

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets

(11) Publication number:

**0 330 838**  
**A1**

(12)

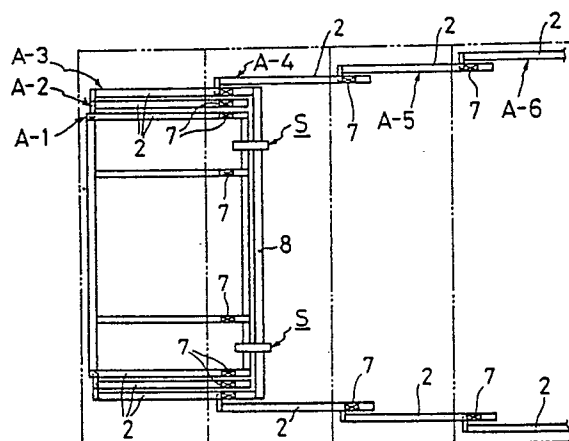
# **EUROPEAN PATENT APPLICATION**

(21) Application number: 89101316.1

(51) Int. Cl.4: **E04H 3/12**(22) Date of filing: **26.01.89**(30) Priority: **03.03.88 JP 27587/88 U**(43) Date of publication of application:  
**06.09.89 Bulletin 89/36**(84) Designated Contracting States:  
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**St. Pöltener Strasse 13**  
**D-7920 Heidenheim(DE)**(54) **Telescoping seating system.**

(57) A telescoping seating system(1) comprising a plurality of seating rows (2) different in height from each other, which can be extended to form a stepped stand, and retracted when not in use to be vertically aligned under the highest seating row; and a locking mechanism (S) for linking together the lowest seating row (A-1) and a desired number of intermediate seating row (A-2,A-3). The locking mechanism (S) comprises a bar (8) supported between a pair of leg supports (3) supporting the highest seating row (A-3) among the intermediate seating rows (A-2,A-3) to be linked en bloc, and a plurality of engaging members (13) provided lower portion of the lowest seating row (A-1), each being actuated by an actuating means (10) thereby to engage with or disengage from the bar (8).

**FIG.2**



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## TELESCOPING SEATING SYSTEM

This invention relates to a telescoping seating system adapted to be used for example in a gymnasium, and more particularly to a locking mechanism of the telescoping seating system for extending or retracting en bloc a desired number of seating rows ranging from the lowest seating row to an intermediate seating row.

Conventionally, a telescoping seating system generally comprises a plurality of seating rows different in height from each other and is capable of assuming a use position in which the seating rows are in a stepped relation, and a storage position when not in use in which all of the seating rows are retracted and vertically aligned under the highest seating row. When entertainment to be held in a gymnasium is of a small scale so that the number of audience is relatively small, or when a space for a game is desired to be enlarged by minimizing a space for seating rows, there has been employed a locking mechanism with which a desired number of seating rows from the lowest seating row to an intermediate seating row have been permitted to extend or retract en bloc in order to conform the seating rows to the multipurpose usage of the gymnasium readily.

The conventional locking mechanism comprises as shown in Japanese Utility Model Laid-Open Pub. No. 62-23950 a connecting bar horizontally suspended between a pair of intermediate seating row-supporting posts so that the back sides of each seating row ranging from the lowest seating row to the intermediate seating row contact the connecting bar, a base plate horizontally supported between the side bases of the lowest seating row, and a holding plate mounted on the base plate so as to be risen or laid down by means of a link.

When the holding plate is risen to be pressed onto the connecting bar, the seating rows ranging from the lowest seating row to the intermediate seating row are locked as a unit.

According to the conventional locking mechanism as explained above, a pair of links are required to be installed at both extreme side of the holding plate, so that the number of parts to be employed is necessarily increased thereby complicating the mechanism as a whole, making the fabrication and adjustment of the mechanism rather troublesome and giving rise to the breakdown of the mechanism.

Furthermore, when the unit of the seating rows ranging from the lowest seating row to the intermediate seating row is extended or retracted in a locked state, a large load is applied to the holding plate in such a manner to urge the holding plate to lay down, thereby causing the trembling or break-

down of the link.

This invention has been made in view of solving the above problems in the prior art to provide a locking mechanism for a telescoping seating system which is simple in structure, free from breakdown, mechanically strong enough to endure a large load which may be applied at the time of extension and retraction of the seating rows, and superior in safety and durability.

In order to attain the above objects, this invention provides a telescoping seating system which comprises a plurality of seating rows different in height from each other and capable of assuming a use position in which the seating rows are in a stepped relation, and a storage position when not in use in which all of the seating rows are retracted and vertically aligned under the highest seating row; and a locking mechanism for linking en bloc a desired number of seating rows ranging from the lowest seating row to an intermediate row, and is characterized in that the locking mechanism comprises a bar horizontally supported between the rear portions of a pair of leg supports disposed below both sides of the intermediate seating row such that each rear side surface of leg support disposed below both sides of each seating row which is lower than the intermediate seating row comes to be contacted to the bar when the leg supports are retracted, a base plate supported between the rear side portions of the lowest seating row, a plurality of actuating means mounted on the base plate, and a plurality of engaging members mounted on the base plate in association with the actuating means and capable of assuming a locking position by engaging with the bar and an unlocking position by being disengaged from the bar through an operation of the actuating means.

When the actuating means is regularly operated prior to extending the seating rows, the engaging members drivably connected to the actuating means is moved to a locking position to engage with the bar, thereby linking as a unit a plurality of seating rows ranging from the lowest seating row to the intermediate seating row. Therefore, when the seating rows are extended in this state, the plurality of seating rows ranging from the lowest seating row to the intermediate seating row are extended in a locked state.

Accordingly, when entertainment to be held in a gymnasium is of a small scale and the number of audience is relatively small, setting of the seating rows can be readily dealt with.

This invention will be further explained with reference to the drawings.

Fig. 1 is a side view of a main portion of a telescoping seating system according to this invention;

Fig. 2 is a top view of the telescoping seating system shown in Fig. 1;

Fig. 3 is an enlarged side view showing a partially cut-out locking mechanism embodying this invention;

Fig. 4 is a front view of the locking mechanism shown in Fig. 3;

Fig. 5 is a horizontal sectional view taken along line X-X; and

Fig. 6 is a side view of the main portion of a locking mechanism according to another embodiment of this invention.

Referring to Figs. 1 and 2, a telescoping seating system 1 comprises a plurality of seating rows 2, each having a different height from one another and linked together in such a manner that each of the seating rows 2 is capable of being moved back and forth. Specifically, when in use, all of the seating rows A-1 to A-n can be extended by pulling out the seating rows 2 in order of lower one beginning from the lowest seating row A-1 to form an ordinary stepped stand, and when not in use, all of the seating rows 2 can be vertically aligned and stored under the highest row (A-n) disposed at the room wall by retracting the seating rows 2 in order of lower one beginning from the lowest seating row A-1.

A plurality of wheels 4 rotatably mounted to each leg support 3 disposed respectively below both sides of each seating row 2 move on floor F, and supporting roller 6 rotatably mounted on the top of a supplementary post 5 erected at both back sides of each seating row 2 runs along a guide member mounted on the reverse side of the seating row 2, so that all of the seating rows 2 can be stably and smoothly moved back and forth.

When the seating rows 2 are in an extended state, the back portion of each seating row 2 is stably supported with support legs 7 of each corresponding height erected on the leg supports 3.

Between the pair of leg supports 3 disposed both sides of the intermediate seating row A-3, a bar 8 having a rectangular cross section is suspended at the rear portions thereof. Therefore, when each of the seating rows A-2 and A-1, which are disposed lower than the intermediate seating row A-3, is retracted and received within the intermediate seating row A-3, the rear sides of each leg support 2 are forced to contact the front side of the bar 8.

Base plates 9 are respectively supported as shown in Fig. 4 between each pair of the leg support 3 disposed at both sides of the lowest seating row A-1.

On each of the base plates 9 is mounted a locking mechanism S. This locking mechanism S comprises an actuating means such as a motor 10, a decelerating equipment 11 integrally connected therewith, a pinion 12 drivably connected to the decelerating equipment and an engaging member such as a rack 13 engaging with the pinion 12 and having on the rear portion thereof a reversed U-like hook 13a.

The pinion 12 and rack 13 are disposed between a pair of guiding plates 14 mounted on the base plate 9 spaced apart from each other.

The pinion 12 is coaxially mounted on a shaft 15 horizontally passing through the pair of the guiding plates. The pinion 12 can be rotated in a regular direction or in a direction reverse to the regular direction through coupling of the shaft 15 via a coupling member 17 to a driving shaft 16 protruded from the decelerating equipment 11.

The rack 13 slides up and down obliquely as shown in Fig. 5 by the engagement of a longitudinal grooves 18 obliquely formed on both sides of the rack 13 with an predetermined length of rids 19 formed on an inner side of the guiding plates. When the rack 13 is moved to the lower limit position, the hook 13a automatically engages with the upper portion of the bar 8 as shown in a dotted line in Fig. 3.

The operation of this locking mechanism is conducted as follows. Before extending the seating rows 2 of the telescoping seating system, the motor 10 is regularly rotated to actuate the pinion 12 connected to both bar 15 and driving shaft 16 to rotate clockwise in Fig. 3 via the deceleration equipment 11 integrally connected with the motor 10. At the same time, the rack 13 which engages with the pinion 12 is moved downward from the upper limit position, as shown in a solid line in Fig. 3, to the lower limit position, as shown in a dotted line in Fig. 3.

When the rack 13 is lowered in this manner, the hook 13a formed at the rear portion of the rack 13 is also lowered to engage with the bar 8, thereby locking and linking en bloc a plurality of seating rows ranging from the lowest seating row A-1 to the intermediate seating row A-3.

When the telescoping seating system 1 is allowed to extend by means of driving means (not shown) with this locked state, the plurality of seating rows including from the lowest seating row A-1 to the intermediate seating row A-3 are moved in the locked state and extended as if they are a first seating row with the seating rows higher than the intermediate seating row forming an ordinary stepped stand (Fig.1 ).

Accordingly, when the game to be conducted inside the gymnasium is of a small scale and the number of audience is small, the setting of a suit-

able number of the seating rows can be readily dealt with.

When the game is finished and the telescoping seating system is to be retracted and stored, the driving apparatus as described above is actuated in the reverse manner. In this case, the plurality of the seating rows including from the lowest seating row A-1 to the intermediate seating row A-3 are also retracted as a whole as if they are one seating row, and vertically aligned under the highest seating row.

When the hook 13a is disengaged from the bar 8 by actuating the reverse rotation of the motor 10, it is possible to extend all of the seating rows in a stepped relation to make the whole seating rows available to audience.

Fig. 6 shows another embodiment of this invention. In the above embodiment, the pinion 12 and rack 13 engaging with the pinion 12 are utilized as a locking mechanism, and the locking and unlocking of the hook 13a integrally formed with the rack 13, to the bar 8 is conducted by the upward and downward sliding of the rack 13. However, with this second embodiment, instead of employing the pinion 12, a hook member 20 having at the rear position a semi-circular engaging portion 20a facing downward is pivotally mounted between a pair of guiding plates 14 through a shaft 15, so that the engagement and disengagement of the hook member 20 can be conducted by rotating the shaft 15 together with the hook member 20 so as to allow the engaging portion 20a to be engaged with or disengaged from a horizontal bar 21 having a circular cross-section.

In the both embodiments explained above, a very simple construction is adopted as a locking mechanism, i.e. a hook is mounted to be simply engaged with a horizontal bar 8 or 21, so that the occurrence of breakdown would be effectively prevented. Moreover, any load which might be brought about during the movement of the plurality of seating rows en bloc is directly born by the base plate 9 through the guiding plate 14, and the strength of the locking mechanism is highly strengthened as compared with the conventional link structure so that it would be hardly broken down.

It should be understood that this invention is not limited to the above embodiments, but various modifications thereof are possible.

For example, the bar 8 may be made adjustable lengthwise, so that the bar 8 can be detachably mounted on any pair of leg supports of every seating rows 2 thereby allowing any desired seating rows to be locked together with the lowest seating row by simply changing the fixing position of bar 8.

As explained above, the locking mechanism as provided by this invention is simple in structure,

easy to fabricate and adjust, and not prone to break down.

Furthermore, the strength of the engaging member is superior to that of the conventional one, so that even if any load which might be brought about during the movement of a plurality of the seating rows being locked together or during unexpected earthquake is given to the engaging member, the trembling or break-down of the locking mechanism would not be caused and would keep a very stable locking status, thus enhancing the safety thereof.

## Claims

1. A telescoping seating system comprising a plurality of seating rows (2) different in height from each other and capable of assuming a use position in which the seating rows (2) are in a stepped relation, and a storage position when not in use in which all of the seating rows (2) are retracted and vertically aligned under the highest seating row; and a locking mechanism (S) for linking en bloc a desired member of seating rows (2) ranging from the lowest seating row (A-1) to an intermediate row (A-3);

characterized in that,

the locking mechanism (S) comprises; a bar (8,21) horizontally supported between the rear portions of a pair of leg supports (3) disposed below both sides of the intermediate seating row (A-3) such that each rear side surface of leg support (3) disposed below both sides of each seating row (A-1,A-2) which is lower than the intermediate seating row (A-3) comes to be contacted to the bar (8,21) when the leg supports (3) are retracted; a base plate (9) supported between the rear side portions of the lowest seating row (A-1); a plurality of actuating means (10) mounted on the base plate (9); and a plurality of engaging members (13) mounted on the base plate in association with the actuating means (10) and capable of assuming a locking position by engaging with the bar (8,21) and an unlocking position by being disengaged from the bar through an operation of the actuating means.

2. The telescoping seating system according to claim 1, characterized in that each of said engaging members is a rack member (13) provided at the rear portion thereof with a hook facing downward, and each of said actuating means comprises a pinion (12) engaged with the rack member.

3. The telescoping seating system according to claim 1, characterized in that each of said engaging members is a hook member (20) rotatably connected to said actuating means.

4. The telescoping seating system according to claim 1, characterized in that said bar (8,21) is detachably supported between any pair of leg supports disposed below one of the intermediate rows.

5. The telescoping seating system according to claim 4, characterized in that said bar is made adjustable in length.

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FIG. 1

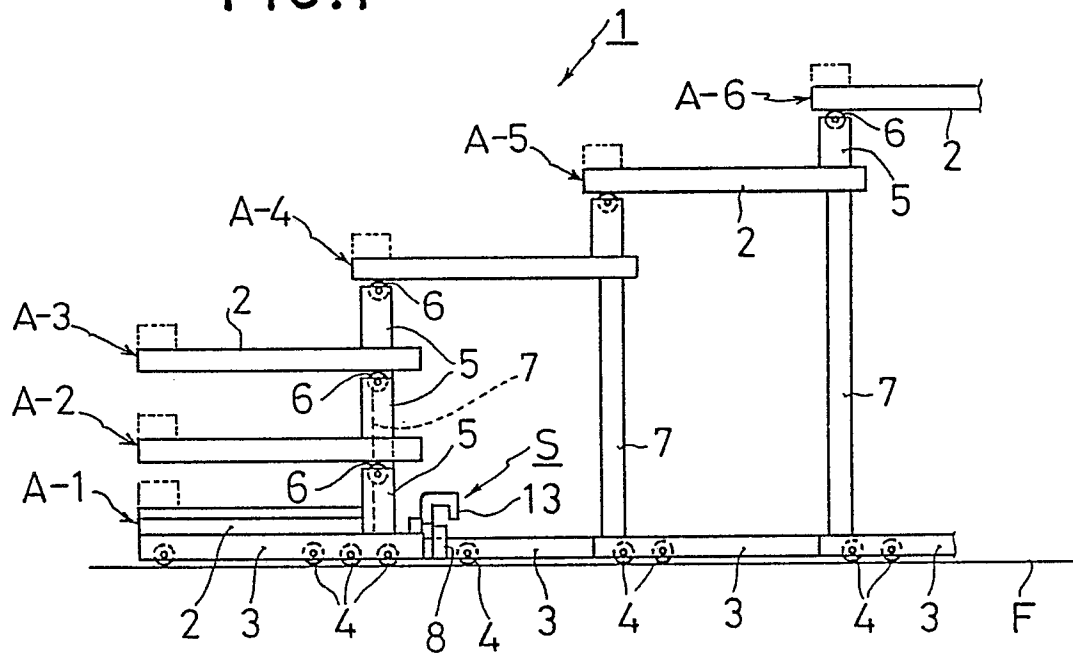


FIG.2

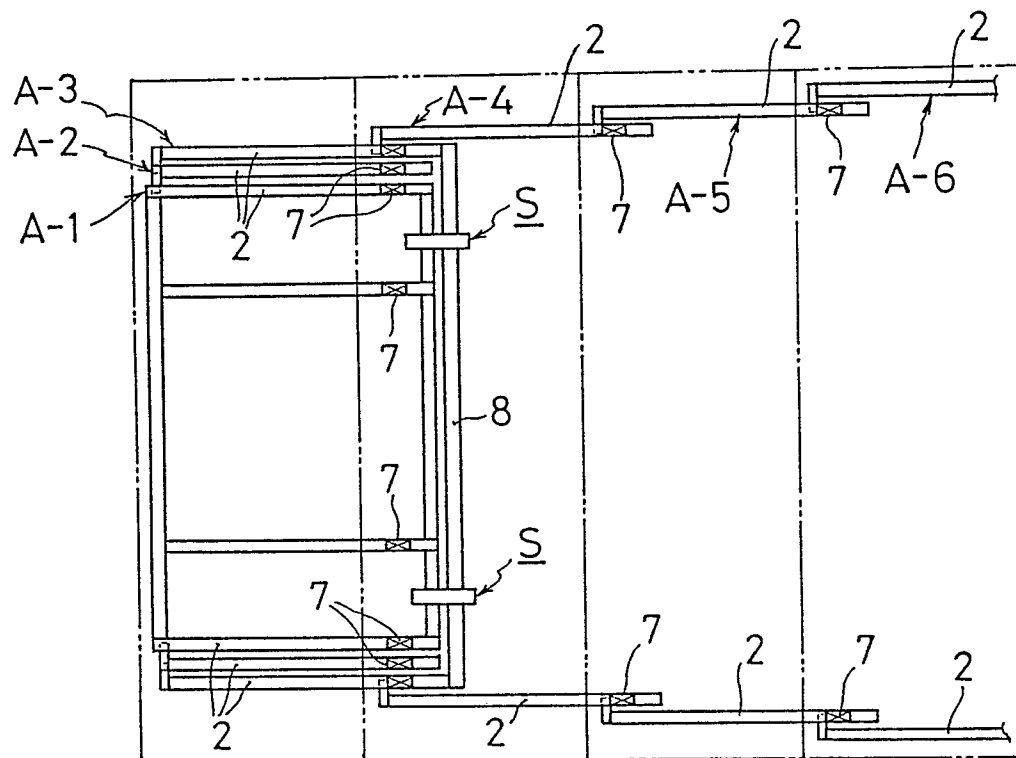


FIG. 3

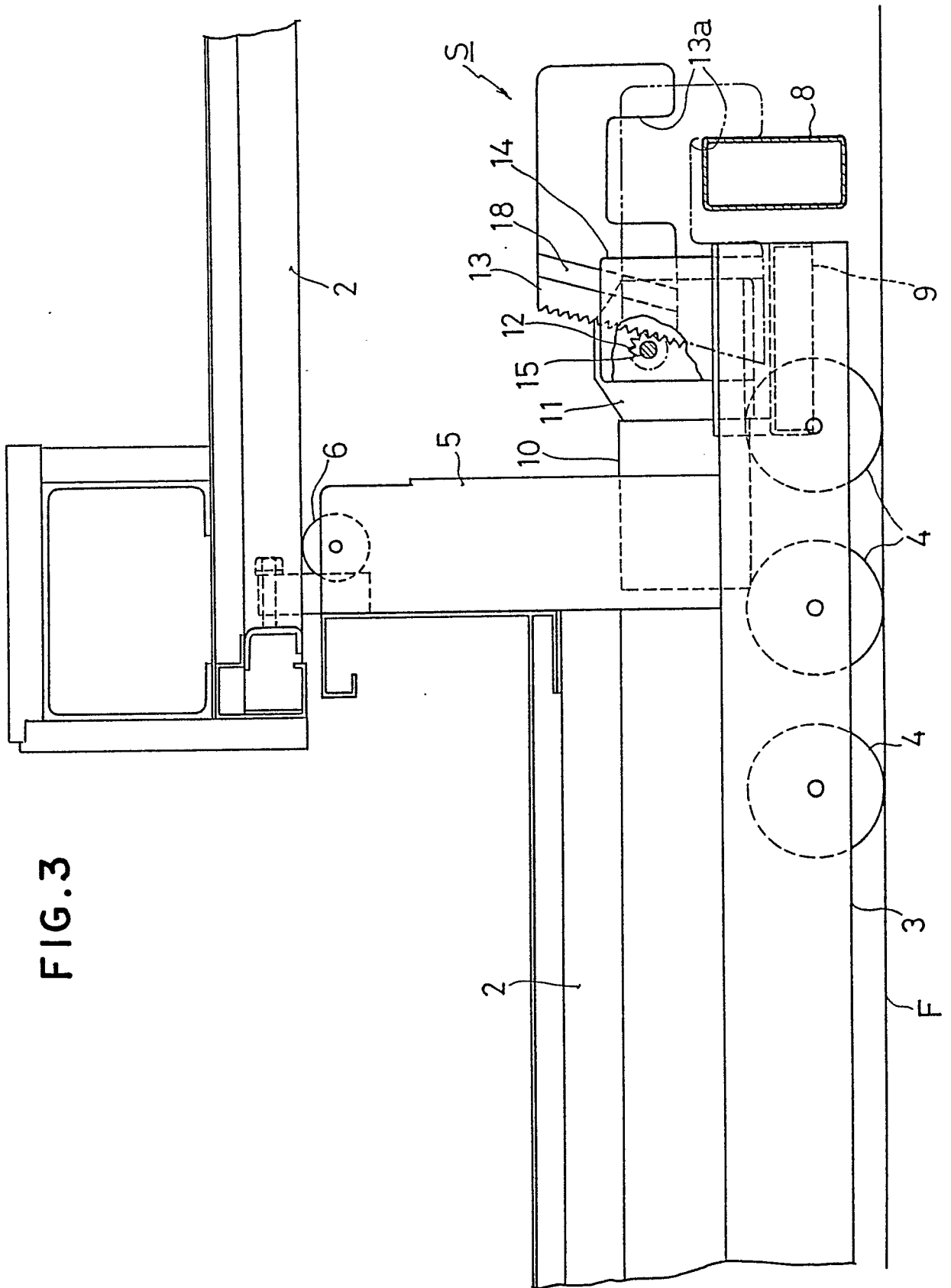


FIG. 4

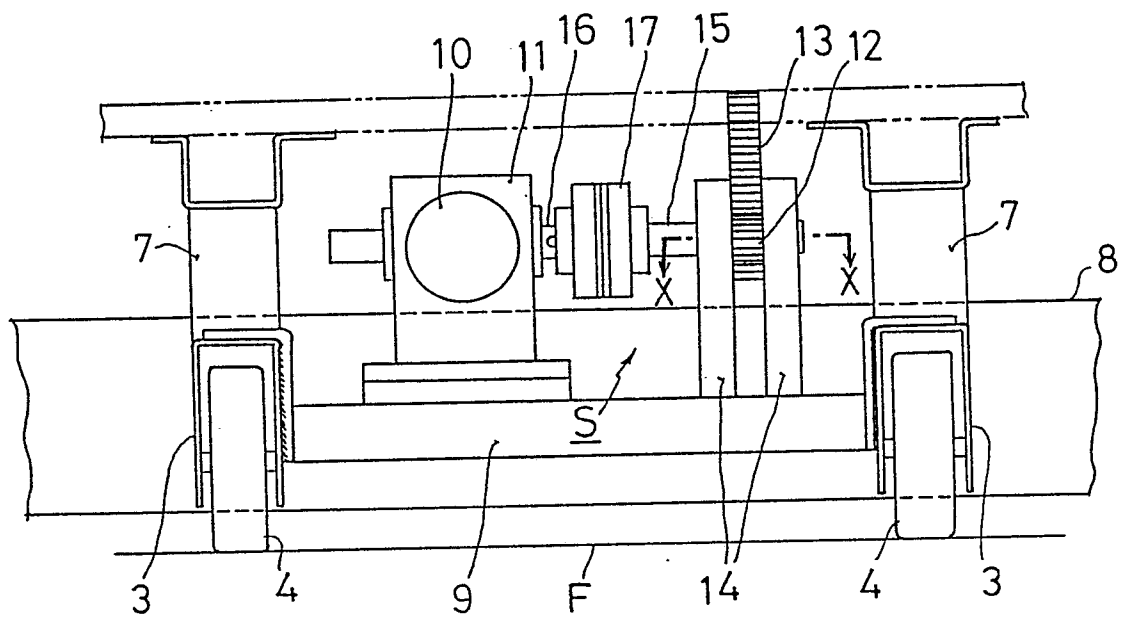
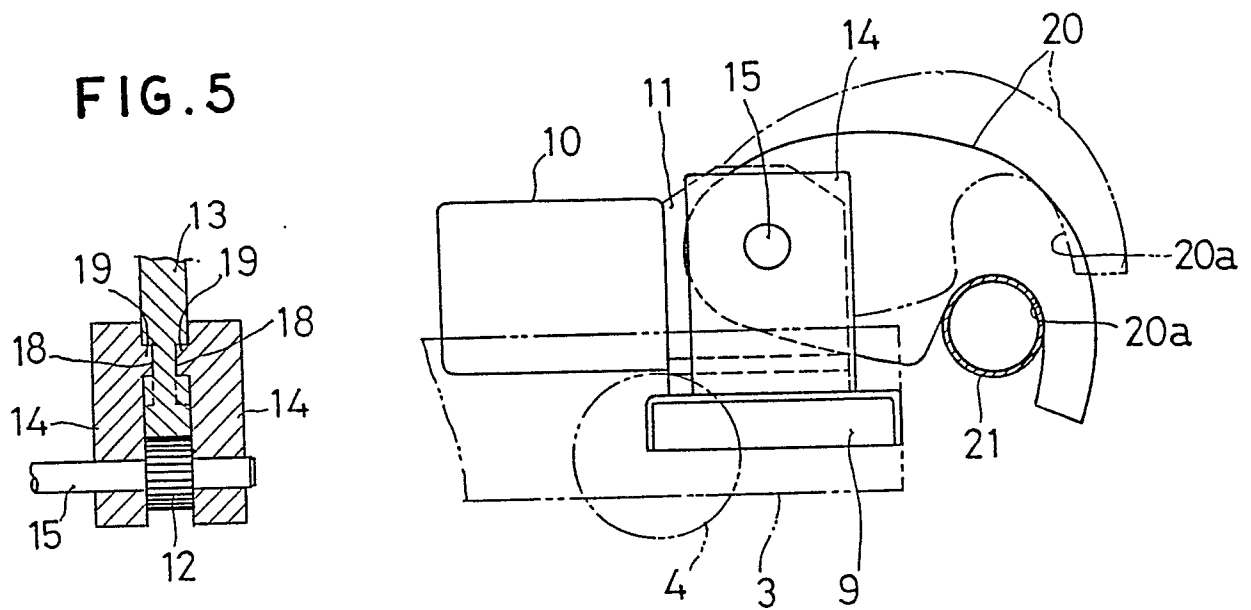


FIG. 6





| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                     |                                                |                                                |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
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| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document with indication, where appropriate, of relevant passages                       | Relevant to claim                              | CLASSIFICATION OF THE APPLICATION (Int. Cl. 4) |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | DE-A-3 013 530 (NIJHA B.V.)<br>* Page 6, last paragraph - page 8, paragraph 2; figures 1,2 *<br>--- | 1                                              | E 04 H 3/12                                    |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-A-3 429 081 (ROBINSON)<br>* Column 3, lines 19-60; figures 1-A,1-B,2 *<br>---                    | 1                                              |                                                |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-A-3 389 511 (DREHOBL)<br>* Column 5, lines 15-48; figures 1,4,5 *<br>-----                       | 1                                              |                                                |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                     |                                                | TECHNICAL FIELDS SEARCHED (Int. Cl.4)          |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                     |                                                | E 04 H                                         |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                     |                                                |                                                |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                     | Date of completion of the search<br>19-04-1989 | Examiner<br>CLASING M.F.                       |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
| <table border="0"><tr><td><b>CATEGORY OF CITED DOCUMENTS</b></td><td><b>T : theory or principle underlying the invention</b></td></tr><tr><td>X : particularly relevant if taken alone</td><td>E : earlier patent document, but published on, or after the filing date</td></tr><tr><td>Y : particularly relevant if combined with another document of the same category</td><td>D : document cited in the application</td></tr><tr><td>A : technological background</td><td>L : document cited for other reasons</td></tr><tr><td>O : non-written disclosure</td><td>.....</td></tr><tr><td>P : intermediate document</td><td>&amp; : member of the same patent family, corresponding document</td></tr></table> |                                                                                                     |                                                |                                                | <b>CATEGORY OF CITED DOCUMENTS</b> | <b>T : theory or principle underlying the invention</b> | X : particularly relevant if taken alone | E : earlier patent document, but published on, or after the filing date | Y : particularly relevant if combined with another document of the same category | D : document cited in the application | A : technological background | L : document cited for other reasons | O : non-written disclosure | ..... | P : intermediate document | & : member of the same patent family, corresponding document |
| <b>CATEGORY OF CITED DOCUMENTS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>T : theory or principle underlying the invention</b>                                             |                                                |                                                |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
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| O : non-written disclosure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | .....                                                                                               |                                                |                                                |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |
| P : intermediate document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | & : member of the same patent family, corresponding document                                        |                                                |                                                |                                    |                                                         |                                          |                                                                         |                                                                                  |                                       |                              |                                      |                            |       |                           |                                                              |