(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 375 024 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **89203149.3**

(51) Int. Cl.5: **E05D 3/06**

(22) Date of filing: **08.12.89**

(30) Priority: **16.12.88 NL 8803086**

(43) Date of publication of application:
27.06.90 Bulletin 90/26

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(71) Applicant: **Koninklijke PTT Nederland N.V.**
P.O. Box 95321
NL-2509 CH The Hague(NL)

(72) Inventor: **Teunissen, Gerardus Maria Clemens**
374 Prins Johan Willem Frisolaan
NL-2263 EA Leidschendam(NL)

(54) Door hinge.

(57) The invention relates to a door hinge allowing the end of the door closing movement to be a perfect translatory motion after a substantially rotatory motion, and vice versa in the reversed movement when opening the door. Between two mounting parts (1) and (2) for the wall (17) and the door (18), respectively there is a connecting piece consisting of two parts, a first part of which consists of a hinging parallelogram formed by two parallel swivel links (6) and (7), which are pivotally connected on the one hand around pin-shaped axes (10) and (11) to the door mounting part (2) and on the other hand around pin-shaped axes (8) and (9) to a connecting link (3), which forms the second part of the connecting piece. This connecting link (3) is with its extended part swivellingly connected around a pin-shaped axis (4) to the wall mounting part (1), which comprises a curve disc (14) with a stop (14.1) and a cylinder-shaped curve path (14.2). The swivel link (7) comprises a guide roller (15) capable of co-operating with the curve disc (14) over the curve path (14.2). The guide roller (15) has been positioned in such a way that as soon as it reaches the curve path (14.2) the curve disc (14) will be clasped between the connecting link (3) and the guide roller (15), as a result of which the guide roller (15) can follow only the curve path (14.2), so that the closing movement will change over to a completely forced translatory motion.

EP 0 375 024 A1

Door hinge

A. Background of the invention

1. Field of the invention

The invention is in the field of hinge constructions for doors, and more in particular relates to a hinge for doors used for a sealing closing off of an opening in a wall, a sealing element being applied between the door and an edge determining the opening. Known applications of hinges of the latter type can be found for example in the field of the electromagnetic sealing and of the air and heat insulating sealings.

2. State of the art

For the purpose of testing and measuring electronic equipment, for example in production processes, one uses measuring rooms, called TEM-cells (Faraday cages), which have to be electromagnetically protected from their environs in the best possible way. The doors of such cells are in their closed position electromagnetically sealed by means of uninterrupted spring contacts in the whole of their groove. When utilizing ordinary door hinges one has to deal with the problem that said spring contacts will be unevenly pressed, which pressure is particularly near the hinge point rather distorted, due to which these spring contacts will soon get out of order and have to be replaced. One will often try to find a solution to said problem for example by making said spring contacts easily replaceable. Another possibility is to take such measures that the end of the closing movement will be a translatory motion instead of a rotatory one. An attempt to achieve this is known for example from the European patent publication EP 0095743. The hinge used in this patent publication has been designed in such a way that it can permit only a translatory motion, which is imposed, be it rather inaccurately, by parts co-operating with one another, which parts are mounted around both on the door and on the door opening, and are of a labyrinth structure, which also serves as a sealing element. Such a complex solution is, especially because of the use of the labyrinth structure, rather expensive and vulnerable as well, since the translatory motion is always effected in a somewhat wringing way.

Solutions for the problem indicated above are known from other fields of the technique, in which cases it is tried to impose the translatory motion from the hinge construction itself. For example the German patent specification DE 3319757 discloses a solution for the problem of the uneven pressure in the refrigerator sector. This solution, which is based on a pin-hole construction comprising a slot-shaped hole, which allows a forced translatory motion after a rotatory motion, and vice versa, is, however, rather complicated. Moreover, the translation is not entirely free from a simultaneous rotation and the path of rotation is small.

In the motorcar industry too one has tried to find solutions to the problem of designing a hinge allowing a perfect translation after a rotation and vice versa. Such a solution is known from the German patent specification DE 3528817. The hinge described in this publication has a hinge point which, when opening the door, will be brought out of the plane of the door case by means of a system of rods moving like scissors. This system of rods comprises two coupled hinging parallelograms, one of which is connected with one side to the door case, and two sides of the other one are extended thus forming two ends which can be moved like scissors. One of these ends is provided with a hinge point and the other one with a pin, which can co-operate with a circular slot in the door. This pin/slot construction ensures that during the opening of the door and the outward movement of the hinge point the rotatory motion of the door around that hinge point will be blocked, so that the door will then undergo a plane-parallel translation only. This blocking will only be stopped when the scissorlike ends cover each other and the position of the pin coincides with that of the hinge point. Then the door can swivel open. When closing the door, it will undergo these motions in a reverse sequence. This known hinge has, however, the following drawbacks. Owing to the relatively great length of the system of rods in an extended state said known hinge is unsuited because of the fact that it is too unstable and too vulnerable for the use as indicated hereinabove where generally heavy doors are used. This vulnerability has become even greater due to the fact that the stopping means for stopping the swivelling movement of the door when opening or closing the same can be mounted on the system of rods only.

B. Summary of the invention

The object of the present invention is to provide a hinge with which it will be possible to impose in a simple way a perfect translatory, id est a perfect plane-parallel motion on a door, after a rotatory motion, and vice versa, which hinge can be

designed in a more compact and more solid way than known from the above-cited state of the art.

A hinge for a door and the like used for a sealing closing off of an opening in a wall which encloses a space, for which purpose a sealing element has been applied between the door and an edge determining the opening, which hinge comprises a wall mounting part and a door mounting part, between which a coupling has been established in such a way that a plane-parallel movement will be imposed on the door when closing it and vice versa when opening it after respectively preceding a mainly rotatory motion, the coupling being formed by a hinging system of rods hung up so that it can swivel, and moreover blocking means have been provided, which during the plane-parallel movement will block the possibility of swivelling of the system of rods, while retaining the possibility of hinging, is according to the invention characterized in that the system of rods is formed by a single parallelogram of rods, and in that the blocking means have been positioned in such a way that they will be substantially within the parallelogram of rods during the plane-parallel movement. Owing to such a hinge a very even pressure of the sealing element applied between the door and the edge will be achieved over the whole circumference of the edge.

Further characteristics of the invention and its preferred embodiments have been summarized in the subclaims and are described in detail with reference to the drawing.

C. References

1. German patent specification DE 3319757
Title: Türscharnieranordnung für einen Aufbewahrungsschrank.

2. German patent specification DE 3528817
Title: Scharnier für Fahrzeugtüren.

3. European patent specification EP 0095743
Title: Door in a construction preventing the transition of interference fields.

D. Brief description of the drawing

The invention will be further elucidated with reference to a drawing, in which

Fig. 1 shows a view of a hinge according to the invention;

Fig. 2 shows a cross-sectional view of a hinge represented in Figure 1 in a direction of view II as indicated in that figure;

Fig. 3 shows a perspective view of the hinge represented in Figure 2 slanting at the top in a direction of view III as indicated in that figure;

Fig. 4 is the same as Figure 3, but seen in the direction of view IV;

Fig. 5 shows a cross-sectional view of the hinge mounted between a wall and a door in five positions (a) up to and including (e).

E. Description of an embodiment

The figures 1 up to and including 4 show various views of a hinge according to the invention in one and the same hinge position, in which figures equal parts of the hinge as far as they can be seen in each of the figures have been provided with an equal numbering. Between a wall mounting part 1 and a door mounting part 2 there is a connecting piece consisting of two parts. A first part of this connecting piece consists of a connecting link 3, which is at its one end 3.1 disposed between the legs 5.1 and 5.2 of a U-shaped wall mounting plate 5, which is part of the wall mounting part 1, in such a way that it can swivel around a pin-shaped axis 4. The second part of the connecting piece is formed by two parallel more or less H-shaped swivel links 6 and 7 of equal length. These swivel links are connected at a certain, suitably chosen distance between each other on the one hand between their pairs of legs (6.1, 6.2) and (7.1, 7.2) in such a way that they can pivot around the pin-shaped axes 8 and 9, respectively, with a part 3.3 ending in the other end of the connecting link 3, and on the other hand between their pairs of legs (6.3, 6.4) and (7.3, 7.4) in such a way that they can pivot around the pin-shaped axes 10 and 11, irrespectively, with a cross piece 13 (possibly provided with a back support 13.1) extending transversely to a mounting plate 12, which (mounting plate 12 and cross piece 13) are both part of the door mounting part 2. The pin-shaped axes 8, 9, 10 and 11 are all parallel with the axis 4, and seen in a cross-sectional view located at the angular points of a parallelogram. The axes 4, 8 and 9 are about, but not necessarily in a plane.

The wall mounting part 1 further comprises a cam-shaped projection, called curve disc 14, extending perpendicularly to the wall mounting plate 5 and rigidly connected to the same. Said curve disc has a tripartite edge area:

(i) a side facing the connecting link 3 and forming a stop 14.1 for a stop side 3.2 of the connecting link 3, which side corresponds to the former side and can be closely contiguous to said stop;

(ii) a side opposite to the stop 14.1 and forming a curved path 14.2 with a circular longitudinal section, and

(iii) a guiding surface 14.3, which causes the surface of the stop 14.1 to change over to the surface of the curved path 14.2.

On a suitably chosen place between the legs 7.1 and 7.2 of the swivel link 7 there is a guide roller 15, which can turn around a pin-shaped axis 16, which is disposed about in the same plane as and parallel with the axes 9 and 10. The curve disc 14 has such a thickness that it can freely extend between the legs of the swivel links 6 and 7, when the connecting link 3 turns around the axis 4 with regard to the wall mounting part 1 (thus taking along the swivel links 6 and 7 and the door mounting part 2). The position of the guide roller 15 is such that when the stop side 3.2 of the connecting link 3 is closely contiguous to the stop 14.1, the guide roller 15 will follow the curve path 14.2 without play during the swivelling movement of the swivel links 6 and 7.

The axis of rotation (pin-shaped axis 4) of the connecting link 3 has been disposed with regard to the stop 14.1 in such a way that in that position the plane formed by the pin-shaped axes 8 and 9 will be about transversely to the wall mounting plate 5. The wall mounting plates as well as the door mounting plates 5 and 12, respectively can be provided with bore holes 22 for inserting fasteners, such as screws, which are not shown in detail.

The working of the hinge will now be further explained with the aid of Figure 5 with the parts (a) up to and including (e). This figure shows a cross-sectional view of the hinge described hereinabove with its wall mounting part 1 and its door mounting part 2 mounted on a wall 17 and on a door 18, respectively, in five positions. The mounting parts have been placed in such a way that the door 18 can sealingly close off an opening 19 in the wall 17 with an edge 20. Sealing elements 21 (for example strip-shaped flexible metal spring contacts in the case of an electromagnetic sealing) have been applied around the opening 19 on the edge or, as shown in the figures, on those parts of the door 18 which in a closed position are immediately opposite to the edge 20. Because of the fact that the connecting link 3, the swivel links 6 and 7 and the cross piece 13 have pivotal connections in the axes 8, 9, 10 and 11 disposed at the angular points of a parallelogram, they form a pivoting parallelogram of rods, the portion 3.3 of the connecting link 3, enclosing the axes 8 and 9, serving as a base rod with regard to which the swivel links 6 and 7 can permanently swivel as swivel rods in a parallel position with respect to each other. The parallelogram of rods pivots between two outermost positions, because the swivel links 6 and 7 can swivel only over an angle which is determined by outermost positions in which the swivel links 6 and 7 are contiguous to each other. During this swivelling movement the cross piece 13, serving as a displacement rod, and all that is (rigidly) connected to the same (so including the door 18), undergoes a parallel displacement with regard to the base rod. By means of the pin-shaped axis 4 this base rod can with its extended part, the aforesaid one end 3,1 of the connecting link 3, swivel with regard to the wall mounting part 1, so also with regard to the wall 17 on which this wall mounting part is mounted, notably over an angle determined on the one hand by the position in which the connecting link 3 is contiguous to the wall 17 and on the other hand by the position in which the connecting link 3 is contiguous to the stop 14.1.

Figure 5(a) shows a cross-sectional view of the hinge represented in a position in which the door 18 is opened as far as possible. When the door 18 is set in a closing motion, then two motions will be possible for the time being, to wit each separately or both of them combined, id est a rotatory motion due to the possibility of swivelling around the pin-shaped axis 4, and a plane-parallel motion due to the possibility of pivoting of the parallelogram of rods. Which motion occurs depends inter alia on the point at which the force necessary for the closing movement is exerted on the door 18. If for example the plane-parallel movement takes place first, in which case the connecting link 3 remains contiguous to the wall 17, the parallelogram of rods will change over to its other outermost position, so the position in which the swivel links 6 and 7 are again contiguous to each other. This position is shown in Figure 5(b). The dimensions of the curve disc 14 are such that in that position the guide roller 15 just touches the curve disc, notably about at the point where the stop 14.1 changes over to the guiding surface 14.3.

When the door 18 is pushed further in the direction of closing, the guide roller 15 will follow the guiding surface 14.3 in the direction of the beginning of the curve path 14.2, in which case the connecting link 3 swivels around the pin-shaped axis 4 in the direction of the stop 14.1. The beginning of this swivelling movement is shown in Figure 5(c), and this movement is transmitted via the pivoting parallelogram as a rotatory motion to the door 18 rigidly connected to the cross piece 13. This rotatory motion, however, involves a simultaneous plane-parallel displacement, since the parallelogram of rods pivots back again to about its outermost position with regard to the connecting link 3, in which case the swivel rods 6 and 7 are contiguous to each other again. This position is shown in Figure 5(d). The connecting link 3 is now with its stopping surface 3.2 closely contiguous to the stop 14.1, the guide roller 15 being just beyond the end of the guiding surface 14.3 at the beginning of the curve path 14.2, which has a longitudinal section forming part of the circumference of a circle, the centre of which coincides with the centre of the pin-shaped axis 9.

When the closing movement is continued, the guide roller 15 can follow only the curve path 14.2, in which case the connecting link 3 remains clamped against the stop 14.1.: The degree of freedom of rotation has disappeared because of the fact that the possibility of swivelling around the axis 4 is blocked because the curve disc 14 is clasped by the connecting link 3 and the guide roller 15 via the pair of legs 7.1 and 7.2 of the swivel link 7. The movement of the door is now a completely plane-parallel one be it described by a circular arc, the radius of which is equal to the distance between the axes 9 and 10. Thus this plane-parallel movement has in this phase of the closing movement of the door 18 not only a mainly vertical (i.e. vertically directed to the wall) component, but also a small horizontal component. The latter will, however, be minimal at a given distance between the axes 9 and 10, if the guide roller 15 when passing through the curve path 14.2 just passes the point of contact of the vertical (i.e. to the wall) tangent of the circular arc, which forms the section of the curve path 14.2 near the curve disc 14 seen in a longitudinal section. True enough, this small horizontal component necessitates a corresponding play in the opening 19 in the wall 17, but it can promote the pressure of sealing elements 21 with which the door 18 may also be provided at its rim.

The door closing movement will end when the door 18 is stopped in the opening 19 by the edge 20. This position is shown in Figure 5(e).

If first only the rotation takes place from the position shown in Figure 5(a), then the door will swivel/swing with the pivoting parallelogram in that position with regard to the connecting link 3 around the axis 4 immediately to the position shown in Figure 5(d), the guide roller being just at and on the beginning of the curve path 14.2. If, however, the closing movement from the position shown in Figure 5(a) concerns a combination of the plane-parallel movement and the rotatory motion described above, then the guide roller 15 will meet the curve disc 14 somewhere on the guiding surface 14.3 during the closing movement, and will subsequently be guided in the direction of the curve path 14.2, in which case the position shown in Figure 5(d) will be taken up again.

If the door 18 is opened from the position shown in Figure 5(e), then the forced plane-parallel movement, in this case in a reverse direction, will first be followed till the door 18 has reached the position shown in Figure 5(d). In that position the clamping of the curve disc 14 comes to an end, and the door can undergo again a movement, which is or is not a combined movement of a rotatory motion and a plane-parallel movement. This combined movement is again dependent on inter alia the place where the force to open the door is exerted on the same. Said movement combined or not will continue till the connecting link 3 is again contiguous to the wall 17, after which (part of) the plane-parallel movement may follow as yet till the position shown in Figure 5(a) is reached again.

It should be noted that in principle the stop and the curve path need not be placed on one and the same cam-shaped projection: They can also be placed on two separate projections, in which case the curve path is of a concave design instead of a convex one, and the blocking does not take place by clamping, but by clasping the connecting link and the guide roller between the stop and the curve disc, which is now concave. This possibility has not been worked out in detail, because it has inter alia the drawback of being less compact than the possibility offered by the above-described embodiment.

In the embodiment described above the swivel rods are designed as H-shaped swivel links 6 and 7. It is obvious that designs with simple or double swivel rods are also possible. The H-shape of the swivel rods, however, makes the hinge much more solid and offers better possibilities of fastening the pin-shaped axis 16 of the guide roller 15. For very heavy constructions the invention even allows a plural H-shape, in which case each of the swivel links 6 and 7 has, as it were, the shape of a double comb, and the guide roller 15 is disposed between two teeth of this come which are arranged side by side.

A variant of the hinge according to the invention consists in that the swivel point of the base rod of the pivoting parallelogram of rods is shifted to the position taken up by the axis 9 when the connecting link 3 is contiguous to the stop 14.1 (as in the positions shown in the Figures 5(d) and (e)). This can be achieved for example by:

(i) shortening the connecting link 3 as far as the part 3.3 in which the axes 8 and 9 are;

(ii) extending the axis 9 on both sides of the legs 7.1 and 7.2 of the swivel link 7; and

(iii) having the U-shaped extended portions 5.1 and 5.2 of the wall mounting plate 5 extended not parallel with this plate, but at right angles to the same as far as said swivel point, and having them inserted into the extended axis 9 on both sides of the swivel link 7.

As in this way the swivel point comes farther away from the wall 17, the door 15 can swivel open even farther, which can also be achieved in the embodiment of the hinge described in the figures, if the wall 17 recedes from the hinge near the swivel point, so the pin-shaped axis 4, as it is the case for example at a corner.

The construction of the hinge according to the

invention permits not only robust, but also very refined embodiments.

Claims

1. A hinge for a door and the like used for a sealing closing off of an opening in a wall which encloses a space, for which purpose a sealing element has been applied between the door and an edge determining the opening, which hinge comprises a wall mounting part and a door mounting part, between which a coupling has been established in such a way that a plane-parallel movement will be imposed on the door when closing it and vice versa when opening it after respectively preceding a mainly rotatory motion, the coupling being formed by a hinging system of rods hung up so that it can swivel, and moreover blocking means have been provided, which during the plane-parallel movement will block the possibility of swivelling of the system of rods, while retaining the possiblity of hinging, characterized in that the system of rods is formed by a single parallelogram of rods, and in that the blocking means have been positioned in such a way that they will be substantially within the parallelogram of rods during the plane-parallel movement.

2. A hinge in accordance with claim 1, characterized in that the parallelogram of rods comprises
- a base rod, whether or not swivellingly connected with its extended part to the wall mounting part,
- a displacement rod, which is integrated in the door mounting part, and
- two swivel rods, which are, on the one hand, with their one end each pivotally coupled to the displacement rod, and, on the other hand, with their other end each pivotally coupled to the base rod,
and in that during the plane-parallel movement the blocking means will keep the base rod rigidly connected to the wall mounting part, and when closing respective ly opening the door, they will stop the swivelling movement of the base rod or allow it to swivel.

3. A hinge in accordance with claim 2, characterized in that the blocking means comprise
- a stop for the base rod, rigidly connected to the wall mounting part and serving to block that base rod and keeping it blocked for the purpose of the plane-parallel movement during the closing movement,
- a curve disc also rigidly connected to the wall mounting part and provided with a curve path consisting of part of a cylinder surface,
- a guide roller mounted on one of the swivel rods between the base rod and the displacement rod, which roller forcedly co-operates with the curve disc at least during the plane-parallel movement over the curve path.

4. A hinge in accordance with claim 3, characterized in that the curve disc is designed as a cam-shaped projection on which the stop as well as the curve path, are mounted, notably back to back, and in that between the stop and the curve path the projection is provided with a guiding surface capable of guiding the guide roller in the direction of the curve path during the closing movement.

5. A hinge in accordance with claim 3 or 4, characterized in that the swivel rods are designed as substantially H-shaped swivel links, between the legs of which the curve disc and the stop can extend, the guide roller being disposed between the legs of one of these links.

6. A hinge in accordance with claim 2, characterized in that the swivel point of the base rod coincides with the swivel point of one of the swivel rods.

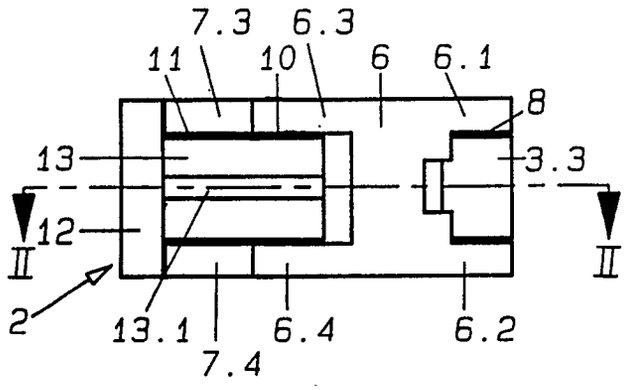

FIG.1

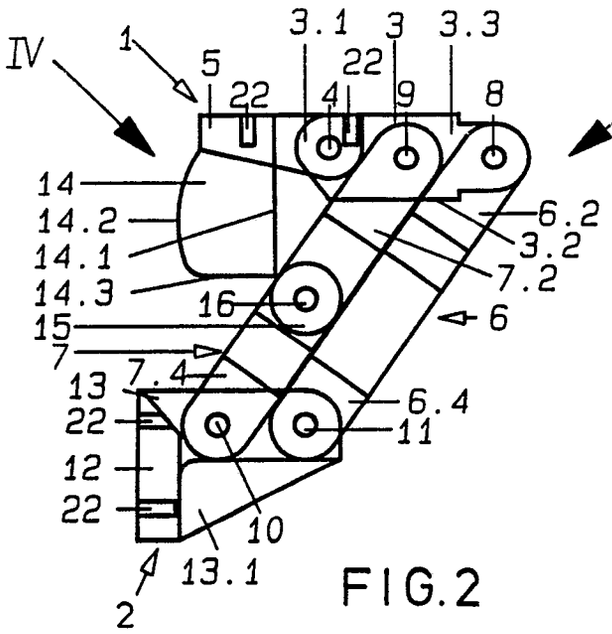

FIG.2

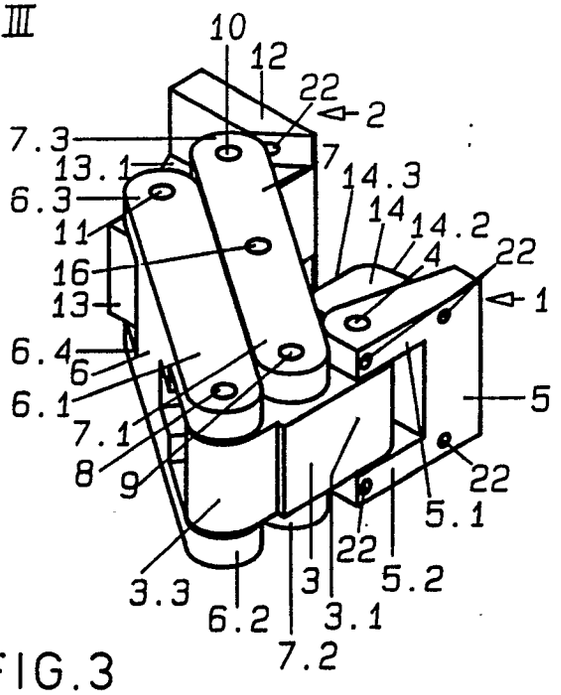

FIG.3

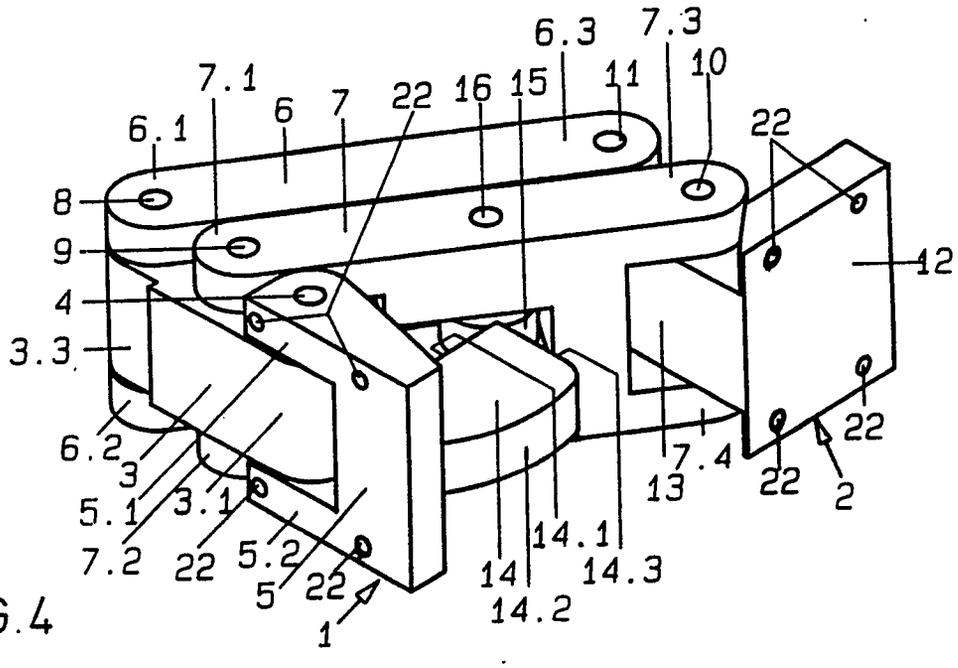

FIG.4

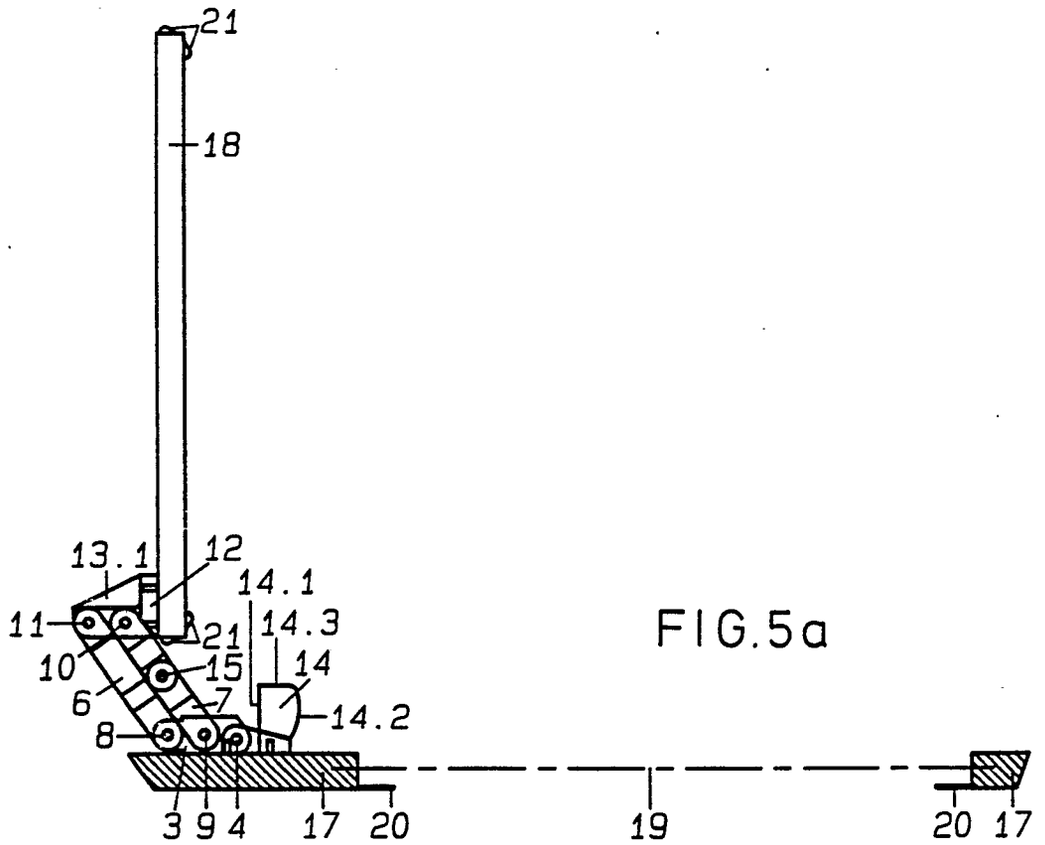
21
18
13.1
12
14.1
11
14.3
21
10
15
14
6
7
14.2
8
3 9 4
17
20
19
20 17

FIG.5a

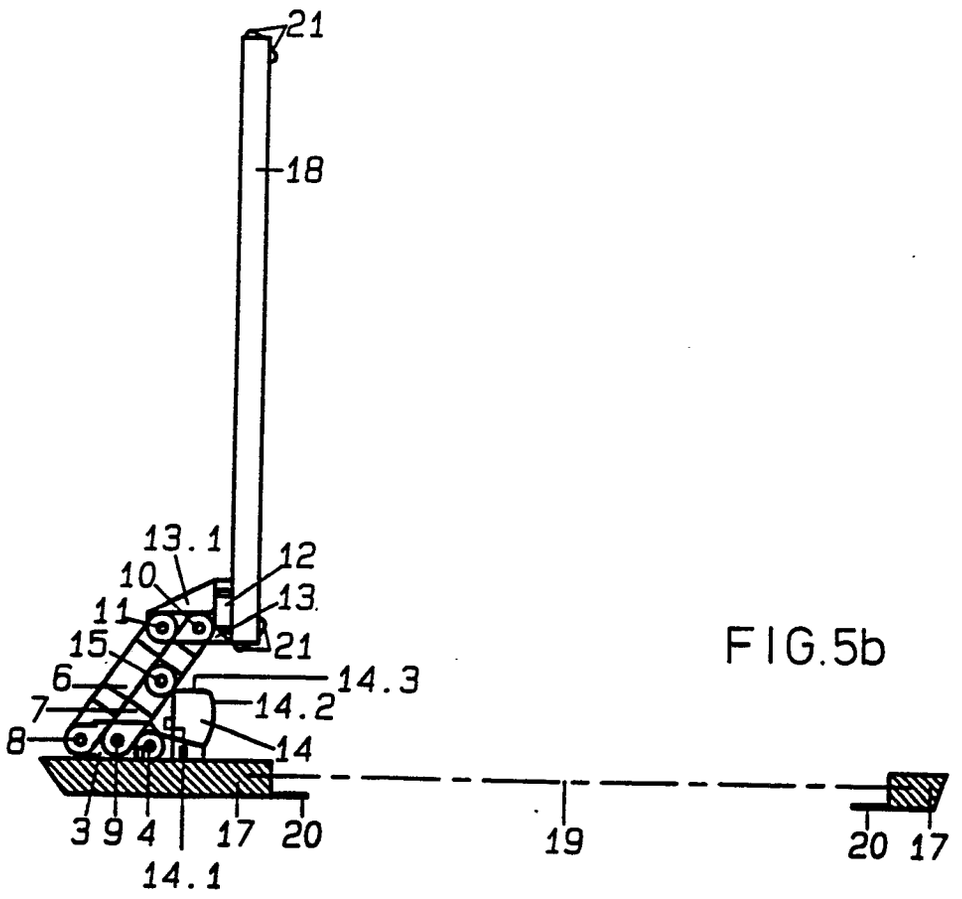
21
18
13.1
12
10
13
11
21
15
14.3
6
14.2
7
14
8
3 9 4
17
20
14.1
19
20 17

FIG.5b

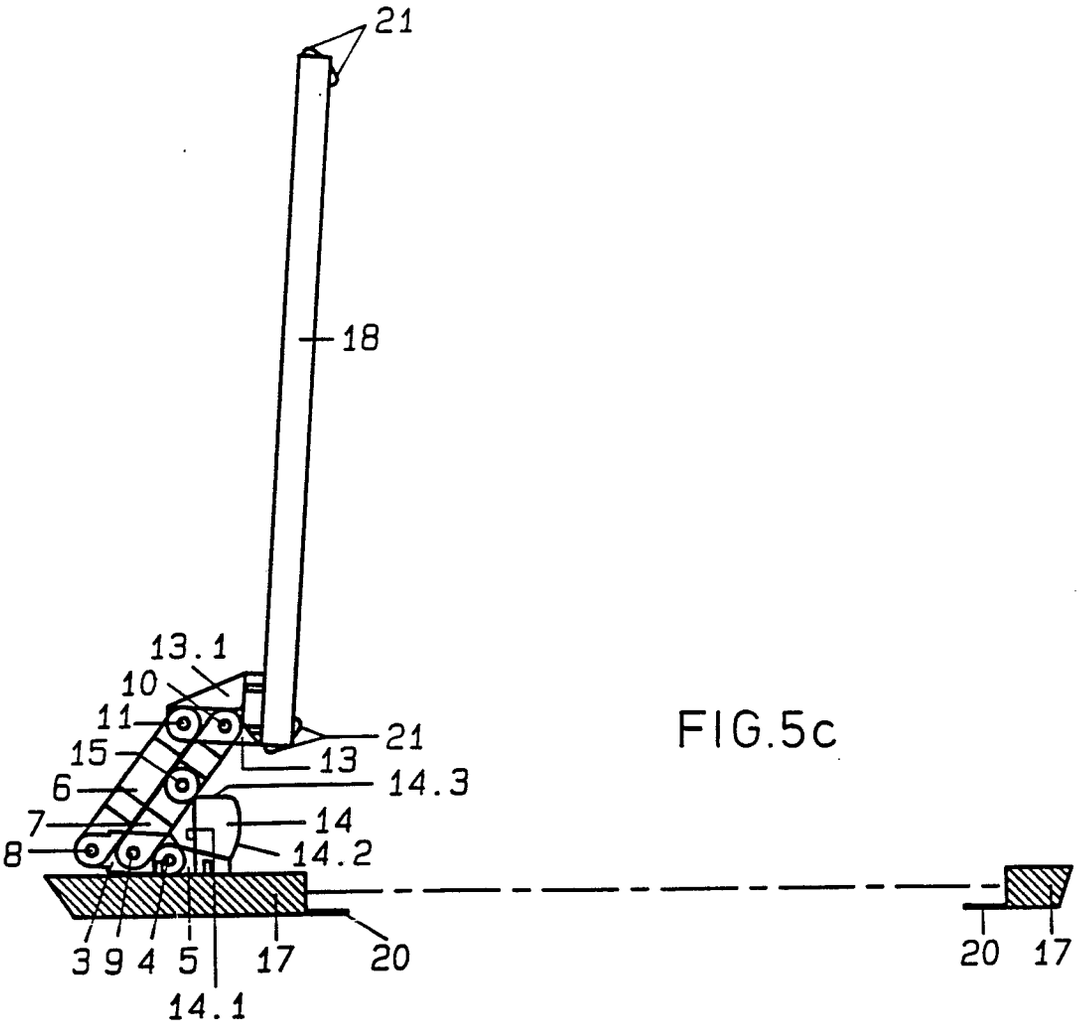

FIG.5c

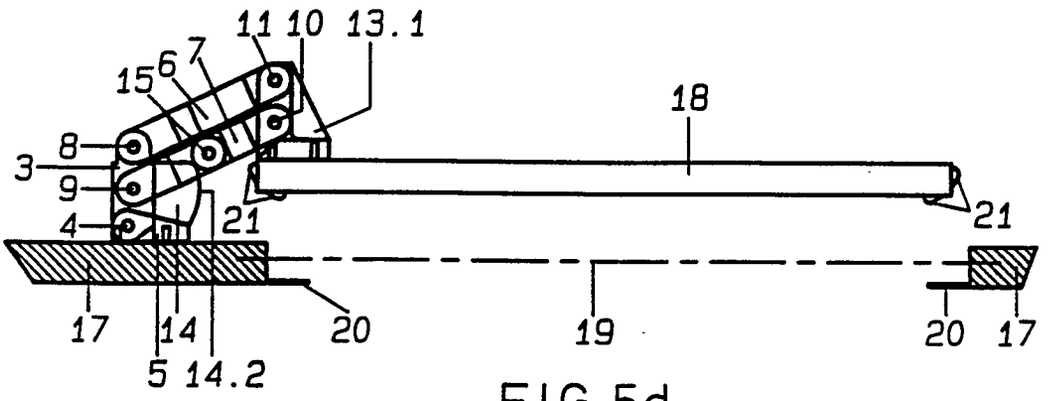

FIG.5d

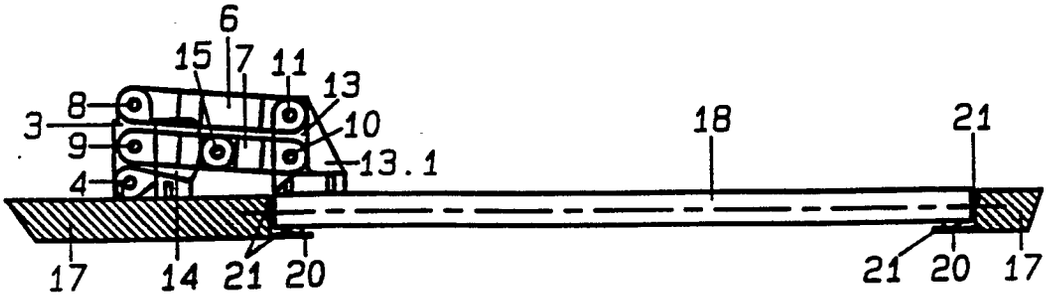

FIG.5e

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 20 3149

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	DE-A-3 528 817 (AUDI) * Column 4, lines 5-15; column 6, lines 7-35; figures 1-4 *	1,2	E 05 D 3/06
D,A	EP-A-0 095 743 (OY EURAMECANO) * Page 2, lines 30-37; page 3, lines 1-14; figure 1 *		
A	DE-A-3 705 768 (BMW) * Column 2, lines 40-49; column 3, lines 40-53; figure 1 *		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E 05 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16-03-1990	NEYS B.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

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

EPO FORM 1503 03.82 (P0401)