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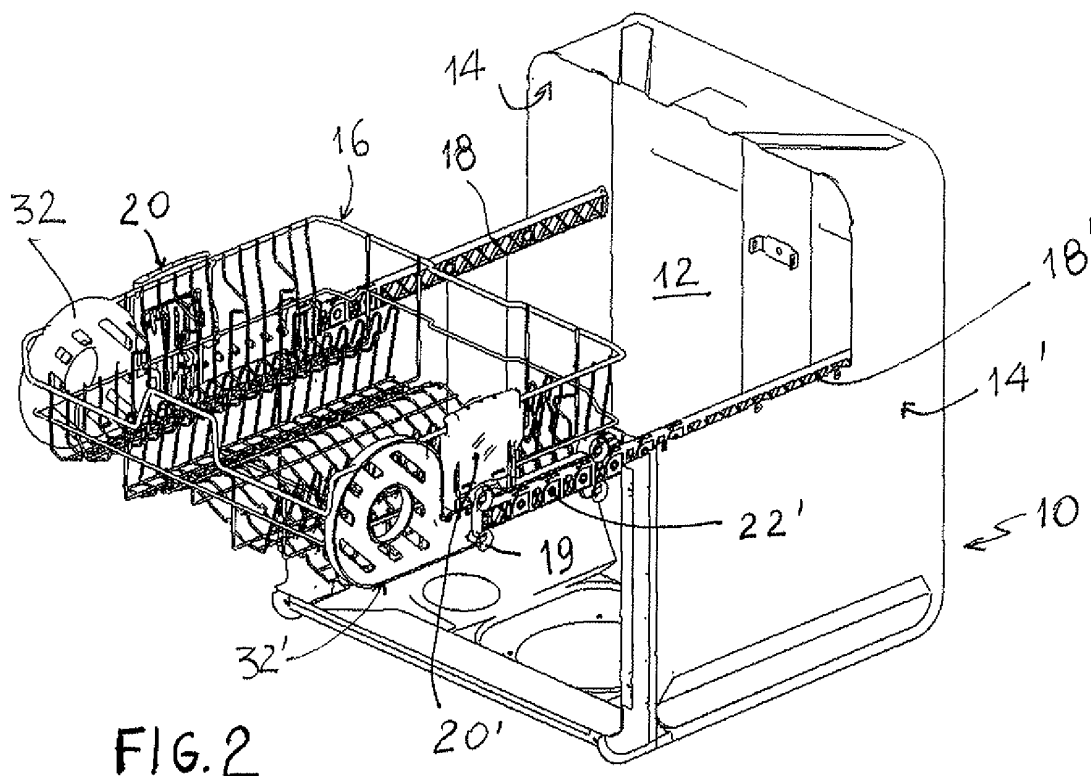
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**AL BA HR MK RS**(71) Applicant: **WHIRLPOOL CORPORATION****Benton Harbor****Michigan 49022 (US)**(72) Inventor: **Dabal, Michal****Whirlpool Eurpoe s.r.l.****21025, Comerio (IT)**(74) Representative: **Guerçi, Alessandro****Whirlpool Europe S.r.l.****Patent Department****Viale G. Borghi 27****21025 Comerio (VA) (IT)**(54) **Dishwasher with rack mounted on rails and roller chains associated thereto**

(57) It is disclosed a dishwasher (10) with a washing chamber (12) and a rack (16) slidably mounted on a pair of rails (18,18') connected to a pair of roller chains (22, 22') that form substantially rigid longitudinal extensions that support said rack (16) during sliding in and out said washing chamber (12). The rollers (24) of the roller chains (22,22') have a structure that prevent downward bending

but allow upward bending of the chains (22,22'). The flanks of the rack (16) comprise housings (32,32') to accommodate the roller chains (22,22') in the bent state. The chains are deployed when the rack is pulled out of the washing chamber, otherwise they are stored in a bent state within the housings (32, 32'). They can be partially deployed or fully deployed, thereby allowing to withdraw the rack on different distances.

**FIG. 2****EP 1 982 633 A1**

## Description

**[0001]** The present invention relates to a dishwasher with a rack mounted on rails and roller chains associated thereto. More particularly, the invention relates to a dishwasher with a rack slidably mounted on rails and roller chains that bend on the flanks of the rack.

**[0002]** A typical dishwasher comprises a washing chamber provided with an upper and a lower rack for holding items to be cleaned. The washing chamber is typically accessible through a door, and the upper rack is typically mounted on a pair of rails to pull the rack out of the washing chamber and load it with the items to be cleaned, or unload it after cleaning. Usually, the rails are movably mounted to opposed walls of the washing chamber, and the racks include wheels that ride on the rails.

**[0003]** Several rack and rails systems are known in the art and disclosed in the patent literature.

**[0004]** EP 1 552 781 A2 discloses a dishwasher comprising a pair of rails that support a sliding rack for holding items to be cleaned. The rails comprise a plurality of U-shaped elements sliding telescopically into each other, the end elements being fixed to the walls of the washing chamber and to the rack, respectively. The elements forming the rails are provided with holes, to allow circulation of water and avoid deposition of solids within the cavity of the U-shaped elements. However, a structure of rails formed by elements sliding telescopically into each other does not ensure optimum stability and perfect alignment during extension, particularly at a full load condition. Also, the U-shape of the sliding elements is critical with respect to possible deposit of solid particles released by the items to be cleaned.

**[0005]** SU 1 329 767 A1 discloses a dishwasher rack of adjustable length, comprising an upper and a lower spring holding dishes to be washed, and side walls represented by roller chains with end portions sliding within channels formed in end walls having the function also of handles. The rack is designed to be removed from the dishwasher to load/unload the items to be cleaned. The roller chains allow to adjust the length of the rack but do not function as support of the rack. The structure of the rack is rather complex and does not ensure that the items to be cleaned are safely held on the rack during operation. Also, a disadvantage of this dishwasher is that a series of manual actions are required to load/unload the rack with the items to be cleaned, including hooking/releasing the upper and lower springs and pulling/pushing the roller chains in and out the channels of the end walls. In contrast, customers require dishwashers reliable with respect to holding the items firmly on the rack, and easy to operate.

**[0006]** It is therefore the overall object of the present invention to disclose a dishwasher comprising a rack that is easy to operate, ensures smooth sliding on the rails during continuous operation, and is relatively not expensive.

**[0007]** The aforesaid and other objects of the inven-

tion, as it will appear from the following description, are achieved by a dishwasher comprising a washing chamber and a rack slidably mounted on a pair of rails in the washing chamber, characterized by comprising a pair of roller chains connected to said rails to form substantially rigid longitudinal extensions that support said rack during sliding in and out said washing chamber; and further characterized by:

- said rollers of said chains comprising lower portions preventing downward bending of said chains,
- said rack comprising housings on the flanks thereof to accommodate said roller chains in the bent state.

**[0008]** According to an aspect of the invention, said rollers of said chains comprise bevelled upper portions allowing upward bending of said chains into said washing chamber.

**[0009]** According to another aspect of the invention, said roller chains of said dishwasher are bent upwards within said housings according to a substantially circular path.

**[0010]** According to a further aspect of the invention, said substantially circular path is defined by a substantially circular groove formed in said housings, said groove having a length sufficient to accommodate said roller chain entirely.

**[0011]** According to still a further aspect of the invention, said rollers of said roller chains are hinged through pins with axis perpendicular to the longitudinal axis of said rails, and comprise a front portion with a bottom wall against which the rear portion of an adjacent roller abuts, so that rotation is limited and downward bending of the chain is prevented, thereby ensuring alignment of said chains to said rails during sliding of said rack in and out said washing chamber.

**[0012]** Some embodiments of the invention will now be described by way of example with reference to the attached drawings, wherein:

Fig. 1 is a schematic perspective view of a dishwasher according to the invention with a rack positioned within the washing chamber;

Fig. 2 is a perspective view of the dishwasher of Fig. 1 with the rack in positioned out of the washing chamber;

Fig. 3, 4 and 5 are perspective views of a part of the dishwasher of Figure 1 or 2 in different operative positions;

Fig. 6 is an exploded perspective view of a part of the dishwasher of Figure 3-5;

Fig. 7 is an enlarged perspective view of an element of the dishwasher of Figure 3-5; and

Fig. 8 is a front view of the element of Fig. 7.

**[0013]** With reference to Fig. 1 and 2, a household dishwasher 10 is schematically represented without front door and with side walls 14,14' partially removed. Dish-

washer 10 comprises a washing chamber 12 and a rack 16 slidably mounted on rails 18,18'. Rack 16 is designed to hold dishes and other kitchen items to be cleaned, as known in the field. Rails 18,18' are fixed to side walls 14,14' of washing chamber 12. Fig. 1 shows rack 16 within washing chamber 12, typically corresponding to a state of door closed. Fig. 2 shows rack 16 pulled out from washing chamber 12, typically corresponding to a state of door open when loading/unloading the rack.

**[0014]** Rack 16 is slidably mounted on rails 18,18a by means of wheels 19 projecting from supports 20,20' fixed to the flanks of rack 16, as better shown in Figures 3-6. Typically, wheels 19 comprise a pair of upper wheels and a pair of lower wheels, to allow a stable and smooth sliding movement of rack 16 on rails 18,18'.

**[0015]** According to an aspect of the invention, a pair of roller chains 22, 22' is connected to rails 18,18', to form substantially rigid longitudinal extensions that support rack 18,18' during sliding movement in and out washing chamber 12.

**[0016]** Each roller chain 22, 22' consists of a series of roller 24, better shown in Figures 6-8, hinged to each other through pins 26 with axis X perpendicular to the longitudinal axis of rails 18, 18'. Each roller is hinged to adjacent rollers by means of two pins, one located in a front portion 23 and the other located in a rear portion 25. Front portion 23 is formed with a central recess 28 suitable to receive the rear portion 25 of an adjacent roller, so that a pin 26 is inserted into corresponding holes of the front portion 23 and of the associated rear portion of an adjacent roller to rotatably connect the two adjacent rollers. Rotation of two adjacent rollers, however, is limited to a direction above an horizontal plane in which rails 18, 18' lay. This is achieved by providing front portion 23 of each roller 24 with a bottom wall 29, against which the rear portion of an adjacent roller abuts, so that rotation in a direction below an horizontal plane in which rails 18, 18' lay is prevented. Such structure of roller 24 prevents a downward bending of roller chains 22, 22', thereby ensuring that chains 22, 22' are rigidly aligned to rails 18, 18' during sliding of rack 16 in and out washing chamber 12.

**[0017]** The upper portion 30 of front portion 23 of each roller 24 is bevelled, so that upward bending of roller chains 22, 22' is possible.

**[0018]** Upward bending of chains 22, 22' is effected when rack 16 is pushed into the washing chamber. To this purpose the flanks of rack 16 are provided with suitable housing 32, 32' for roller chains 22, 22' in the bent state. As shown in Figure 3-6, housings 32, 32' are rigidly connected to supports 20,20' fixed to the flanks of rack 16. Supports 20, 20' and housing 32, 32' are preferably made of a single piece, as shown in Fig. 6 with reference to support 20 and housing 32 for chain 22. Such piece includes also shafts such as 34 on which wheels 19 are mounted.

**[0019]** According to an aspect of the invention, roller chains 22, 22' bend within housings 32, 32' according to

a substantially circular path, so that any entanglement or blocking of the motion of the chains caused by a too narrow bend of rollers 24 is prevented. Also, bending of the chains according to a substantially circular path reduces the space required to store the chain in the bent state.

**[0020]** A bending according to a substantially circular path is achieved by providing a substantially circular groove such as 36 in housings 32, 32'. As shown in Fig. 3, groove 36 has a length sufficient to accommodate roller chains 22, 22' for their entire length, corresponding to a state of the rack fully pushed into washing chamber 12, for instance during washing operation.

**[0021]** Therefore, roller chains 22, 22' are capable to be in a fully extended position, as shown by Figure 2 and 5, and in a fully bent position, as shown by Figure 1 and 3, and in all intermediate positions in-between, as shown for example in Figure 4.

**[0022]** In the fully extended position of Figure 2 and 5, roller chains 22, 22' are aligned with rails 18, 18', to form substantially rigid longitudinal extensions of rails 18, 18' that support rack 16 during sliding in and out washing chamber 12. The height of rollers 24 is the same as the height of rails 18, 18', so that there is no discontinuity in the line of ride of wheels 19 on the passage from rails to chains, thereby a smooth support to wheels 19 is provided. Side skid and downward bending of the chains are prevented by the structure and mutual connection of rollers 24. Side skid is prevented by the coupling of rear portions 25 into recess 28 of front part 23, which allow rotation about X axis only. Bending downwards is prevented by bottom wall 29 of front part 23, as described above.

**[0023]** When rack 16 is pushed from the fully extended position in the direction of washing chamber 12, each chain 22, 22' is forced to bend by engaging circular groove 36, as shown in Fig. 4. Bending upwards is eased by the bevelled upper portion 30 of rollers 24. In the fully bent state of Fig. 3, chain 22 occupies almost entirely groove 36, in which it is stored typically when the door of the washing chamber is closed.

**[0024]** The structure of the rack, rails and roller chains assembly according to the invention is such to ensure a reliable and continuous operation. Roller chains 22, 22' are preferably made of a synthetic resin, for example by moulding each component with a suitable plastic material. This allows to combine the desired mechanical properties with optimum resistance to wet environment and/or chemical corrosion that could be caused by cleaning agents and additives used during operation of the dishwasher. Also, support 20 and housing 32 can be produced in one piece of suitable plastic material, preferably by injection moulding. Each rail 18, 18' can be produced in a single piece of suitable plastic material, instead of conventional steel rails, and can be fixed directly to the walls of washing chamber 12, ensuring also a better stability.

**[0025]** It is clear from the description above that other embodiments of the dishwasher according to the inven-

tion are possible within the same inventive concept.

## Claims

1. Dishwasher (10) comprising a washing chamber(12) and a rack (16) slidably mounted on a pair of rails (18,18') in the washing chamber, **characterized by** comprising a pair of roller chains (22, 22') connected to said rails (18,18') to form substantially rigid longitudinal extensions that support said rack (16) during sliding in and out said washing chamber (12); and further **characterized by**:
  - said rollers (24) of said roller chains (22,22') comprising lower portions (29) preventing downward bending of said chains (22,22');
  - said rack (16) comprising housings (32,32') on the flanks thereof to accommodate said roller chains (22,22') in the bent state.
2. Dishwasher according to claim 1, **characterized in that** said rollers (24) of said roller chains (22,22') comprise bevelled upper portions (30) allowing upward bending of said chains into said housings (32,32').
3. Dishwasher according to claim 1, **characterized in that** said roller chains (22,22') are bent within said housings (32,32') according to a substantially circular path.
4. Dishwasher according to claim 3, **characterized in that** said substantially circular path is defined by a substantially circular groove (36) formed in said housings (32,32'), said groove (36) having a length sufficient to accomodate said roller chains (22,22') entirely.
5. Dishwasher according to claim 1, **characterized in that** said rollers (24) of said roller chains (22,22') are hinged through pins (26) with axis (X) perpendicular to the longitudinal axis of said rails (18,18'), and comprise lower portions (29) limiting rotation to prevent downward bending of the chains, thereby ensuring alignment of said chains (22,22') to said rails (18,18') during sliding of said rack (16) in and out said washing chamber (12).
6. Dishwasher according to claim 5, **characterized in that** said lower portions (29) of said rollers (24) limiting rotation comprise a bottom wall formed in the front portion (23) of each of said roller (24) against which the rear portion (25) of an adjacent roller abuts, so that downward bending of the chain is prevented, thereby ensuring alignment of said chains (22,22') to said rails (18,18') during sliding of said rack (16) in and out said washing chamber (12).
7. Dishwasher according to claim 1, **characterized in that** said housings (32, 32') for said roller chains (22, 22') are rigidly connected to supports (20,20') fixed to the flanks of said rack (16).
8. Dishwasher according to claim 7, **characterized in that** said supports (20, 20') and said housings (32, 32') are made of a single piece.
9. Dishwasher according to claim 1, **characterized in that** said supports (20, 20') and said housings (32, 32') are made of a single piece of plastic material.
10. Dishwasher according to claim 9, **characterized in that** such single piece of plastic material includes also shafts (34) on which wheels (19) are mounted for sliding movement of said rack (16) on said pair of rails (18,18').

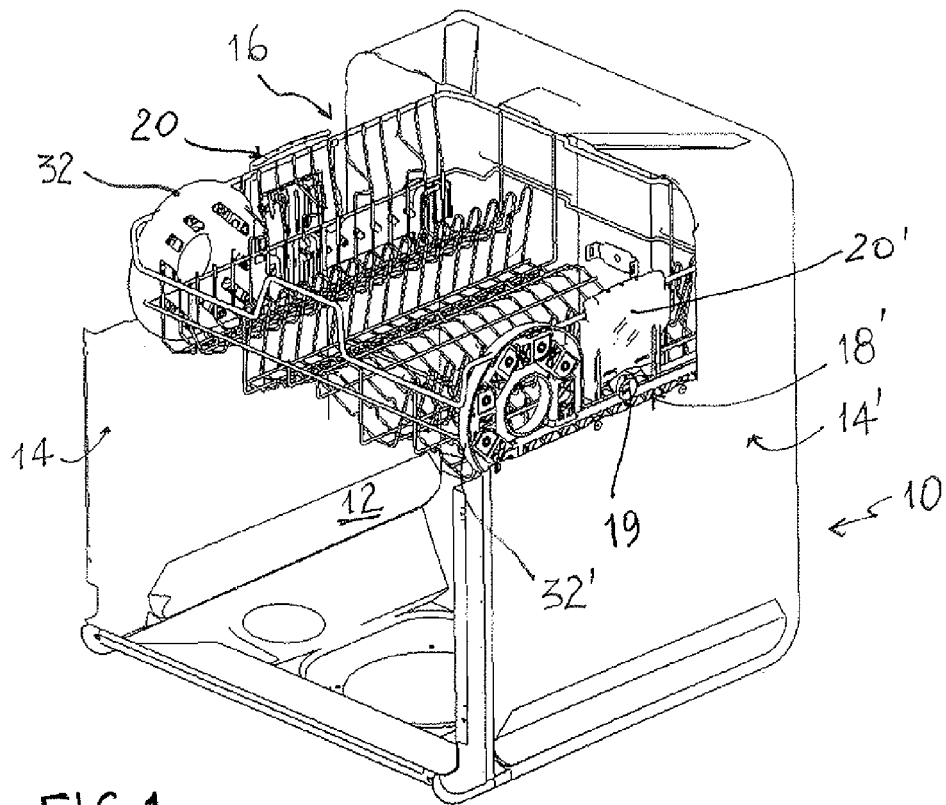


FIG. 1

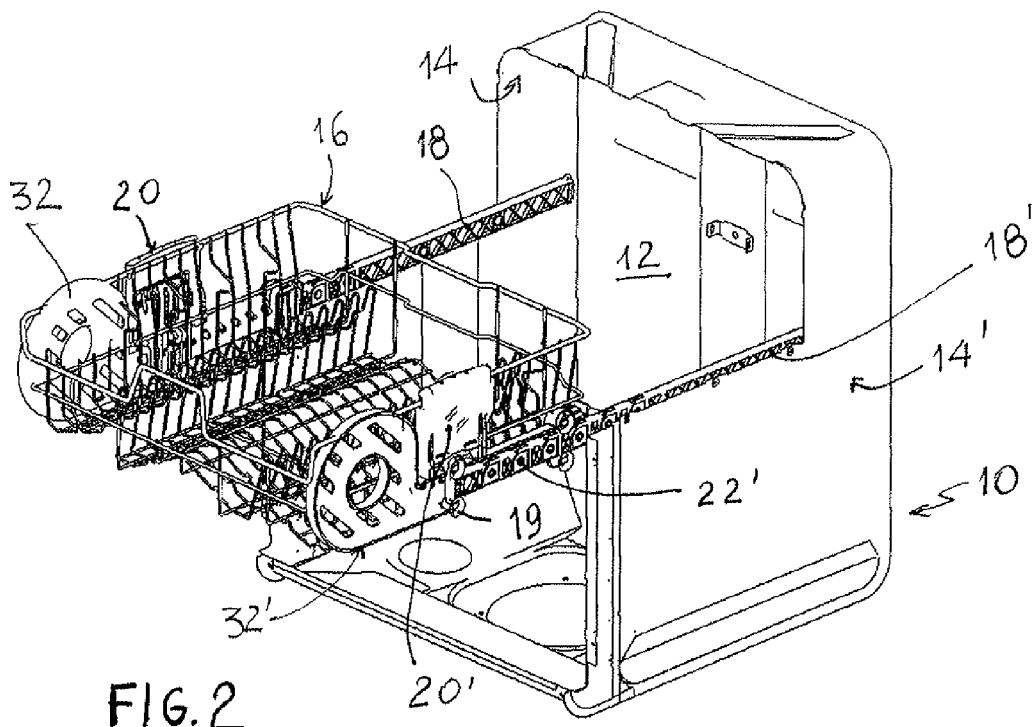
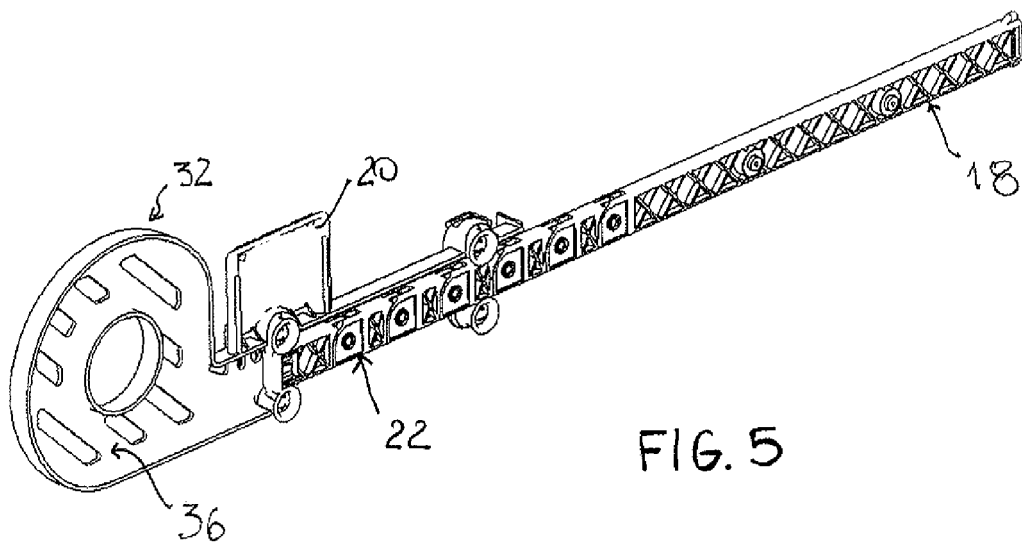
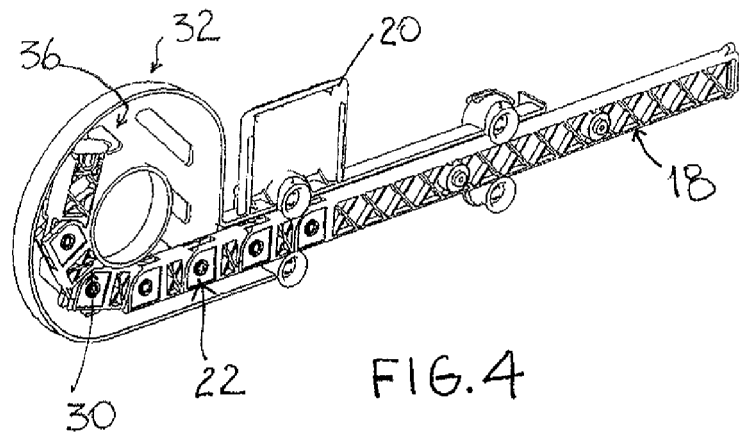
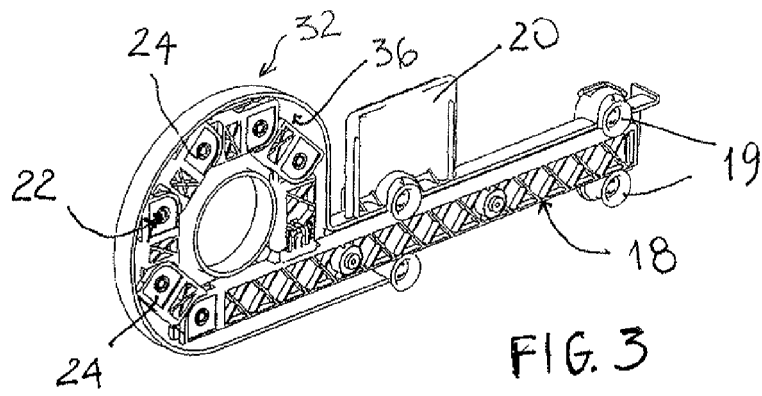


FIG. 2



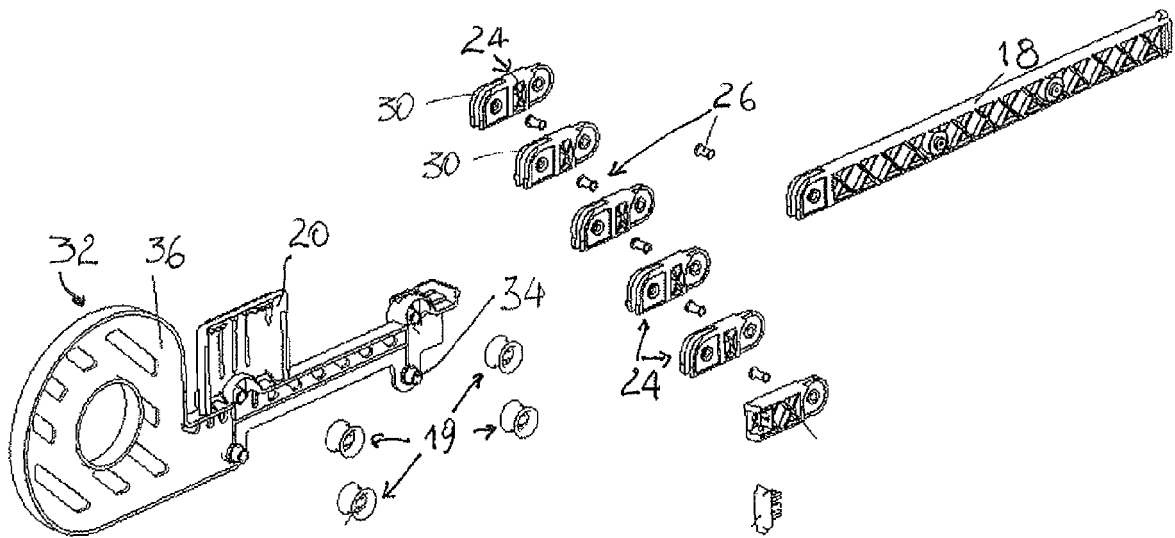


FIG. 6

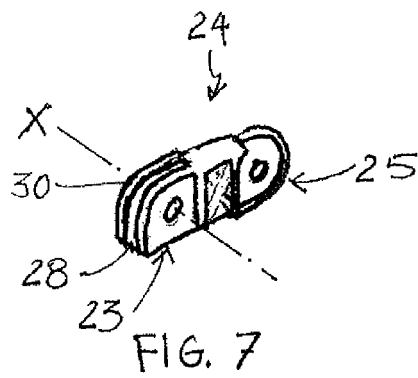


FIG. 7

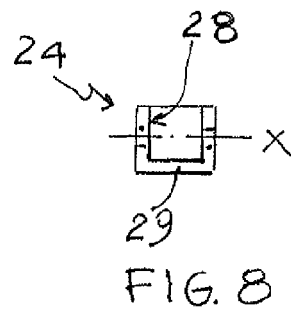


FIG. 8



European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 07 10 6214

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                    |                                                       |                                         |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                    |                                                       |                                         |
| Place of search<br>The Hague                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                    | Date of completion of the search<br>26 September 2007 | Examiner<br>Norman, Pia                 |
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 07 10 6214

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