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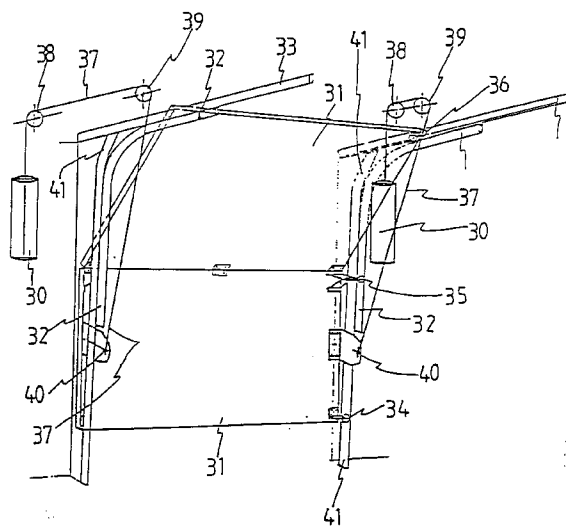
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**Balance system and guide for up-and-over sectional door provided with counterweight.**

Up-and-over sectional door, consisting of at least two, and preferably two, panels (31) hingedly attached to each other, consisting of guide profiles (32) for guiding the panels (31) in such a way that they can slide upwards and at the top of the door opening tilt back and end virtually horizontally, and consisting of guide profiles (33) for guiding the top side of the top panel (31) backwards virtually horizontally, while guide profiles (41) are provided for guiding the underside of the bottom panel (31) virtually vertically upwards to a maximum height, and consisting of a pulling cable (37) which is fixed about halfway up the bottom panel (31) and when the door is closed runs slanting upwards away from the door opening, is guided over rollers (38), (39), and bears a counterweight (30), while the pulling cable (37) runs towards the first roller (39) and approaches the door opening when the door is open.



**FIG. 6**

The present invention relates to an up-and-over sectional door, and more particularly to the system by means of which during sliding up or down thereof a balance is sought between the weight of the downward hanging part of the door and the effective lifting force exerted by the counterweight on said door.

The present invention also relates to the guide profiles for guiding the various panels of the door during sliding up or down thereof.

In the following description of the prior art reference is made to the appended Figures 1 and 2, where Figure 1 is a perspective view of a known up-and-over sectional door in which the variable lifting force is obtained by a chain of partial weights attached to a fixed point, and where Figure 2 is a perspective view of a known up-and-over sectional door in which the variable lifting force is obtained by winding up the pulling cable onto a conical roller.

Up-and-over sectional doors which are provided with a counterweight (5), (16) are generally known and consist of a number (generally four or more) of rectangular panels (1), (21) hingedly fixed to each other with their respective edges of equal length abutting each other. The panels thus fixed to each other together form the door. The dimensions of the door are determined in such a way here that they correspond to the dimensions of the passage to be shut off by the door. This passage is called the door opening in the text which follows.

When the door is in the closed position, all panels (1), (21) are situated above one another in the vertical plane of the door opening, so that the door shuts off the opening.

In order to open the door, it must be slid up, in the course of which the various panels (1), (21) tilt backwards one by one through approximately 90°, so that in the end they reach a virtually horizontal position at the level of the top side of the door opening. In order to hold the various panels (1), (21) in place in each position of the door, and in order to guide said panels (1), (21) during sliding up or down, each panel is provided with guide means - for example, rollers (not visible in Figs. 1 and 2) - extending laterally relative to each panel (1), (21) and engaging in guide profiles (9), (10), (19), (20) disposed on either side of the door.

A first pair of two curved guide profiles (9), (19) extends vertically upwards from the ground on either side of the door opening and then in the region of the top side of said door opening describes a backward bend of virtually 90° in two parallel vertical planes. The virtually horizontal part of said profiles (9), (19) extends backwards over a distance at least corresponding to the height of the door.

A second pair of parallel and straight guide profiles (10), (20) extends backwards virtually horizontally from the plane of the door opening above the horizontal parts of the first pair of guide profiles (9), (19), in the same vertical planes respectively as this first

pair of profiles. Both profiles (10), (20) of the second pair extend at least as far back as the horizontal parts of the first pair of guide profiles (9), (19).

In the region of its top edge, the top panel (1), (21) of the door has on either side laterally projecting guide means which engage in the second pair of guide profiles (10), (20). Laterally projecting guide means are also fixed on either side to the panels (1), (21) lying below, but these last-mentioned guide means engage in the first pair of guide profiles (9), (19).

The door is opened by exerting an upward directed force by hand on one of the panels (1), (21), preferably on a handle on the bottom panel. The various panels (1), (21) consequently slide upwards, in the course of which they are guided by their guide means in the respective guide profiles (9), (10) and (19), (20).

The top panel will in this case tilt backwards through the guide in the second pair of backward extending guide profiles (10), (20), and will consequently pivot backwards relative to the panel lying below. When the door is slid further open, each following panel (1), (21) is guided successively through the bend in the first pair of profiles (9), (19) and in the course of this tilts backwards, thereby pivoting relative to any panel lying below. All panels - and thus the whole door - ultimately reach a virtually horizontal position at the level of the top side of the door opening, extending backwards from the plane of the door opening. In this position of the door, the door opening is clear.

A disadvantage of this known arrangement of guide profiles (9), (10) and (19), (20) lies in the fact that in the slid-up position of the door the bottom panel (1), (21) is situated with its underside in the bend of the first pair of guide profiles (9), (19), and is thus not slid up to its maximum position. Therefore, the door opening cannot be used to its maximum height.

Since the weight of such a door is generally such that sliding it up by hand would be very difficult or impossible, such a door is generally provided with a system which exerts a certain lifting force on said door, so that, on the one hand, when sliding it up the user does not have to lift the full weight of the door and, on the other hand, when sliding the door shut the user does not have to hold back its full weight, in order to prevent the door from coming down at great speed and becoming damaged.

Such a system can consist of a torsion spring or a counterweight (5), (16), or of a combination of the two systems.

The system with counterweight consists of a pulling cable (2), (11), one end of which is fixed to the underside of the bottom panel (1), (21), and which is run upwards from there over one or more guide rollers (3), (4), while the other end bears a downward hanging weight (5), (16).

A known problem with the use of this system is the fact that in this way a constant lifting force is exerted on the door. However, the necessary counterweight varies when the door is being slid up or down. When the door is being opened, the full weight of the door must be lifted at the beginning, which requires a fairly great auxiliary lifting force from the counterweight. In a more open position of the door, a number of panels are already situated in the horizontal position, and the weight which then has to be lifted - the weight of the panels still hanging down - has decreased, so that less lifting force is required from the counterweight. If a great counterweight were selected, opening of the door would go well initially, but at the end the counterweight would be much too great, and the door would have to be supported in order to prevent it from sliding upwards and backwards under the influence of too great a force. In order to slide the door downwards subsequently, a great pulling force would have to be exerted by hand. If too small a weight were selected, one would have to lift too much initially when opening the door and hold back too much at the end when closing the door.

The ideal situation is that in which during sliding up or down in any position of the door there is a balance between the weight of the downward hanging part of the door and the lifting force as a result of the counterweight.

The solution to the problem described above is supplied by two known systems (see Fig. 1 and Fig. 2).

A first known system (see Figure 1) consists of a pulling cable (2) which is fixed to the underside of the bottom panel (1) and at the top is guided over two guide rollers (3), (4), and to which a weight (5) is fixed at the end hanging down from the second guide roller (4), which weight consists of a number of partial weights (6) forming a downward hanging chain, through the fact that they are attached to each other in such a way that they are freely movable one by one relative to each other. The bottom partial weight (6) of the weight (5) is attached to a fixed attachment point (7) in such a way that it is freely movable. When the door is slid down fully, the lifting force exerted by the counterweight (5) on the door is determined by the sum of the weights of all partial weights (6). This total weight is preferably selected so that it is the same as the weight of the door. As the door is slid higher up, an increasing number of partial weights (6) go lower than the attachment point (7), with the result that the chain of partial weights (6) goes into a position hanging down in a loop (8) at the attachment point (7). The weight of these lower hanging partial weights (6) can consequently be broken down into a force on the attachment point (7) and a force on the pulling cable (2). The force on the pulling cable (2) has consequently decreased, and therefore so has the effective lifting force on the door. Consequently, the

higher the door is slid up, the more partial weights (6) hang in the downward hanging loop (8), and the smaller the effective lifting force which is exerted by the chain of partial weights (6) on the pulling cable (2), and thus on the door.

A disadvantage of this system lies in the fact that the special counterweight (5) greatly increases the cost of such a door.

An additional disadvantage is that there needs to be a wall for the purpose of providing the attachment point (7), but this is not the case in all situations.

A second known system (see Figure 2) consists of a pulling cable (11) which is fixed to the bottom panel (21) of the door and above the door is wound onto a conical part (12) at one end of a roller (13). A cylindrical part (14) is provided at the level of the other end of said roller (13). A cable (15), which has a free downward hanging end to which a counterweight (16) is attached, is also wound onto this cylindrical part (14). A helical groove (17), (18) is provided both on the conical part (12) and on the cylindrical part (14). From the end fixed to the door, the pulling cable (11) is wound onto the roller (13), from the side of the conical part (12) with the smallest diameter, and is forced by the groove (17) to wind up further towards the side with the largest diameter.

During the sliding up of the door, the roller (13) turns under the influence of the counterweight (16), and the cable (15) is unwound from the cylindrical part (14), while the pulling cable (11) is wound onto the conical part (12), thereby covering an increasing diameter of said part (12).

The moment caused by the counterweight (16) is constant in size through the fact that, on the one hand, at the place where the cable (15) is hanging down the diameter of the roller (13) is the same in any position of the door and, on the other, the weight is also constant in size.

This constant moment results in a pulling force in the pulling cable (11) which is inversely proportional to the diameter of the conical part (12) from which the pulling cable (11) hangs down. Therefore, as the door slides further open, an increasingly small lifting force is exerted on the door.

A disadvantage of this system lies in the fact that a large amount of space is required above the door. This considerably reduces the height of the passage through the open door, compared with the height of the door opening in the rough masonry. In order to prevent this, the lintel has to be placed higher, or the entire door, with guide profiles and roller (13) disposed above them, has to be placed behind the lintel, with the result that the effective space of the place shut off by the door becomes less in length.

The aim of the invention is, on the one hand, to provide a balance system for an up-and-over sectional door with counterweight which is simpler and by means of which the disadvantages indicated above

are overcome.

The aim of the invention is, on the other hand, also to provide an arrangement of guide profiles by means of which the door opening can be used to the maximum when the door is open.

An object of the invention is an up-and-over sectional door with counterweight, consisting of at least two rectangular panels, and having guide profiles and guide means which are the same as or equivalent to the arrangements known according to the above-described prior art, but which is characterized in that the attachment point of the pulling cable to the bottom panel and the erection point of the roller over which said pulling cable - coming from the bottom panel - is guided first are selected in such a way that in the closed position of the door an acute angle is formed between said pulling cable and the vertical through the attachment point along one side of said vertical, in which case the pulling cable, running upwards, moves away from the vertical plane of the door opening, and in that in the open position of the door an acute angle is formed between said pulling cable and the vertical through the attachment point along the other side of said vertical, in which case the pulling cable, running upwards, moves towards the vertical plane of the door opening.

Such an embodiment ensures that during sliding up of the door the pulling cable gradually assumes a different direction relative to the vertical plane of the door opening. The pulling force in the cable remains constant during the entire movement, but the effective lifting force which is formed by the vertical component of said pulling force changes as a function of the position of the door. When the bottom panel comes up, the angle between the vertical through the attachment point and the pulling cable increases, and as a result thereof an effective lifting force which changes proportionally as a function of the weight which has to be lifted during opening of the door, or which has to be supported during opening of the door, is obtained.

It is also essential that from the moment that the bottom panel has reached the bend backwards the angle between the vertical through the attachment point and the pulling cable should become smaller again. The vertical component on the bottom panel becomes greater again, but this vertical component causes no appreciable acceleration of the sliding movement, because the bottom panel in that position must slide both upwards and backwards. The vertical component ensures that this movement can run very smoothly and easily, by neutralizing the weight of said bottom panel. The horizontal component helps the backward directed movement.

In a particular position of the bottom panel in the bend, the pulling cable itself will coincide with the vertical through the attachment point, and will thus now exert only a vertical force component on the bot-

tom panel, and no longer a backward directed component.

At the end of the movement of the door to its open position, the angle is formed between the vertical through the attachment point and the pulling cable along the other side of said vertical and, in addition to a great vertical component, there is even a horizontal component which counteracts the backward movement. Said horizontal component brakes the movement at the end of the movement, but it is, of course, too small to pull the door forward again.

Another object of the invention is an up-and-over sectional door with counterweight, consisting of two rectangular panels and having guide profiles which are the same as or equivalent to the earlier described arrangements known according to the prior art, in which two guide means are provided in the region of the top edge of the top panel, which guide means are fixed so that they project laterally at either side and engage in the first pair of guide profiles, and consisting of a balance system for exerting a variable upward directed force on the door which is proportionally variable as a function of the position of the door, characterized in that in the region of the top edge the bottom panel has guide means which project laterally at either side and engage in the first pair of guide profiles, and in the region of the bottom edge guide means which project laterally at either side and engage in a third pair of guide profiles, and in that the profiles of this third pair extend on either side of the door opening and in the same vertical planes as the first pair of profiles respectively, vertically upwards from the ground to the region of the virtually horizontal plane of the second pair of profiles.

The advantage of this embodiment lies in the fact that the bottom panel can be slid until it is fully against the top side of the door opening (where until now the problem was that the underside of this bottom panel remained hanging down at an angle into the bend), so that the door opening can be used to the maximum height.

Further features and advantages of the invention are illustrated with reference to the special embodiments according to the invention described below, but this does not limit the invention to these embodiments alone. In the description which follows reference will be made to the appended figures, in which:

Figures 1 and 2 illustrate the above-described prior art;

Figure 3 shows in side view an up-and-over sectional door according to the invention, in the closed position;

Figure 4 shows in side view an up-and-over sectional door according to the invention, in the half open position;

Figure 5 shows in side view an up-and-over sectional door according to the invention, in the open position.

Figure 6 shows in perspective an up-and-over sectional door according to the invention, viewed from the back.

A special embodiment (see Figures 3 to 6) of an up-and-over sectional door according to the invention consists of the special arrangement according to Claim 1, but in which the door consists of only two panels.

The main advantage thereof lies in the fact that the costs of manufacturing such a door are lower than those of manufacturing a door consisting of more than two panels. For, the time required for manufacturing and combining the various panels of a door is proportional to the number of panels.

The attachment point (40) of the pulling cable (37) to the bottom panel (31) and the erection point of the roller (39) over which said pulling cable (37) - coming from the bottom panel (31) - is first guided in a particularly advantageous embodiment are selected in such a way that in the closed position of the door an angle between  $3^\circ$  and  $25^\circ$  is formed between the pulling cable (37) and the vertical through the attachment point (40), and that in the open position of the door this angle formed along the other side of the vertical has a value between  $15^\circ$  and  $55^\circ$ .

Such an arrangement ensures very smooth and easy operation of the door.

The attachment point of the pulling cable (37) to the bottom panel (31) of the door is also important per se, and in a preferred embodiment is selected so that it lies between  $1/3$  and  $2/3$  of the way up the bottom panel (31).

When the bottom panel (31) is situated in the bend of the guide profiles (32), the necessary pulling force which has to be exerted on the panel (31) in order to neutralize its downward hanging weight depends on the point of application of said force. For, this bottom panel (31) pivots relative to the panel (31) lying above. If this point of application lies in the region of the bottom edge, this necessary lifting force is smaller than (up to half) the weight of the panel (31), owing to the size of the lever arm thus obtained. The result of this - in the case of the known doors - is that the moment the bottom panel goes into the bend an abrupt reduction in the necessary lifting force occurs, so that at that moment the balance is upset due to the fact that the lifting force exerted by the counterweight suddenly becomes too great.

If the cable (37) is attached in the region of the centre of the bottom panel (31) (in the region of the centre of gravity), this disadvantage is considerably reduced, through the fact that a greater part of the weight has to be neutralized by the counterweight, and consequently the sudden reduction in necessary lifting force is less abrupt.

A particularly advantageous embodiment is, of course, that in which the attachment point (40) of the pulling cable (37) is situated halfway up the bottom

panel (31).

In order to obtain the maximum usable height of the door opening in an up-and-over sectional door, according to the invention use is made of a third pair of guide profiles (41) extending vertically upwards from the ground on either side of the door opening, in the same vertical planes respectively as the first pair of profiles (32), until they reach the region of the horizontal plane of the second pair of profiles (33), while the guide means (34) which are fixed on either side of the bottom panel, in the region of the bottom edge, engage respectively in this third pair of profiles (41).

In a preferred embodiment, the guide profiles (41) of the third pair have in the region of the top end, at the same height, a curve backwards, and they run further with a straight end slanting backwards. This curve preferably occurs at the level of the bend in the first pair of profiles (32).

This curve in the profiles (41) allows the bottom edge of the bottom panel (31) to slide further backwards when the door is open.

Due to the fact that the third pair of guide profiles (41) extends in the plane of the door opening to the ground - for the guiding of the underside of the bottom panel by the guide means (34) - the first pair of guide means (32) must extend downwards to the level at which the guide means (35) higher up are situated when the door is closed.

In the most advantageous embodiment of the sectional door according to the invention, the arrangement of the third pair of guide profiles (41) of the type described above is used in combination with a balance system according to the invention of the type described above.

In a preferred embodiment of the sectional door, a pulling cable with counterweight is provided according to the invention on either side of the door (see Figure 6), and the door is composed of two panels.

This provides a sectional door which is particularly smooth and easy to operate and offers a maximum usable height of the door opening, while the erection of the door does not require much space above the door opening, and the costs of manufacture are reduced in the case of the embodiment with two panels.

## Claims

1. Up-and-over sectional door with counterweight (30), comprising at least two rectangular panels (31) which are hingedly attached to each other and are slidable by means of guide means (34), (35), (36) in guide profiles (32) disposed on either side of said panels (31) and extending virtually vertically upwards, and bent over in such a way at the top that they extend backwards virtually horizontally, so that the panels can be slid to a

closed position, in which they extend above one another in order to shut off a door opening, and to an open position in which they are situated behind one another in a virtually horizontal plane in the region of the top side of the door opening; and also comprising a pulling cable (37) which is fixed to the panel which in the closed position is the bottom one, and which cable above the guide profiles (33) is guided over at least one roller (38), (39), and of which the end hanging down from the roller (38) bears a counterweight (30), **characterized in that** the attachment point (40) of the pulling cable (37) to the bottom panel (31) and the erection point of the roller (39) over which said pulling cable (37) - coming from the bottom panel (31) - is guided first are determined in such a way that when the door is closed an acute angle is formed between said pulling cable (37) and the vertical through the attachment point (40) along one side of said vertical, in which case the pulling cable (37), running upwards from the attachment point (40), moves away from the vertical plane of the door opening, and in that in the open position of the door an acute angle is formed between said pulling cable (37) and the vertical through the attachment point (40) along the other side of said vertical, in which case the pulling cable (37), running upwards from the attachment point (40), moves towards the vertical plane of the door opening.

2. Up-and-over sectional door with counterweight according to Claim 1, **characterized in that** the door consists of two panels (31).
3. Up-and-over sectional door with counterweight according to Claim 1 or 2, **characterized in that** in the closed position of the door an angle between  $3^\circ$  and  $25^\circ$  is formed between the pulling cable (37) and the vertical through the attachment point (40).
4. Up-and-over sectional door with counterweight according to one or more of the preceding claims, **characterized in that** in the open position of the door an angle between  $15^\circ$  and  $55^\circ$  is formed between the pulling cable (37) and the vertical through the attachment point (40).
5. Up-and-over sectional door with counterweight according to one or more of the preceding claims, **characterized in that** the attachment point (40) of the pulling cable (37) to the bottom panel (31) is situated between  $1/3$  and  $2/3$  of the way up said panel (31).
6. Up-and-over sectional door with counterweight according to one or more of the preceding claims,

**characterized in that** the attachment point (40) of the pulling cable (37) to the bottom panel (31) is situated halfway up said panel (31).

7. Up-and-over sectional door according to one or more of the preceding claims, **characterized in that** the door comprises a first pair of curved guide profiles (32) extending virtually vertically upwards on either side of the panels (31) in the plane of the door opening and bent over at the top in such a way that in the vicinity of the top side of the door opening they extend backwards virtually horizontally, in that the door comprises a second pair of straight guide profiles (33) extending backwards parallel to each other virtually horizontally from the plane of the door opening, over a distance which corresponds at least to the height of the door, in that in the region of the top edge of the top panel (31) two guide means (36) which are fixed at either side so that they project laterally and which engage in the second pair of guide profiles (33) respectively are provided, in that the bottom panel (31) in the region of the top edge has guide means (35) which project laterally at either side and engage in the first pair of guide profiles (32), and in the region of the bottom edge has guide means (34) which project laterally at either side and engage in a third pair of guide profiles (41), and in that the profiles (41) of said third pair extend virtually vertically upwards on either side of the door opening to the region of the second pair of profiles (33).
8. Up-and-over sectional door according to Claim 7, **characterized in that** the guide profiles (32) of the first pair extend in the plane of the door opening from the level at which the guide means (35) are situated when the door is closed.
9. Up-and-over sectional door according to Claim 7 or 8, **characterized in that** in the region of the top end the guide profiles (41) of the third pair at the same height have a backward curve and higher up have a straight end running backwards.
10. Up-and-over sectional door according to Claim 9, **characterized in that** the guide profiles (41) of the third pair have the curve at the level of the bend in the first pair of profiles (32).

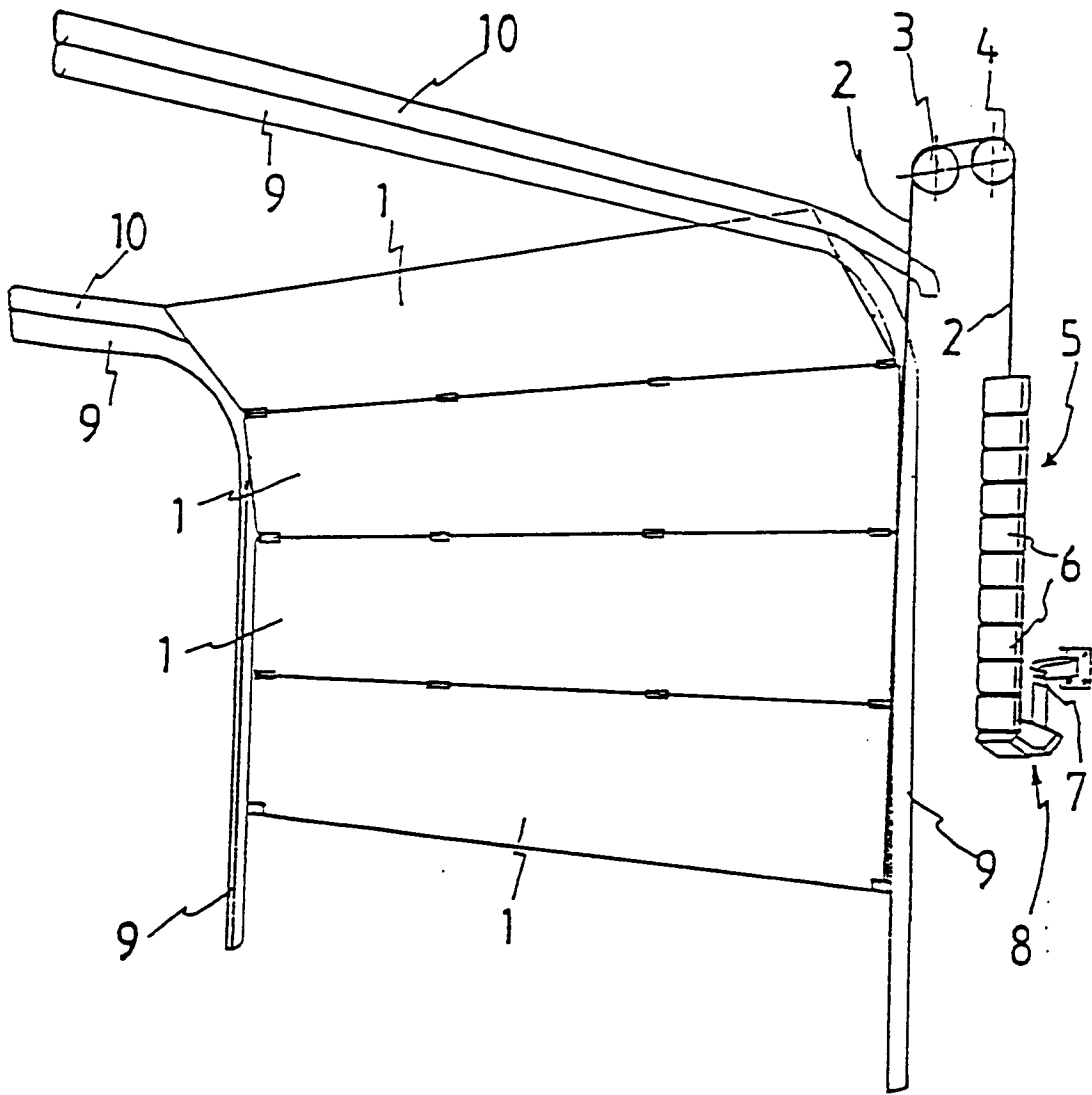


FIG. 1

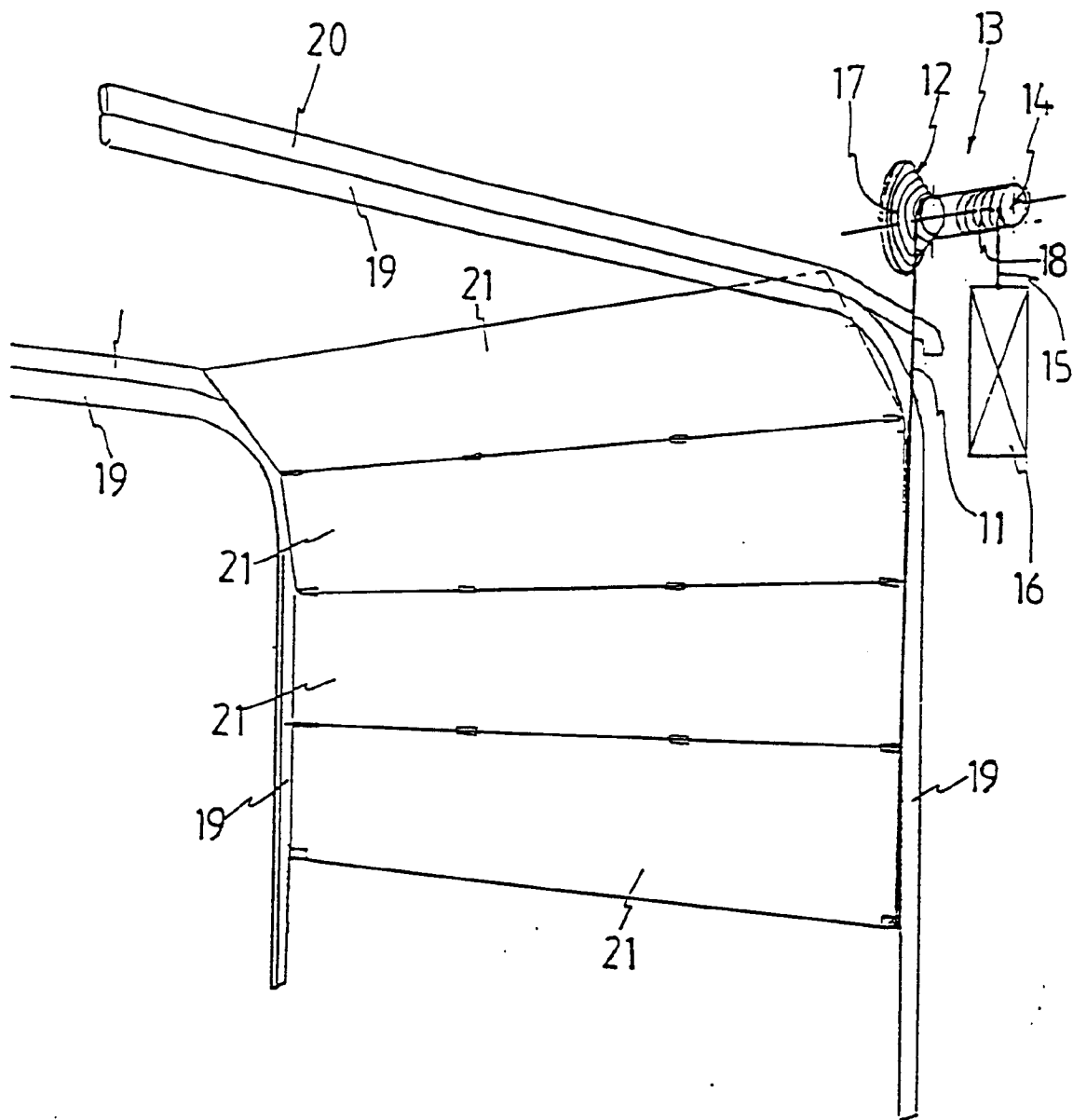


FIG. 2

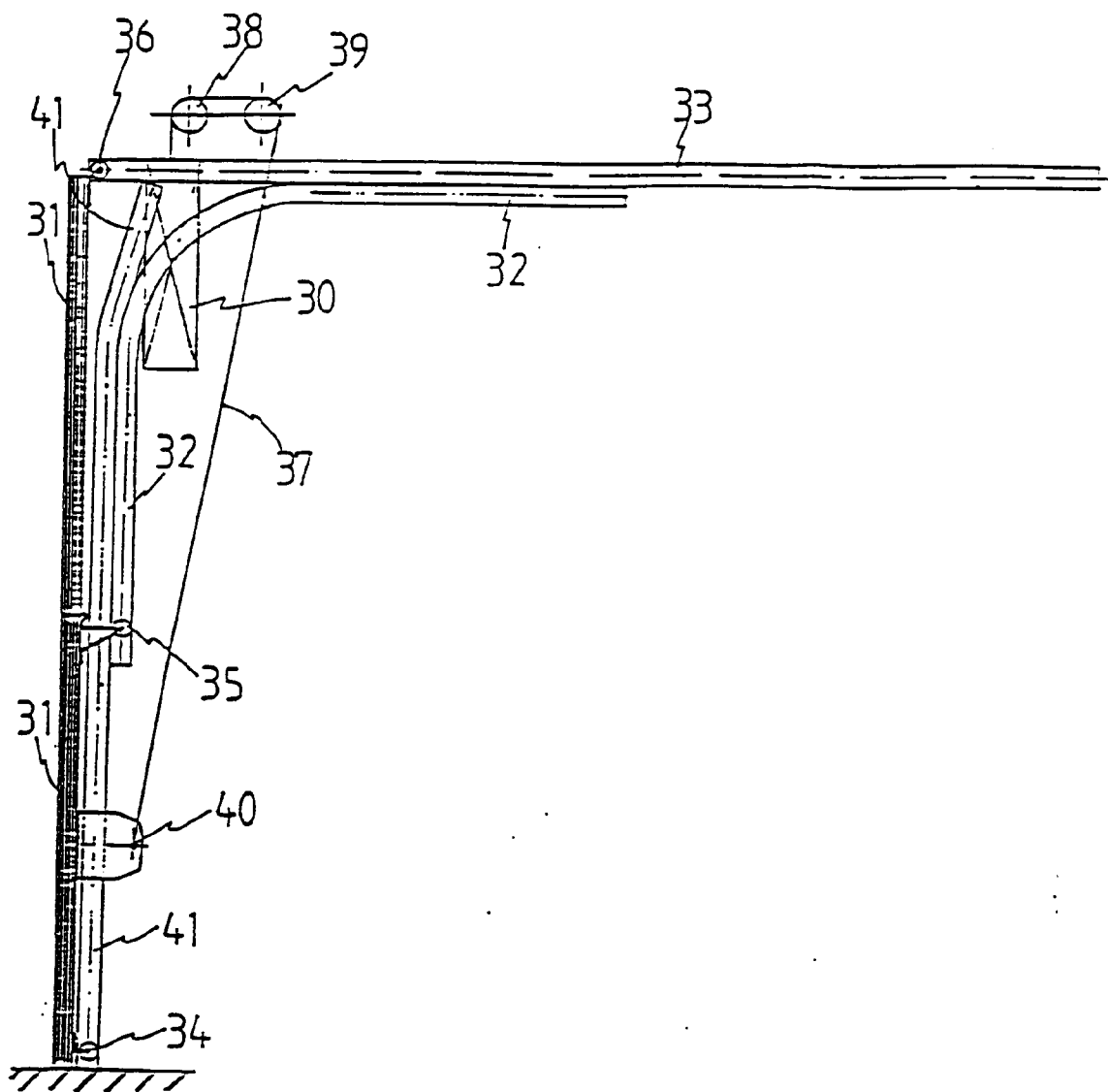


FIG. 3

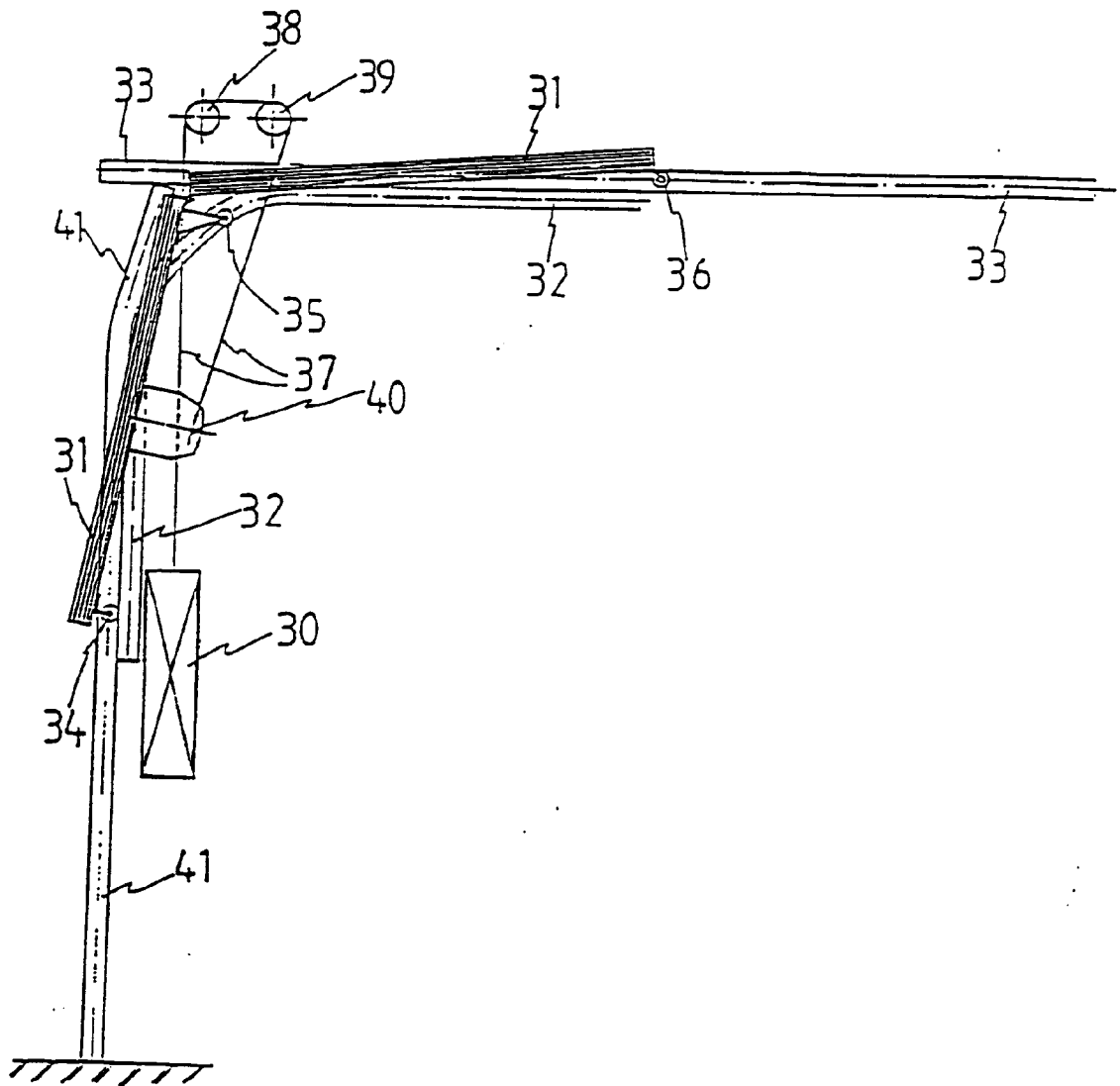


FIG. 4

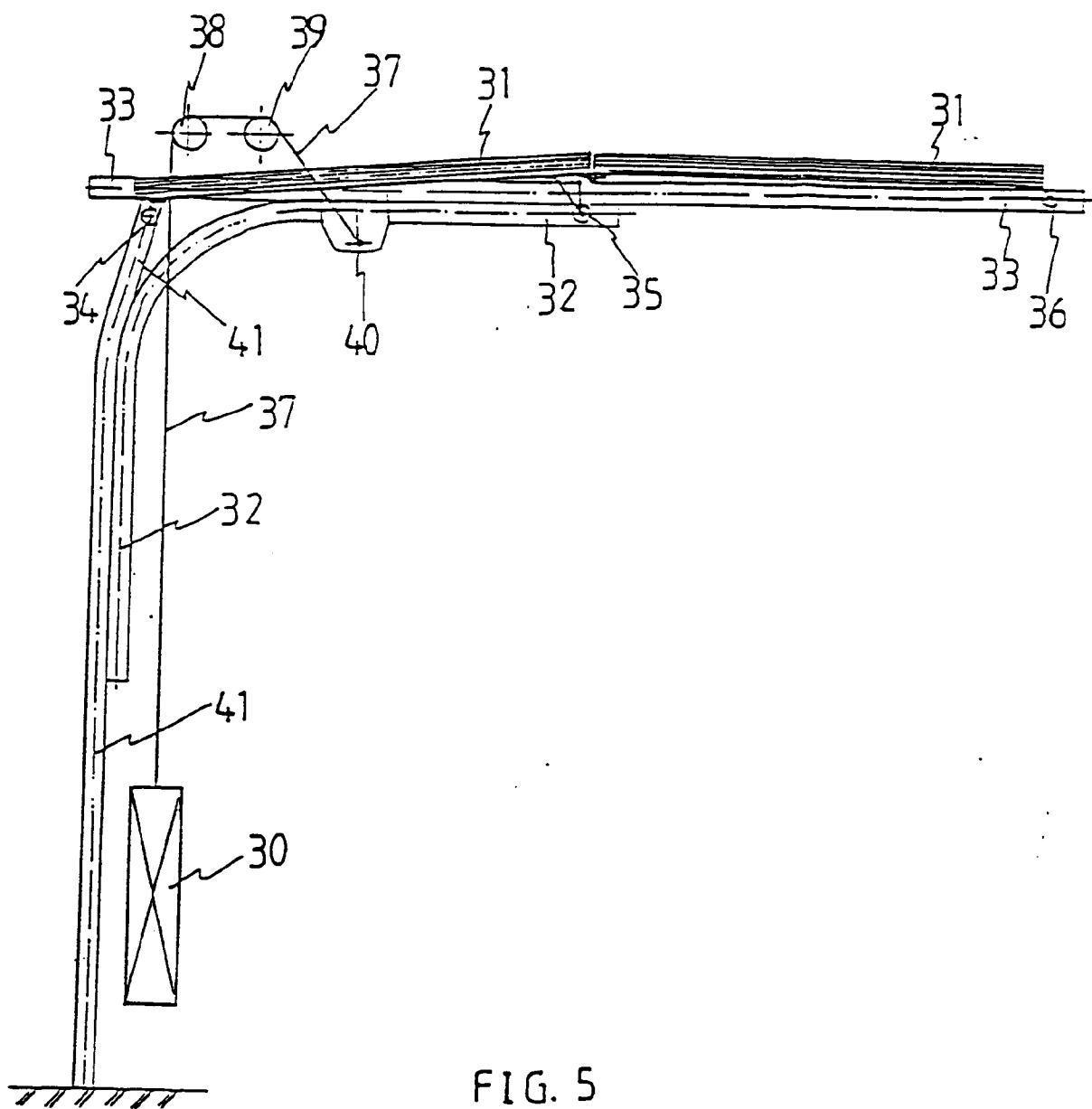


FIG. 5

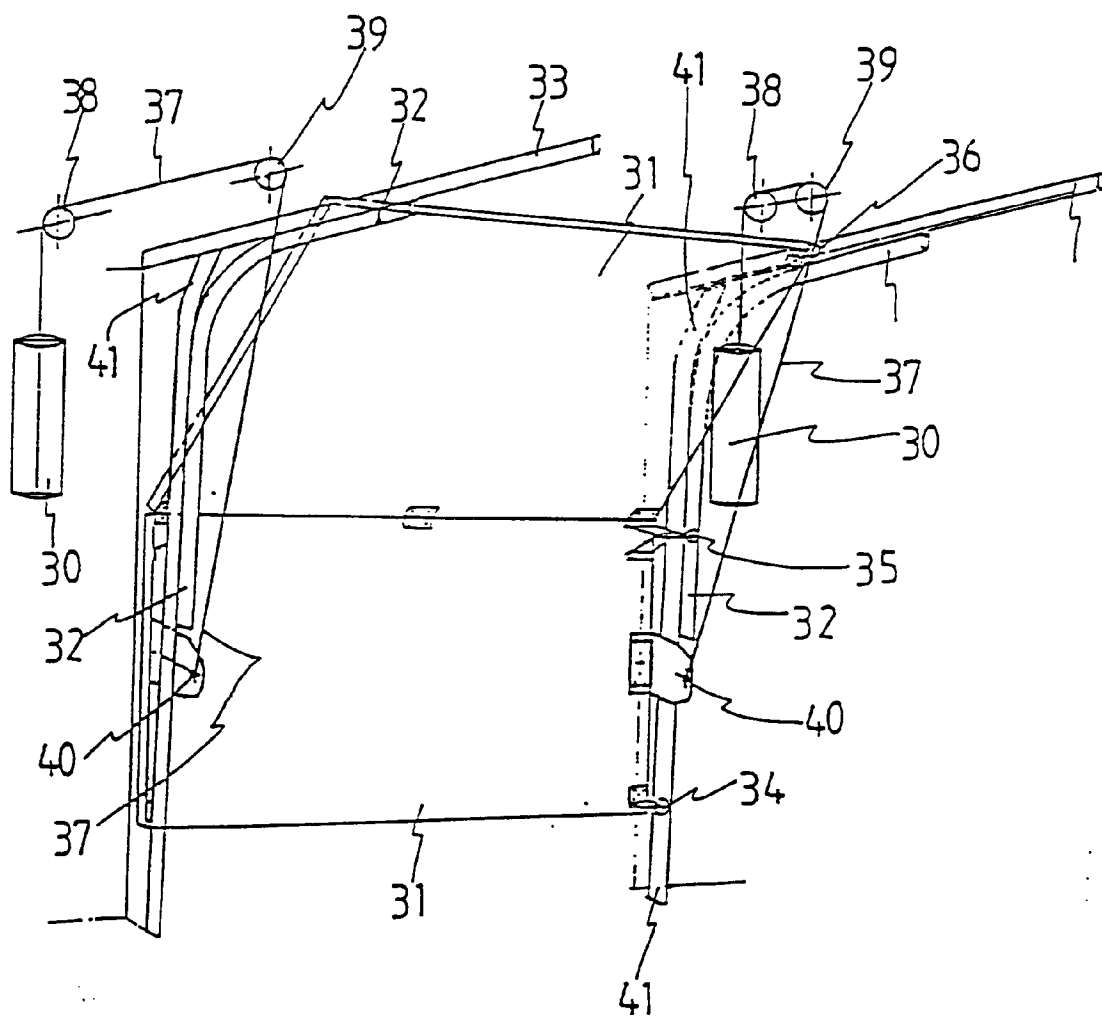


FIG. 6



European Patent  
Office

EUROPEAN SEARCH REPORT

Application Number  
EP 94 20 0060

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)
A	US-A-2 436 006 (KAISER) * the whole document * ---	1-10	E06B9/62 E05D13/00 E05D15/38
A	CH-A-678 557 (DOERING) * figures * ---	1-10	
A	DE-A-27 37 655 (H. KRUEGER MASCHINENFABRIK GMBH & CO) * the whole document * -----	1-10	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			E06B E05D E05F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 April 1994	Examiner Kukidis, S
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