is well known that chemical compounds which modulate the activity of neuronal calcium channels are potentially useful in treating disorders of the central nervous system.

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The compounds of the invention have the following general formula:



(I)

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in which the aminosulfonyl group is attached at the 3- or 4-position, and in which

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R¹ is hydrogen, C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl or optionally substituted phenyl-C₁₋₄ alkyl,

5

R² is C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl, optionally substituted phenyl-C₁₋₄ alkyl or -(CH₂)₂NR⁵R⁶ where R⁵ and R⁶ are each hydrogen or C₁₋₆ alkyl, and

10

R³ and R⁴ are each C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl, C₃₋₆ alkenyl, optionally substituted phenyl or optionally substituted phenyl-C₁₋₄ alkyl,

15

or R¹ and R², or R³ and R⁴, or R⁵ and R⁶, together with the nitrogen atom to which they are attached, form a carbocyclic group containing 4 to 7 carbon atoms optionally substituted with one to three methyl or ethyl groups and optionally containing an oxygen atom or a further nitrogen atom, said carbocyclic group being optionally fused to an optionally substituted phenyl group;

or a salt thereof.

The compounds of the invention have been found to be active in tests that show modulation of voltage-5 dependent calcium channels, and are thus indicated for use in the treatment of diseases in which such modulation is beneficial, in particular diseases of the central nervous system.

10 In the above formula (I), a C₁₋₆ alkyl group includes methyl, ethyl, propyl, isopropyl, butyl, tert. butyl and hexyl, and is preferably methyl or ethyl. A substituted phenyl group is phenyl substituted with one or more, for example one to three, substituents selected from, for 15 example C₁₋₄ alkyl, especially methyl, C₁₋₄ alkoxy, especially methoxy and ethoxy, hydroxy, nitro, cyano, halo, especially chloro or fluoro, trihalomethyl, especially trifluoromethyl, carboxy and C₁₋₄ alkoxy- carbonyl. A halo atom is preferably chlorine, bromine 20 or fluorine. A substituted phenyl group preferably has one to three substituents selected from hydroxy, C₁₋₄ alkyl, halo, nitro and trifluoromethyl. An optionally substituted phenyl-C₁₋₄ alkyl group is preferably of the formula R-(CH₂)_n- where R is optionally substituted 25 phenyl and n is 1 to 4, but the linking chain can also

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be branched alkylene. A C₃-10 cycloalkyl group is preferably, for example, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl and these groups may optionally be substituted by one or two C₁-4 alkyl, 5 especially methyl, substituents. A C₃-10 cycloalkyl-C₁-4 alkyl group is one such cycloalkyl group attached to a C₁-4 alkyl, and is preferably of the formula R-(CH₂)_n- where R is cycloalkyl and n is 1 to 4. When R³ or R⁴ are C₁-6 alkyl they are preferably C₃-6 alkyl.

10

The groups R¹ and R², R³ and R⁴, and R⁵ and R⁶, can form a carbocyclic ring with the nitrogen to which they are attached and optionally also contain an oxygen atom or an additional nitrogen. Preferred examples, including 15 the nitrogen of the amino sulfonyl group, are pyrrolidino, piperazino, morpholino and especially 3,5-dimethylpiperidino.

A particular group of compounds of the invention is one 20 of formula (I) in which R¹, R², R³ and R⁴ are each C₁-6 alkyl, C₃-10 cycloalkyl, C₃-10 cycloalkyl-C₁-4 alkyl or optionally substituted phenyl-C₁-4 alkyl, and R¹ can in addition be hydrogen, or R¹ and R², or R³ and R⁴

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together with the nitrogen atom to which they are attached, form a carbocyclic group as defined above.

In a preferred group of compounds R¹, R², R³ and R⁴ are 5 each C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl or optionally substituted phenyl-C₁₋₄ alkyl, and R¹ is in addition hydrogen.

It is preferred that R¹ is hydrogen. Furthermore, R³ 10 and R⁴, which can be the same or different, are preferably C₁₋₄ alkyl. It is further preferred that R² is optionally substituted phenyl-C₁₋₄ alkyl.

A further preferred group of compounds is one of 15 formula (I) in which R² is -(CH₂)₂NR⁵R⁶.

A further preferred group of compounds is one of formula (I) in which R³ or R⁴ is C₃₋₆ alkyl or when R³ 20 and R⁴ are taken together with the nitrogen atom they form a piperidine ring which is substituted at the 3-and/or 5-positions with one or two methyl or ethyl substituents.

It will be appreciated that the compounds of the invention can contain one or more asymmetric carbon atom which gives rise to enantiomers. The compounds can be prepared as racemates or can be made from enantiomeric 5 intermediates. Both racemates and enantiomers form part of the present invention.

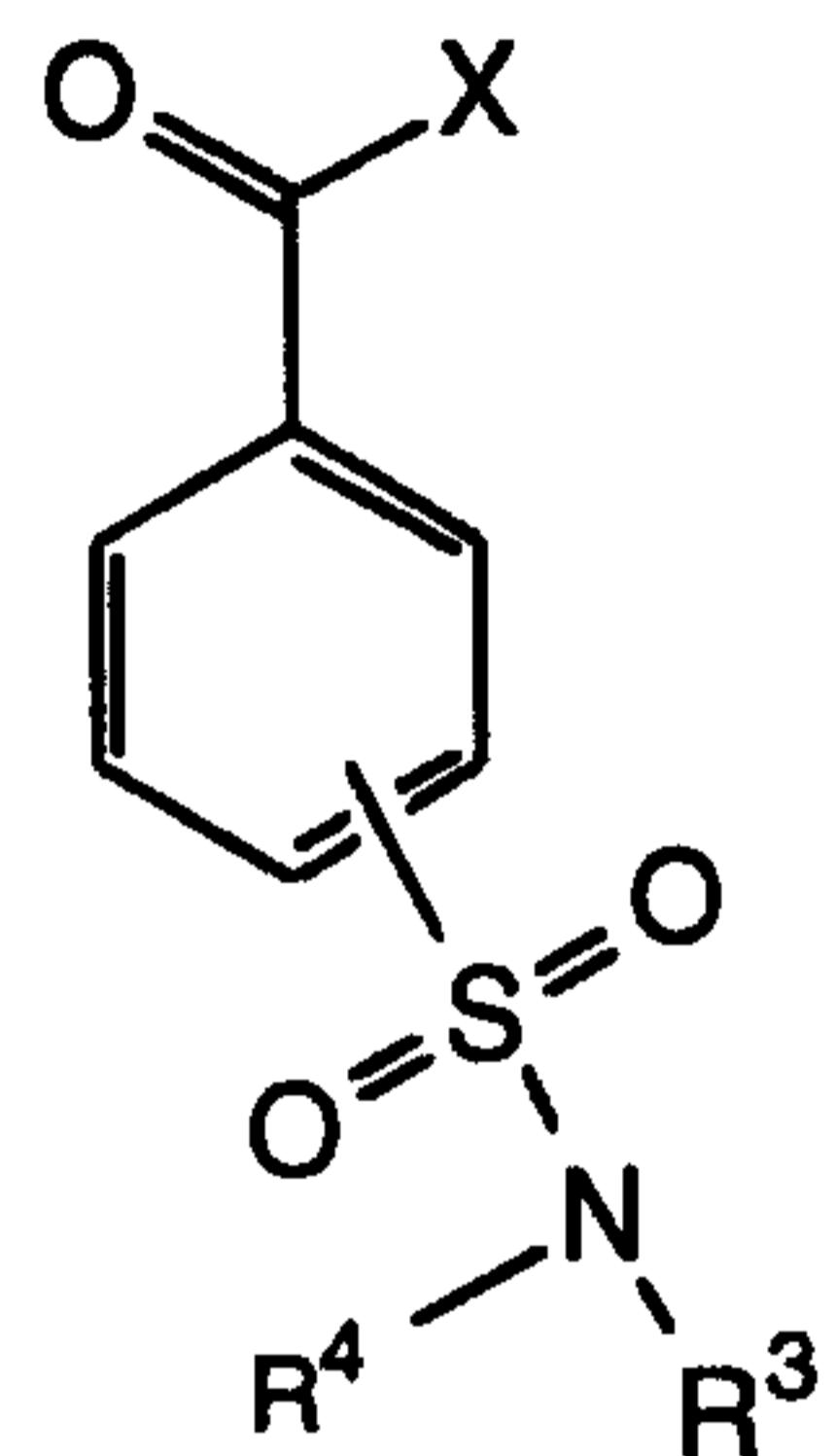
It will also be understood that salts of the compounds of the invention can be prepared and such salts are 10 included in the invention. They can be any of the well known acid addition salts. Acid addition salts are preferably the pharmaceutically acceptable non-toxic addition salts with suitable acids, such as those with inorganic acids, for example hydrochloric, hydrobromic, 15 nitric, sulfuric or phosphoric acids, or with organic acids, such as organic carboxylic acids, for example glycollic, maleic, fumaric, malic, oxalic, tartaric, citric, salicylic or o-acetoxybenzoic acids, or organic sulfonic acids, methane sulfonic, 2-hydroxyethane 20 sulfonic, toluene-p-sulfonic or naphthalene-2-sulfonic acids.

In addition to pharmaceutically-acceptable salts, other salts are included in the invention. They may serve as 25 intermediates in the purification of compounds or in the preparation of other, for example pharmaceutically-

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acceptable, salts, or are useful for identification, characterisation or purification.

The invention also includes a process for producing the
5 compounds of formula (I) above which comprises reacting
a compound of the formula:



(II)

10 where X is a leaving group such as, for example, halo or hydroxy, with an amine of the formula HNR^1R^2 .

The reaction is preferably carried out in an organic solvent such as, for example, chloroform or
15 acetonitrile, at a temperature of from 0° C. to 100° C. such as, for example, ambient temperature.

Intermediate compounds of formula (II) are known in the art and can be prepared readily by known methods. When

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an acid halide is employed (X is halo such as, for example, chloro), the reaction is preferably carried out in the presence of a solid phase scavenger to absorb the acid liberated by the reaction. When the free acid is 5 employed (X is hydroxy), a condensing reagent such as, for example, dimethylaminopropyl-ethylcarbodiimide can be employed.

Amine reactants of the formula HNR^1R^2 are also well 10 known and can be prepared readily by known methods. Those in which R^2 is $-(\text{CH}_2)_2\text{NR}^5\text{R}^6$ can, for example, be prepared by reductive amination, that is, by reacting the appropriate diamine with an aldehyde in reducing conditions.

15

Alternatively, such compounds in which R is $-(\text{CH}_2)_2\text{NR}^5\text{R}^6$ can be prepared by alkylation of the corresponding compound of formula (I) in which R^1 is hydrogen.

20

As mentioned above, the compounds of the invention are active in tests that indicate their utility in the treatment of diseases of the central nervous system. The compounds modulate the activity of calcium channels 25 and, in particular, they block voltage sensitive calcium

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channels as determined in a test based on Boot J. R., et al., Specificity of autoantibodies in the Lambert-Eaton Myasthenic Syndrome, Ann NY Acad. Sci. (1997), in which measurements of calcium flux using calcium sensitive dyes are made. Compounds described in the following Examples were found to inhibit voltage-dependent calcium channels in cloned human cell lines expressing specific voltage-dependent calcium channels with an IC₅₀ of less than 10 μM.

10

The compounds of the invention are thus indicated for use in the treatment of anoxia, ischaemia, stroke and heart failure, migraine, diabetes, cognitive impairment, pain, epilepsy, traumatic head or spinal injury, AIDS related dementia and blindness, amnesia, neurodegenerative diseases such as Alzheimer's, Parkinson's and Huntington's diseases and age-related memory disorders, Down's syndrome, mood disorders, drug or alcohol addition withdrawal, nausea from chemotherapy, and carbon monoxide or cyanide poisoning.

The invention also includes a pharmaceutical composition comprising a pharmaceutically acceptable diluent or carrier in association with the compound of the invention or a pharmaceutically acceptable salt or ester thereof.

The compound may be administered by various routes, for example by the oral or rectal route, topically or parenterally, for example by injection or infusion, 5 being usually employed in the form of a pharmaceutical composition. Such compositions are prepared in a manner well known in the pharmaceutical art and comprise at least one active compound. In making the compositions of the present invention, the active ingredient will 10 usually be mixed with a carrier, or diluted by a carrier, and/or enclosed within a carrier which may, for example, be in the form of a capsule, sachet, paper or other container. When the carrier serves as a diluent, it may be a solid, semi-solid, or liquid material which 15 acts as a vehicle, excipient or medium for the active ingredient. Thus, the composition may be in the form of tablets, lozenges, sachets, cachets, elixirs, suspensions, ointments containing, for example, up to 10% by weight of the compound, soft and hard gelatin 20 capsules, suppositories, injection solutions and suspensions and sterile packaged powders.

Some examples of suitable carriers are lactose, dextrose, sucrose, sorbitol, mannitol, starches, gum 25 acacia, calcium phosphate, alginates, tragacanth, gelatin, syrup, methyl cellulose, methyl- and propyl-hydrobenzoate, talc magnesium stearate and mineral oil. The compositions of the injection may, as is well known

in the art, be formulated so as to provide quick, sustained or delayed release of the active ingredient after administration to the patient.

5 Where the compositions are formulated in unit dosage form, it is preferred that each unit dosage form contains from 5 mg to 500 mg. The term 'unit dosage form' refers to physically discrete units suitable as unit dosages for human subjects and animals, each unit
10 containing a predetermined quantity of active material calculated to produce the desired therapeutic effect, in association with the required pharmaceutical carrier.

The active compound is effective over a wide dosage range and, for example, dosages per day will normally fall within the range of from 0.5 to 300 mg/kg, more usually in the range of from 5 to 100 mg/kg. However, it will be understood that the amount administered will be determined by the physician in the light of the relevant circumstances including the conditions to be treated, the choice of compound to be administered and the chosen route of administration, and therefore the above dosage ranges are not intended to limit the scope of the invention in any way.

25

The invention is illustrated by the following Preparations and Examples.

EXAMPLE 1

5 4-(N,N-dipropylaminosulfonyl)-N-benzyl-benzamide

To 50-100 mg polyvinylpyridine was added a 25 mM solution of benzylamine in chloroform (1 ml), followed by a 37.5 mM solution of 4-(N,N-dipropylaminosulfonyl)-10 benzoyl chloride in chloroform (1 ml). The mixture was shaken at room temperature for 4 hours.

Aminomethylpolystyrene (100 mg, 0.1 mmole) was added and shaking continued for a further 16.5 hours. The mixture was then filtered and the resin washed with chloroform 15 (2 x 2 ml). The combined filtrates were vacuum evaporated to give the required product. (TS-MS: m/z 375, [M+H]⁺)

The following compounds were similarly prepared (mass 20 spectrum values are given in brackets).

Thermospray Mass Spectrum values

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| | 4-(N,N-Dipropylaminosulfonyl)-N-3,4-dimethoxybenzyl-benzamide | (435) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-3,5-dimethoxybenzyl-benzamide | (435) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-3-methoxybenzyl-benzamide | (405) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-3,4,5-trimethoxybenzyl-benzamide | (465) |
| 5 | 4-(N,N-Dipropylaminosulfonyl)-N-4-chlorobenzyl-benzamide | (409/410) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-4-trifluoromethylbenzyl-benzamide | (443) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-4-dimethylaminobenzyl-benzamide | (418) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-4-methylbenzyl-benzamide | (389) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-3-chlorobenzyl-benzamide | (409/410) |
| 10 | 4-(N,N-Dipropylaminosulfonyl)-N-3-methylbenzyl-benzamide | (389) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-3-trifluoromethylbenzyl-benzamide | (443) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-3,5-difluoromethylbenzyl-benzamide | (411) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-2,6-dimethoxybenzyl-benzamide | (435) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-2-methylbenzyl-benzamide | (389) |
| 15 | 4-(N,N-Dipropylaminosulfonyl)-N-2-chlorobenzyl-benzamide | (409/410) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-2-methoxybenzyl-benzamide | (405) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-2-trifluoromethylbenzyl-benzamide | (443) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-3,4-dimethylbenzyl-benzamide | (403) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-2,6-dichlorobenzyl-benzamide | (444) |
| 20 | 4-(N,N-Dipropylaminosulfonyl)-N-4-methoxyphenethyl-benzamide | (419) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-phenethyl-benzamide | (389) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-3-methoxyphenethyl-benzamide | (419) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-4-nitrophenethyl-benzamide | (434) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-2-phenylpropyl-benzamide | (403) |
| 25 | 4-(N,N-Dipropylaminosulfonyl)-N-4-chlorophenethyl-benzamide | (423/424) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-4-methylphenethyl-benzamide | (403) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-2-methoxyphenethyl-benzamide | (419) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-2-chlorophenethyl-benzamide | (423/424) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-3-trifluoromethylphenethyl-benzamide | (457) |
| 30 | 4-(N,N-Dipropylaminosulfonyl)-N-hexyl-benzamide | (369) |
| | 4-(N,N-Dipropylaminosulfonyl)-N-2-methylbutyl-benzamide | (355) |

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| | 4- (4-N,N-Dipropylaminosulfonyl)benzoylmorpholine | (355) |
| | 2- (4-N,N-Dipropylaminosulfonyl)benzoyl-6,7-dimethoxy-tetra-hydroisoquinoline | (461) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-3-methoxypropyl-benzamide | (357) |
| 5 | 4- (N,N-Dipropylaminosulfonyl)-N-2-methylpropyl-benzamide | (355) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-cyclohexylmethyl-benzamide | (381) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-cyclohexyl-benzamide | (367) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-cyclopentyl-benzamide | (353) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-pentyl-benzamide | (355) |
| 10 | 4- (N,N-Dipropylaminosulfonyl)-N-3-methylbutyl-benzamide | (355) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-3-phenylpropyl-benzamide | (403) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-4- <i>tert</i> .butylcyclohexyl-benzamide | (423) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-4-phenylbutyl-benzamide | (417) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-1-aminopropylpyrrolidine | (396) |
| 15 | 4- (N,N-Dipropylaminosulfonyl)-N-3-methylcyclohexyl-benzamide | (381) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-1-benzyl-4-aminoperidine | (458) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-cyclopropylmethyl-benzamide | (339) |
| | 4- (N,N-Dipropylaminosulfonyl)-N-butyl-benzamide | (341) |

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EXAMPLE 2

4- (N,N-dipropylaminosulfonyl)-N-4-methoxybenzyl-benzamide

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A mixture of a 75 mM solution of 4-methoxybenzylamine in chloroform (0.5 ml), a 75 mM solution of N-(dimethylaminopropyl)-N'-ethylcarbodiimide hydrochloride in chloroform (0.5 ml) and a 50 mM

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solution of 4-(N,N-dipropylaminosulfonyl)-benzoic acid in chloroform (0.5 ml) was stirred at room temperature for 17 hours. Methanol (0.5 ml) was added with stirring and the solution applied to a methanol-washed 500 mg SCX 5 solid phase extraction (SPE) cartridge. The cartridge was washed with methanol (4 ml) and the combined eluates vacuum evaporated to give the required product. (TS-MS: m/z 405, $[M+H]^+$).

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EXAMPLE 3

4-(N,N-dibutylaminosulfonyl)-N-4-methoxybenzyl-benzamide

15 A mixture of a 200 mM solution of dibutylamine in acetonitrile (0.5 ml) and a 25 mM solution of 4-chlorosulfonylbenzoic acid in acetonitrile (1 ml) was stirred at room temperature for 18 hours. Methanol (1 ml) was then added with stirring and the solution 20 applied to a methanol-washed 500 mg SCX SPE cartridge. The cartridge was washed with methanol (4 ml) and the combined eluates vacuum evaporated. The residue was dissolved in dichloromethane (1 ml) and a 75 mM solution of 4-methoxybenzylamine in chloroform (0.5 ml) and a 25 75 mM solution of N-(dimethylaminopropyl)-N'-ethylcarbodiimide hydrochloride in chloroform (0.5 ml)

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added. This mixture was stirred at room temperature for 17 hours. Methanol (0.5 ml) was added with stirring and the solution applied to a methanol-washed 500 mg SCX SPE cartridge. The cartridge was washed with methanol 5 (4 ml) and the combined eluates vacuum evaporated to give the required product. (TS-MS: m/z 433, [M+H]⁺)

The following compounds were prepared similarly.

| | | Thermospray Mass Spectrum values |
|----|---|----------------------------------|
| 10 | 4- (N-pentylaminosulfonyl)-N-4-methoxybenzyl-benzamide | (391) |
| 15 | 4- [N- (3-methylcyclohexyl)aminosulfonyl]-N-4-methoxybenzyl-benzamide | (417) |
| | 4- [(N-butyl-N-propyl)aminosulfonyl]-N-4-methoxybenzyl-benzamide | (419) |
| | 4- [N- (3,5-dimethylpiperidin-1-yl)aminosulfonyl]-N-4-methoxybenzyl-benzamide | (417) |
| | 4- [(N-diisobutyl)aminosulfonyl]-N-4-methoxybenzyl-benzamide | (433) |
| | 4- [N- (3-methylpiperidin-1-yl)aminosulfonyl]-N-4-methoxybenzyl-benzamide | (403) |
| 20 | 4- [(N-methylbutyl)aminosulfonyl]-N-4-methoxybenzyl-benzamide | (405) |
| | 4- [(4-methylpiperidin-1-yl)aminosulfonyl]-N-4-methoxybenzyl-benzamide | (403) |
| | 4- [(3,3-dimethylpiperidin-1-yl)aminosulfonyl]-N-4-methoxybenzyl-benzamide | (417) |
| | 4- [(N-cyclopropyl-N-propylmethyl)aminosulfonyl]-N-4-methoxybenzyl-benzamide | (417) |

25

EXAMPLE 4

3- (N,N-dipropylaminosulfonyl)-N-3,4-dimethoxyphenethyl-benzamide

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A mixture of a 200 mM solution of dipropylamine in acetonitrile (0.5 ml) and a 25 mM solution of 3-chlorosulfonylbenzoic acid in acetonitrile (1 ml) was stirred at room temperature for 18 hours. Methanol 5 (1 ml) was then added with stirring and the solution applied to a methanol-washed 500 mg SCX SPE cartridge. The cartridge was washed with methanol (4 ml) and the combined eluates vacuum evaporated. The residue was dissolved in dichloromethane (1 ml) and a 75 mM solution 10 of 3,4-dimethoxyphenethylamine in chloroform (0.5 ml) and a 75 mM solution of N-(dimethylaminopropyl)-N'-ethylcarbodiimide hydrochloride in chloroform (0.5 ml) added. This mixture was stirred at room temperature for 17 hours. Methanol (0.5 ml) was added with stirring and 15 the solution applied to a methanol-washed 500 mg SCX SPE cartridge. The cartridge was washed with methanol (4 ml) and the combined eluates vacuum evaporated to give the required product. (TS-MS: m/z 449, [M+H]⁺)

20

EXAMPLE 5

(1) 4-[(N,N-di-n-propylamino)sulfonyl]-benzoic acid

25 To a stirred solution of di-n-propylamine (3.03 g, 0.03 mole) in dry tetrahydrofuran (20 ml) at 0° C.

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(ice/salt bath), was added 4-chlorosulfonylbenzoic acid (2.2 g, 0.01 mole). Stirring was continued for 1 hour. Ice water was added cautiously and the reaction made acid with 2NHCl. The 4-[(N,N-di-n-
5 propylamino)sulfonyl]-benzoic acid was collected by filtration as a white solid which was dried *in vacuo* at 40° C.

Similarly prepared were:

10

3-[(N,N-di-n-propylamino)sulfonyl]-benzoic acid

4-[(N-phenyl-N-n-propylamino)sulfonyl]-benzoic acid

4-[(N-phenyl-N-n-allylamino)sulfonyl]-benzoic acid

3-[N-(3,3-dimethylpiperidin-1-yl)sulfonyl]-benzoic acid

15 4-[N-(3,3-dimethylpiperidin-1-yl)sulfonyl]-benzoic acid

4-[(N-phenyl-N-n-butylamino)sulfonyl]-benzoic acid

3-[(N-phenyl-N-n-propylamino)sulfonyl]-benzoic acid

3-[N-(3-ethylpiperidin-1-yl)sulfonyl]-benzoic acid

3-[(N-phenyl-N-methyl)sulfonyl]-benzoic acid

20 4-[N-(3-methylpiperidin-1-yl)sulfonyl]-benzoic acid

(2) 4-[(N-di-n-propylamino)sulfonyl]-N-4-methoxybenzyl-
benzamide

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To a solution of 4-[(N,N-di-n-propylamino)sulfonyl]-benzoic acid (2.85 g, 0.01 mole) in dry dichloromethane (ml) at 0° C. was added oxalyl chloride (2.54 g, 0.02 mole) and dimethylformamide (4 drops). The 5 reaction mixture was stirred for 2 hours. The reaction was evaporated to dryness *in vacuo*. The resulting acid chloride was added to a stirred solution of *p*-methoxybenzylamine (1.51 g, 0.011 mole) and triethylamine (1.11 g, 0.011 mole) in dry 10 tetrahydrofuran (25 ml) at 0-5° C. After stirring for 4 hours the reaction was poured into ice water and extracted with ethyl acetate. The solvent was washed with brine, dried and evaporated to dryness *in vacuo*. Chromatography on flash silica using 10% ethyl 15 acetate/dichloromethane gave 4-[(N,N-di-n-propylamino)sulfonyl]-N-4-methoxybenzyl-benzamide as a white solid. M.p. 132-134° C.

Similarly prepared were:

20 3-[(N,N-di-n-propylamino)sulfonyl]-N-4-methoxybenzyl-benzamide. M.p. 132-134° C.

4-[(N-phenyl-N-n-propylamino)sulfonyl]-N-4-methoxybenzyl-benzamide. M.p. 112-114° C.

25 4-[(N-phenyl-N-n-butylamino)sulfonyl]-N-n-hexyl-benzamide. M.p. 84-86° C.

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4- [(N-phenyl-N-n-allylamino)sulfonyl]-N-n-hexyl-benzamide. M.p. 90-92° C.

4- [(N-phenyl-N-n-propylamino)sulfonyl]-N-n-hexyl-benzamide. M.p. 92-94° C.

5 3- [N- (3,3-dimethylpiperidin-1-yl)sulfonyl]-N-4-fluorobenzyl-benzamide. M.p. 125° C.

4- [N- (3,3-dimethylpiperidin-1-yl)sulfonyl]-N-4-fluorobenzyl-benzamide. M.p. 138-140° C.

3- [(N,N-di-n-propylamino)sulfonyl]-N-4-fluorobenzyl-

10 benzamide. M.p. 84-86° C.

N-methyl-3- [N- (3,3-dimethylpiperidin-1-yl)sulfonyl]-N-4-fluorobenzyl-benzamide. M.p. <50° C.

N-benzyl-3- [N- (3,3-dimethylpiperidin-1-yl)sulfonyl]-N-4-fluorobenzyl-benzamide. M.p. 112° C.

15 4- [(N-phenyl-N-n-butylamino)sulfonyl]-N-4-fluorobenzyl-benzamide. M.p. 128-130° C.

3- [(N-phenyl-N-n-propylamino)sulfonyl]-N-4-fluorobenzyl-benzamide. M.p. 99° C.

4- [(3,3-dimethylpiperidin-1-yl)sulfonyl]-N- (2- { [(4-

20 fluorophenyl)methyl] amino}ethyl)benzamide. Maleate. M.p. 132-134° C.

3- [N- (3-ethylpiperidin-1-yl)sulfonyl]-N-4-fluorobenzyl-benzamide. 405 (M+H)⁺

N- [2- (dimethylamino)ethyl]-3- [(3,3-dimethylpiperidin-1-

25 yl)sulfonyl]-N-4-fluorobenzyl-benzamide maleate. M.p. 126° C.

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N-[2-(dimethylamino)ethyl]-3-[(3,3-dimethylpiperidin-1-yl)sulfonyl]-*N*-cyclohexylmethyl-benzamide. M.p. 122° C.

N-[2-(dimethylamino)ethyl]-4-[(N-phenyl-*N*-n-propylamino)sulfonyl]-*N*-cyclohexylmethyl-benzamide

5 maleate. M.p. 140-142° C.

N-[2-(pyrrolidino)ethyl]-3-[(3,3-dimethylpiperidin-1-yl)sulfonyl]-*N*-isoamyl-benzamide hydrochloride. M.p. 179° C.

10 *N*-[2-(pyrrolidino)ethyl]-4-[(3-ethylpiperidin-1-yl)sulfonyl]-*N*-isoamyl-benzamide malea. M.p. 166-168° C.

N-[3-(pyrrolidino)propyl]-3-[(3,3-dimethylpiperidin-1-yl)sulfonyl]-*N*-isoamyl-benzamide hydrochloride. M.p. 155° C.

15 *N*-[3-(pyrrolidino)propyl]-3-[(3,3-dimethylpiperidin-1-yl)sulfonyl]-*N*-cyclohexylmethyl-benzamide. M.p. 124° C.

N-[2-(*N*-methyl-pyrrolidin-2-yl)ethyl]-3-[(3,3-dimethylpiperidin-1-yl)sulfonyl]-*N*-isoamyl-benzamide maleate. M.p. 115-117° C.

20 *N*-[2-(piperidin-1-yl)ethyl]-3-[(3-methylpiperidin-1-yl)sulfonyl]-*N*-(2-4-methoxyphenethyl)-benzamide. M.p. 210° C.

N-[2-(piperidin-1-yl)ethyl]-3-[(3-methylpiperidin-1-yl)sulfonyl]-*N*-(2-4-methoxyphenethyl)-benzamide

25 hydrochloride. M.p. 205° C.

The following Examples illustrate typical formulations containing a compound of the invention.

5

EXAMPLE 6

Tablets each containing 10 mg of active ingredient are made up as follows:

10

| | |
|---|--------|
| Active ingredient | 10 mg |
| Starch | 160 mg |
| Microcrystalline cellulose | 100 mg |
| Polyvinylpyrrolidone (as 10% solution in water) | 13 mg |
| 15 Sodium carboxymethyl starch | 14 mg |
| Magnesium stearate | 3 mg |
| <hr/> | |
| Total | 300 mg |
| <hr/> | |

20

The active ingredient, starch and cellulose are mixed thoroughly. The solution of polyvinylpyrrolidone is mixed with the resultant powders and passed through a sieve. The granules so produced are dried and re-passed 25 through a sieve. The sodium carboxymethyl starch and magnesium stearate are then added to the granules which,

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after mixing, are compressed on a tablet machine to yield tablets each weighing 300 mg.

EXAMPLE 7

5

Capsules each containing 20 mg of active ingredient are made as follows:

| | | |
|----|--------------------|--------|
| | Active ingredient | 20 mg |
| 10 | Dried starch | 178 mg |
| | Magnesium stearate | 2 mg |
| | | _____ |
| | Total | 200 mg |
| | | _____ |

15

The active ingredient, starch and magnesium stearate are passed through a sieve and filled into hard gelatine capsules in 200 mg quantities.

20

EXAMPLE 8

Capsules each containing 20 mg of medicament are made as follows:

25

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| | | |
|---|--------------------------|--------|
| | Active ingredient | 20 mg |
| | Lactose | 171 mg |
| | Sodium lauryl sulphate | 2 mg |
| | Sodium starch glycollate | 6 mg |
| 5 | Magnesium stearate | 1 mg |
| | | _____ |
| | | 200 mg |
| | | _____ |

10 The active ingredient, lactose, sodium lauryl sulphate and sodium starch glycollate are mixed thoroughly. The blend is mixed with the magnesium stearate and filled into hard gelatine capsules in 200 mg quantities.

15 EXAMPLE 9

Tablets each containing 20 mg and medicaments are made as follows:

| | | |
|----|------------------------------|--------|
| 20 | Active ingredient | 20 mg |
| | Lactose | 103 mg |
| | Microcrystalline cellulose | 150 mg |
| | Hydroxypropylmethylcellulose | 15 mg |
| | Sodium starch glycollate | 9 mg |
| 25 | Magnesium stearate | 3 mg |

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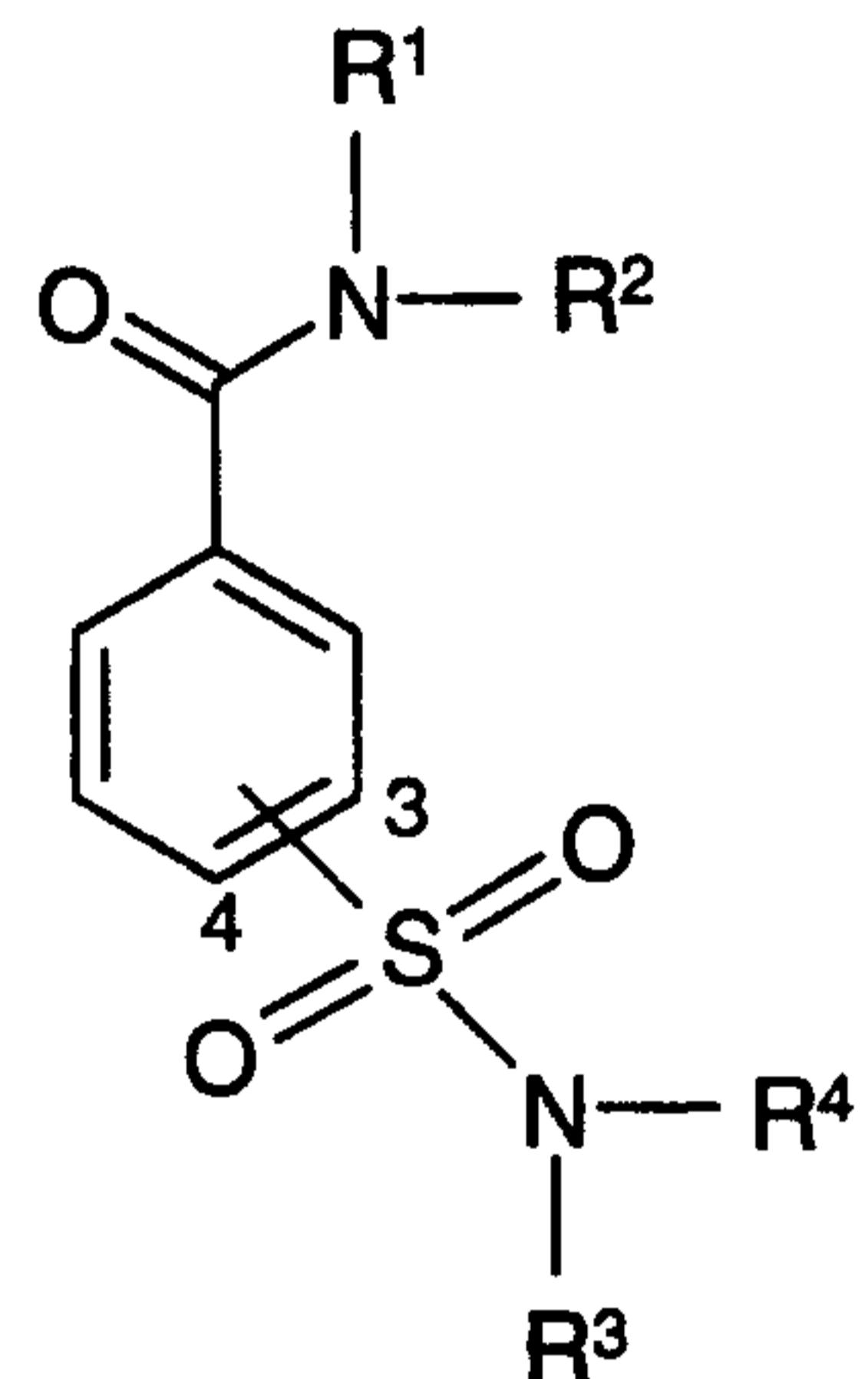
300 mg

5 The active ingredient, lactose, microcrystalline cellulose, sodium starch glycollate and hydroxypropylmethylcellulose are passed through a sieve and blended together. Water is added to the blended powders to form a damp mass. The damp mass is passed

10 through a coarse screen, dried, then re-screened. The dried granules are mixed with the magnesium stearate and compressed into tablets of 300 mg weight.

CLAIMS

1. A compound of the formula



5

in which the aminosulfonyl group is attached at the
3- or 4-position, and in which

10 R¹ is hydrogen, C₁-6 alkyl, C₃-10 cycloalkyl, C₃-10
cycloalkyl-C₁-4 alkyl or optionally substituted
phenyl-C₁-4 alkyl,

15 R² is C₁-6 alkyl, C₃-10 cycloalkyl, C₃-10
cycloalkyl-C₁-4 alkyl, optionally substituted
phenyl-C₁-4 alkyl or -(CH₂)₂NR⁵R⁶ where R⁵ and R⁶
are each hydrogen or C₁-6 alkyl, and

R³ and R⁴ are each C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl,
C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl, C₃₋₆ alkenyl,
optionally substituted phenyl or optionally
5 substituted phenyl-C₁₋₄ alkyl,

or R¹ and R², or R³ and R⁴, or R⁵ and R⁶, together
with the nitrogen atom to which they are attached,
form a carbocyclic group containing 4 to 7 carbon
10 atoms optionally substituted with one to three
methyl or ethyl groups and optionally containing an
oxygen atom or a further nitrogen atom, said
carbocyclic group being optionally fused to an
optionally substituted phenyl group;

15
or a salt thereof.

2. A compound according to Claim 1 in which R¹, R², R³
and R⁴ are each C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀
20 cycloalkyl-C₁₋₄ alkyl or optionally substituted
phenyl-C₁₋₄ alkyl, and R¹ can in addition be
hydrogen, or R¹ and R², or R³ and R⁴ together with
the nitrogen atom to which they are attached, form
a carbocyclic group.

3. A compound according to Claim 2 in which R¹, R², R³ and R⁴ are each C₁₋₆ alkyl, C₃₋₁₀ cycloalkyl, C₃₋₁₀ cycloalkyl-C₁₋₄ alkyl or optionally substituted phenyl-C₁₋₄ alkyl, and R¹ can in addition be 5 hydrogen.

4. A compound according to Claim 3 in which R¹ is hydrogen, R² is optionally substituted phenyl-C₁₋₄ 10 alkyl and R³ and R⁴ are C₁₋₆ alkyl.

5. A compound according to Claim 1 in which R² is -(CH₂)₂NR⁵R⁶.

15 6. A compound according to Claim 1 or 5 in which R³ or R⁴ is C₃₋₆ alkyl or when R³ and R⁴ are taken together with the nitrogen atom they form a piperidine ring which is substituted at the 3- and/or 5-positions with one or two methyl or ethyl 20 substituents.

7. A pharmaceutical formulation comprising a compound according to any of Claims 1 to 6 or a

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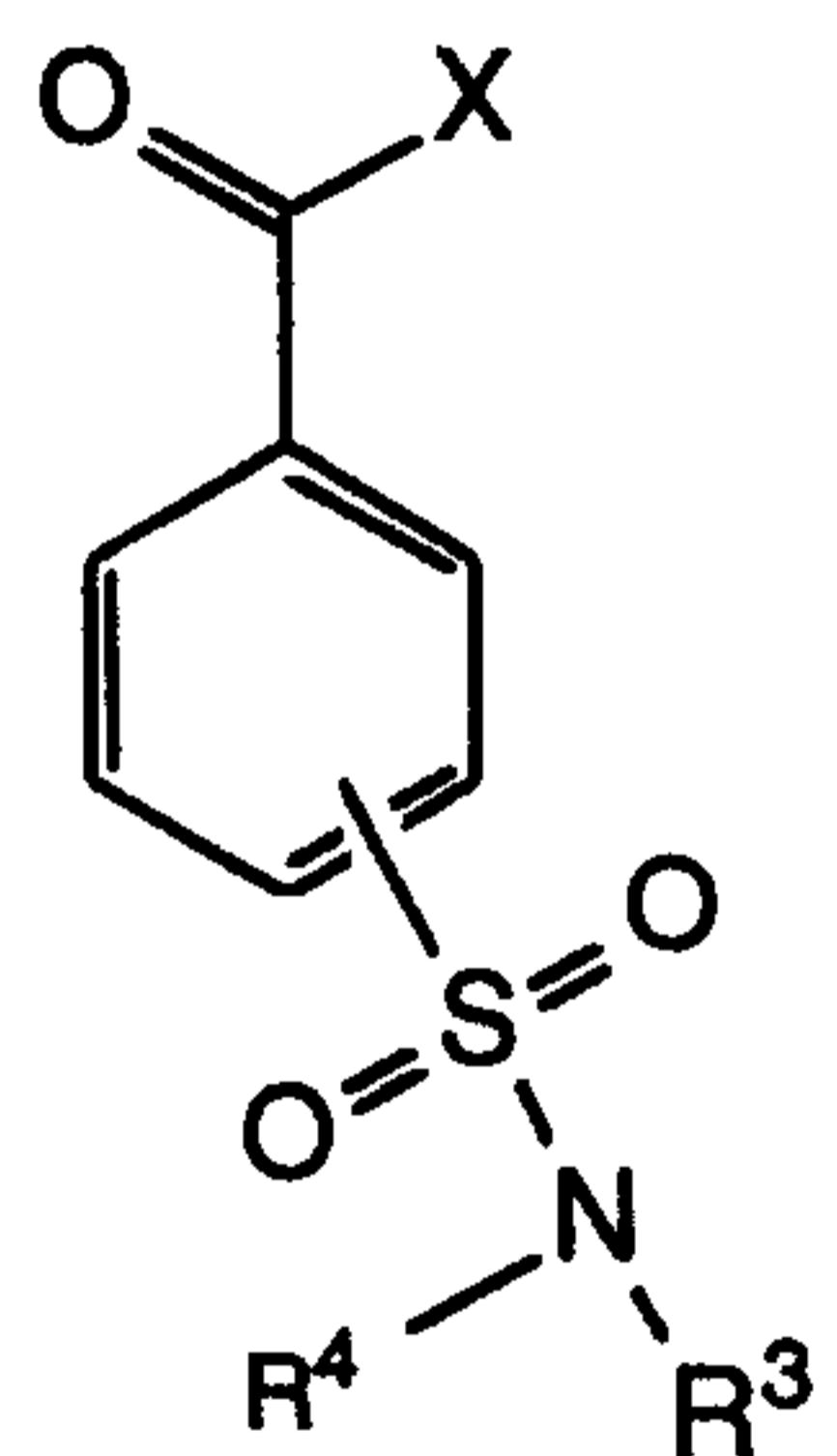
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pharmaceutically acceptable salt thereof, together with a diluent or carrier therefor.

8. A compound according to any of Claims 1 to 6, for
5 use as a pharmaceutical.

9. Use of a compound according to any of Claims 1 to
6, in the manufacture of a medicament for treating
a disease of the central nervous system.

10. 10. A process for producing a compound according to
Claim 1, which comprises reacting a compound of the
formula



15

(II)

where X is a leaving group, with an amine of the formula HNR¹R².

