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(72) Inventor: **Klinke, Norbert**
6440 Augustenborg (DK)

(74) Representative: **Pedersen, Soeren Skovgaard**
Linak A/S
Patent Department
P.O. Box 238
9100 Aalborg (DK)

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(71) Applicant: **LINAK A/S**
DK-6430 Nordborg (DK)

(54) **Lifting column preferably for furniture such as tables and beds**

(57) A lifting column, in particular for furniture, such as tables and beds, comprises at least two mutually telescopically slidable members (1, 2). A spindle (4) is secured at the end of one member (1), while a spindle nut (8) is connected with the adjacent end of the other member (2). The spindle nut may be caused to rotate by an electric motor (6) via a transmission (7) to bring about the telescopic displacement of the members (1, 2). The structure is advantageous in that a favourable ratio of the stroke to the mounting height of the column may be provided. Further, a good overlap may be achieved between the two members (1, 2) in the fully extended position of the column, which enhances the stability of the column. The structure additionally provides the possibility of arranging power supply and control electronics in one member.

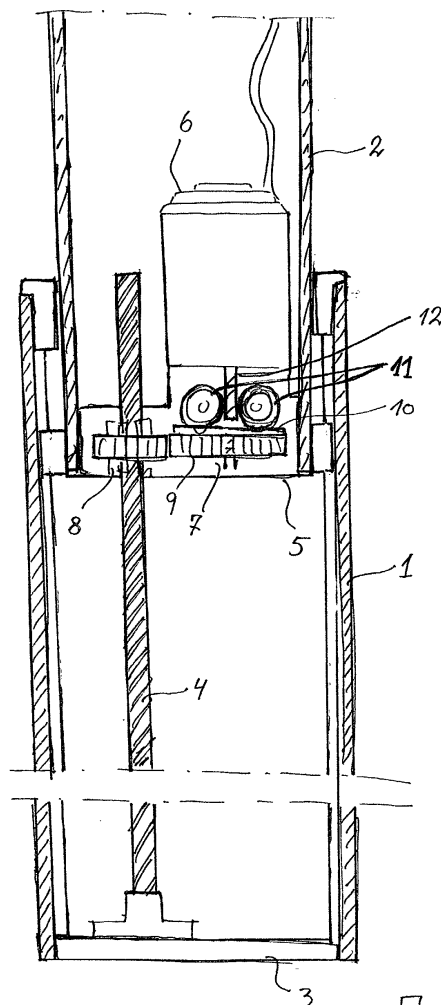


Fig. 1

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Description

[0001] The present invention relates to a lifting column of the type stated in the introductory portion of claim 1.

[0002] For the description of the invention lifting columns for height-adjustable tables are chosen as a basis. The columns consist of two or three mutually telescopically slidable tubular profile members. An electrically driven linear actuator, concealed within the column, is typically used as a drive unit. The actuators are of the type which is based on a spindle driven by an electric motor. A tubular drive rod is connected with a spindle nut, and rotation of the spindle causes the drive rod to be extended or retracted depending on the direction of rotation of the spindle. The stroke of the actuator is directly related to its mounting dimensions, which involves a conflict between the mounting dimensions of the column and the desired minimum and maximum height of the column. In reality, the achievable maximum and minimum height is a compromise where each millimetre in mounting dimensions and stroke counts. The internal position of the actuator has a further adverse influence on the minimum/maximum height ratio.

[0003] To achieve sufficient stability of the columns, it is necessary to have an overlap of a certain length between the members. Other things being equal, a large overlap gives a more stable column, while a small overlap causes the column to be more unstable. This then involves a further compromise, viz. a compromise between mounting dimension, stroke and overlap. Particularly in case of desks where the tabletop with PCs and other equipment is carried by a single column positioned centrally at one long side of the table, a very great stability of the column is required.

[0004] Another factor is the entire electrical equipment which typically consists of a control box containing a low volt power supply (DC 24V/48V) based on a transformer and a control device. The wiring is rather comprehensive, as the control box is wired to the mains and is connected to the actuator as well as a control panel. Usually, the control box is placed below the tabletop, and therefore it is necessary to take measures against electrical and magnetic impacts from there in order to avoid impacts on equipment positioned on the tabletop. Alternatively, the control box is placed loosely on the floor, which is obviously not satisfactory.

[0005] The object of the invention is to improve the ratio of mounting dimension to stroke of the column as well as its stability.

[0006] This is possible with a column according to the invention which is characterized in that the spindle is secured at the end of one member, that the spindle nut is connected with the adjacent end of the other member, and that the spindle nut may be caused to rotate by the motor via a transmission to bring about telescopic displacement of the members. Hereby, it is possible to achieve an improved ratio of mounting dimension to

stroke and also a reasonable overlap between the two members. A further advantage is that the electrical equipment may be arranged in the member with the motor. The column may thus be finish-mounted at the factory, and moreover it has advantages in terms of electrical and magnetic shielding to place power supply and control enclosed in a metallic tube.

[0007] In an embodiment, the motor is arranged with the motor shaft in parallel with the spindle, which allows a column of slim cross-section.

[0008] In another embodiment, the motor is arranged with the motor shaft perpendicular to the spindle. This gives a lower mounting height, but it requires a larger cross-section of the column in the longitudinal extent of the motor. The embodiment makes it directly possible to use a worm drive in the transmission. This is reliable and gives a good gearing down of the motor speed, just as it involves a low level of noise.

[0009] In an embodiment, the spindle is secured at the end of the outer member, while the motor and the transmission as well as the spindle nut are arranged in the movable member. The outer member may be arranged at the bottom, i.e. stationary, while the inner member may move out and in. Conversely, the inner member may be arranged at the bottom, i.e. stationary, while the outer member moves up and down this.

[0010] In an embodiment, the column comprises three members, and the motor and the transmission are secured at the end of the inner member. Seated here is also the spindle nut which cooperates with a hollow spindle that extends through the intermediate member and is secured at the opposite end thereof. A spindle is secured at the remote end of the outer member, and this spindle is seated in the hollow spindle and cooperates with a spindle nut.

[0011] As part of the transmission from the motor to the spindle nut, the spindle nut may be formed with a gear wheel, expediently having an internal toothing. Nut and gear wheel may be moulded of plastics as an integral unit.

[0012] In another embodiment, the spindle nut is coupled to the side of a separate gear wheel. The end face of the nut may e.g. be formed with pins that extend into holes in the side of the gear wheel, or vice versa. The engagement faces may also be provided with carrier teeth. The gear wheel may also have a cylindrical portion in which the nut is seated completely or partly and is coupled by means of a splined connection.

[0013] In an embodiment, the spindle nut or another cylindrical element in the transmission is provided with a helical spring, whose one end is fixed in the structure, and whose turns extend such that the spring exerts a braking force when the column is retracted. It is hereby possible to impart a self-blocking capability to the column or to increase its self-blocking capability when it is lowered. The braking effect of the spring is determined empirically on the basis of the given purpose.

[0014] As mentioned in the foregoing, the power sup-

ply and/or the control electronics may be arranged inside the column. In an embodiment, it is arranged in the member with the motor. If the transformer may be arranged deep inside the member, it is possible to use a simple form of transformer, since it is well shielded, because the top of the column will typically be covered by an iron plate which is used as a mounting bracket for the column. Where, nevertheless, it is desired to use a ring core transformer, this may be arranged such that the spindle may pass through its inner opening.

[0015] An embodiment of the invention will be described more fully below with reference to the accompanying schematic diagrams, in which:

Fig. 1 shows a longitudinal section through a first embodiment of the column,

fig. 2 shows a longitudinal section through a second embodiment of the column,

fig. 3 shows a cross-section of the column, seen from above,

fig. 4 shows an exploded view of the end bottom of the inner tube,

fig. 5 shows a longitudinal section through a column having three members.

[0016] The column comprises an outer tube 1 and an inner tube 2 telescopically mounted in the outer tube. The outer tube has an end bottom 3 to which a spindle 4 is secured with its end. At the adjacent end of the inner tube there is an end bottom 5 that forms the chassis for an electric motor 6, a transmission 7 and a spindle nut 8. The spindle nut is provided with an external toothing which is in engagement with a gear wheel 9 in the transmission. A toothing 10 is provided on the side of the gear wheel, said toothing engaging two diametrically positioned gear wheels 11. Further, a worm wheel is provided in extension of these two gear wheels, said worm wheel being engaged with a worm 12 from the motor 6. When the motor is started in one direction of rotation, the spindle nut 8 will rotate in one direction and move up the spindle 4 and thereby push the inner tube 2 out. When the direction of rotation of the motor is reversed, the spindle nut 8 will rotate in the other direction and will then move down the spindle 4, thereby retracting the inner tube 2. As will appear, the lifting height of the column may substantially be maximized to the length of the outer tube 1. Then, the size of the overlap may be chosen freely, depending on the desired stability of the column.

[0017] Fig. 2 of the drawing shows an embodiment in which the spindle nut 8 is coupled to the side of a gear wheel 13 in that the nut 8 has a protruding portion 14, which extends into an opening 15 in the centre of the gear wheel and is connected by a splined connection.

The nut is here additionally provided with a brake in the form of a helical spring 16 which, with its turns, is wound around a cylindrical part of the nut 8. The turns extend such that the spring exerts a braking effect in the inward movement of the inner tube 2, i.e. decelerates the speed when the column is lowered and additionally contributes to the self-blocking capability of the column in the positions in which the inner tube might be parked.

[0018] The end bottom 5 for the inner tube 2 is formed by two half shells 5a, 5b with a dividing line which extends through the spindle and the motor shaft. The end bottom passes like a plug up into the end of the inner tube and has an annular flange 17 for engagement with the end edge of the tube 2. The end bottom has a bore 18 for the spindle 14, and a bore 19 for the motor shaft is also provided at the top of the bottom. The end bottom has mounts for the spindle nut and various gear wheels in the transmission. The end bottom may be finish-mounted with nut, gear wheel and motor and be secured as a unit in the bottom of the inner tube 2.

[0019] In fig. 2, a control box 20 is indicated, which may merely be formed by a plastics sleeve without special strength, as it is protected in the inner tube 2. The plastics sleeve preferably has an external cross-section so that it fits precisely in the inner tube 2. The power supply is based on a ring core transformer 21 positioned such that the spindle can pass through the centre of it. The control electronics is indicated at 22.

[0020] In fig. 5 of the drawing, a column having three members 30, 31, 32 is indicated, where the motor 6 drives the nut 36 on the fixed spindle 35 via a hollow spindle 34, the reason being the considerably poorer efficiency of the hollow spindle 34 relative to the fixed spindle 35. When the intermediate member 31 is extended, the nut 34 on the hollow spindle 34 begins to rotate, and thereby the inner member 32 is extended.

[0021] The invention thus provides a compact and stable lifting column, and has incorporated power supply and control electronics in a special embodiment. In structures having two, optionally more columns, it is just one that is equipped with power supply and control electronics, while the others are wired to it.

Claims

1. A lifting column, in particular for furniture, such as tables and beds, comprising at least two mutually telescopically slidable members (1, 2) which are formed by rigid tube profiles, preferably extruded aluminium profiles, a spindle (4) in one member (1), and have arranged thereon a spindle nut (8), a reversible electric motor (6), a power supply (21) and control electronics (22) as well as an operating panel, **characterized in that** the spindle (4) is secured at the end of one member (1), that the spindle nut (8) is connected with the adjacent end of the other member (2), and that the spindle nut (8) may be

caused to rotate by the motor (6) via a transmission (7) to bring about the telescopic displacement of the members (1, 2).

2. A lifting column according to claim 1, **characterized in that** the motor (6) is arranged with the motor shaft in parallel with the spindle (4). 5
3. A lifting column according to claim 1, **characterized in that** the motor (6) is arranged with the motor shaft perpendicular to the spindle (4). 10
4. A lifting column according to claim 1, **characterized in that** the spindle (4) is secured at the end (1) of the outer member. 15
5. A lifting column according to claim 1, **characterized in that** the spindle nut (8) is provided with a gear wheel. 20
6. A lifting column according to claim 1, **characterized in that** the spindle nut (8) is coupled to the side of a gear wheel (13). 25
7. A lifting column according to claim 1, **characterized in that** the spindle nut (8) or another cylindrical element in the transmission is provided with a helical spring (16), whose end is fixed in the structure, and whose turns extend such that the spring exerts a braking force when the column is retracted. 30
8. A lifting column according to claim 1, **characterized in that** the transmission (7) comprises a worm drive. 35
9. A lifting column according to claim 1, **characterized in that** the power supply and/or the control electronics (21, 22) is arranged in the member (2) with the motor (6). 40
10. A lifting column according to claim 9, **characterized in that** the power supply comprises a ring core transformer (21), and that the ring core transformer is arranged such that the spindle (4) may pass through its inner opening. 45

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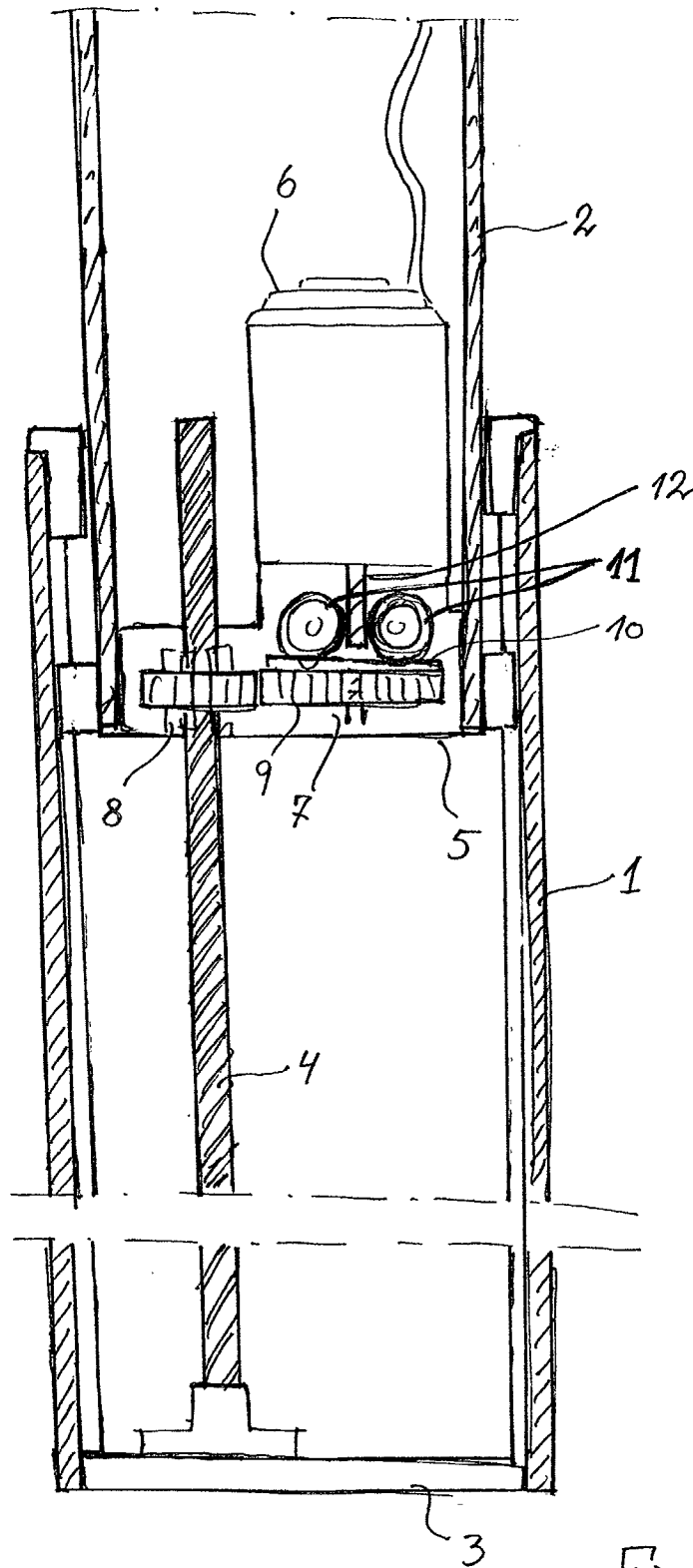
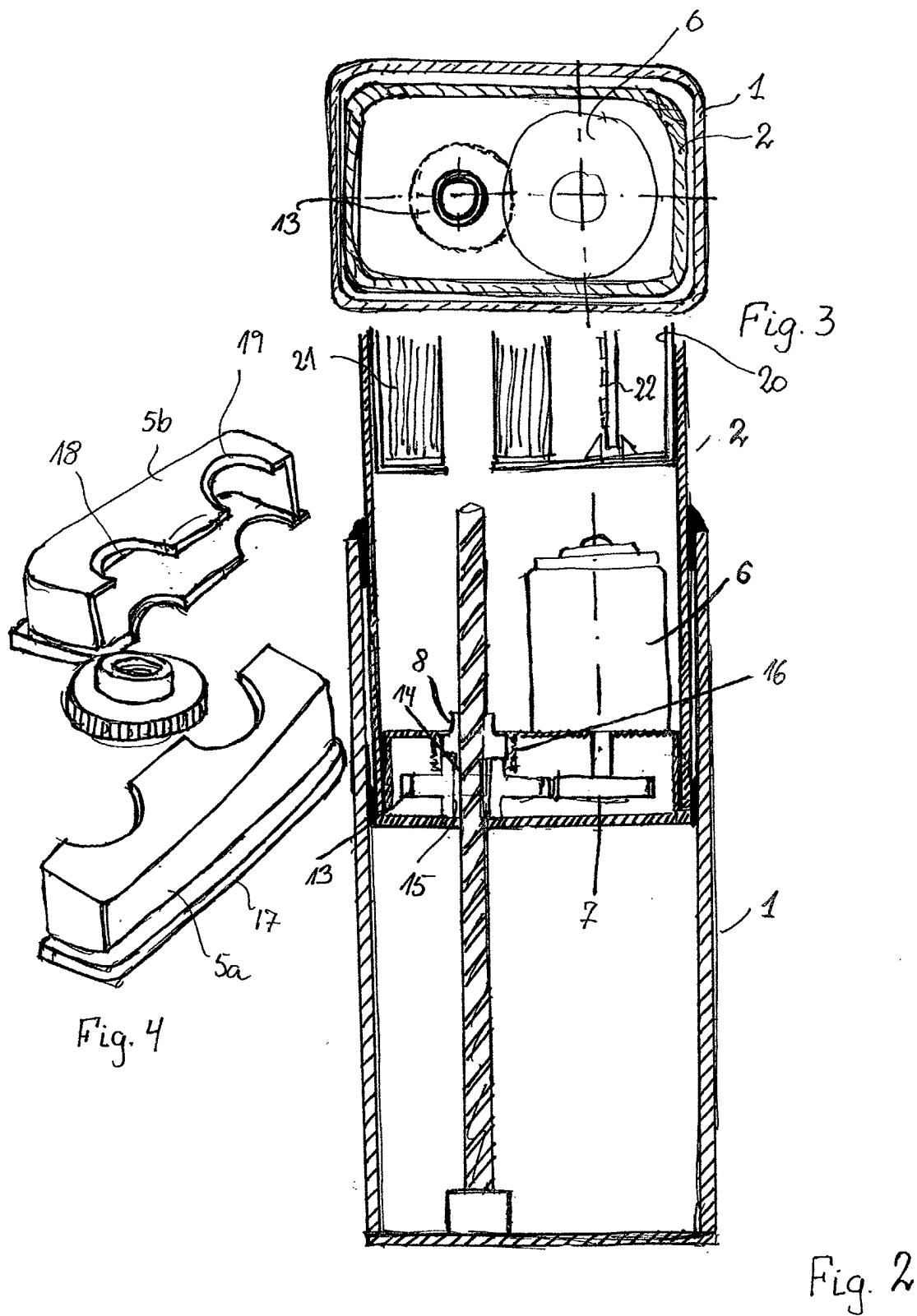


Fig. 1



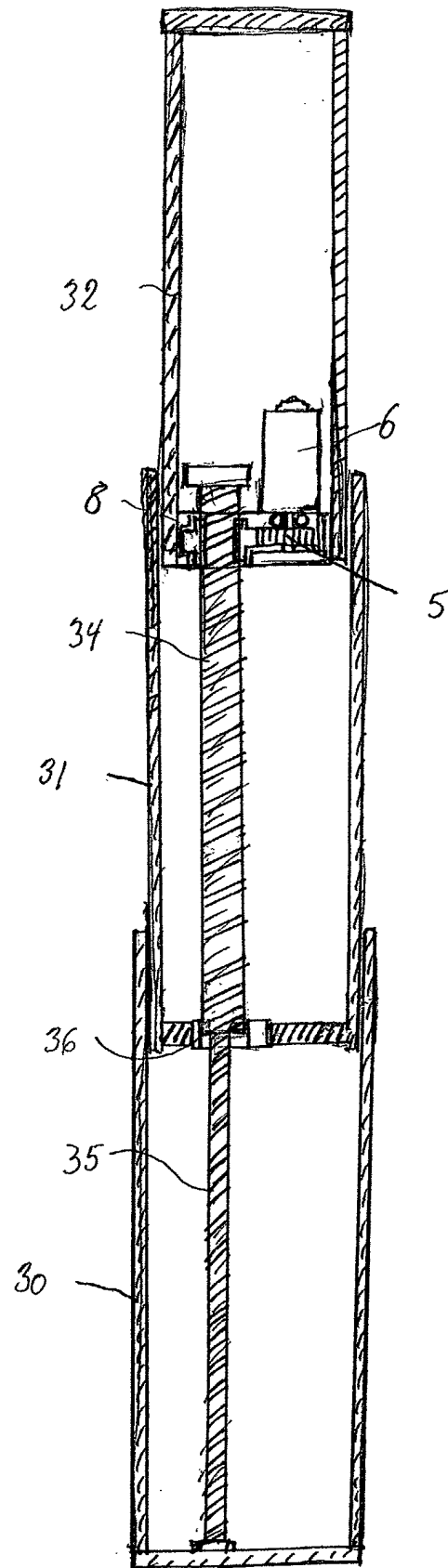


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 02 07 5543

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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27 May 2002	Examiner Ottesen, R
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 02 07 5543

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