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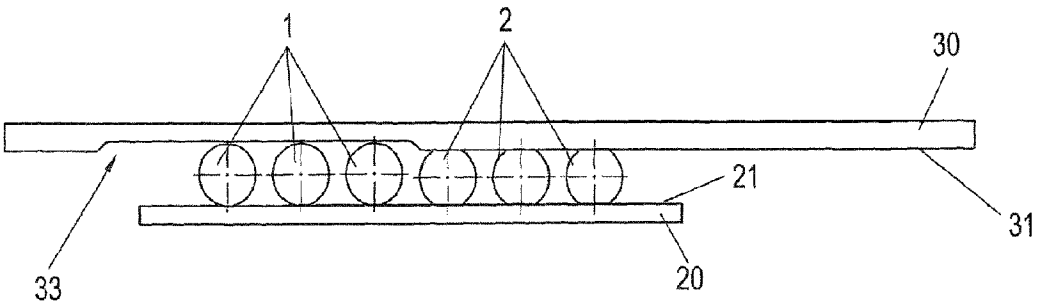

(57) Abrégé/Abstract:
A pull-out guide for furniture parts that can be moved in relation to each other comprises at least two pull-out rails having at least one running surface, between which at least one first rolling element and at least one second rolling element are arranged. The rolling elements are rotatably retained in at least one rolling- element cage. One or more of the at least one first rolling elements are arranged within at least one of the at least one rolling-element cage, one after the other in a longitudinal direction of the pull-out guide and the at least one first rolling element and the at least one second rolling element have an identical nominal diameter. At least one of the running surfaces has a free-running segment in which the at least one first rolling element is positioned, in a retracted state of the pull-out guide. The running surfaces have a greater distance from each other within the free-running segment than outside the free-running segment. The free-running segment has a length which is as at least as great as a maximum distance of two of the at least one of the first rolling elements.

ABSTRACT

A pull-out guide for furniture parts that can be moved in relation to each other comprises at least two pull-out rails having at least one running surface, between which at least one first rolling element and at least one second rolling element are arranged. The rolling elements are rotatably retained in at least one rolling-element cage. One or more of the at least one first rolling elements are arranged within at least one of the at least one rolling-element cage, one after the other in a longitudinal direction of the pull-out guide and the at least one first rolling element and the at least one second rolling element have an identical nominal diameter. At least one of the running surfaces has a free-running segment in which the at least one first rolling element is positioned, in a retracted state of the pull-out guide. The running surfaces have a greater distance from each other within the free-running segment than outside the free-running segment. The free-running segment has a length which is as at least as great as a maximum distance of two of the at least one of the first rolling elements.

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PULL-OUT GUIDE FOR FURNITURE PARTS THAT CAN BE MOVED IN RELATION TO EACH OTHER

FIELD

This disclosure relates to a pull-out guide for furniture parts that can be moved in relation to each other, comprising at least two pull-out rails having at least one running surface. At least one first rolling element and at least one second rolling element are arranged between the pull-out rails, which rolling elements are rotatably retained in a rolling-element cage, wherein the at least one first rolling element and the at least one second rolling element have an identical nominal diameter.

BACKGROUND

Pull-out guides for furniture parts that can be moved in relation to each other such as drawers which are movably mounted in a furniture body are known from the prior art, e.g. from the publication DE **536 654** C**2**. Rotatably mounted cylindrical rollers or balls are used as rolling elements in the rolling-element cage. “Hard” steel balls or rollers are frequently used because they allow smooth guidance even under high mechanical loads by a heavy weight which is movably held by the pull-out guide. A loud rolling noise can be disadvantageous however.

For the purpose of reducing the rolling noises, it is known to use plastic rolling elements in drawers which need not carry any exceptionally high weights. There is a problem in respect of the plastic rolling elements however that prolonged idle times can lead to a flattening of the rolling elements. The flattening of the plastic rollers is reversible. The plastic rollers are thoroughly kneaded by a subsequent actuation of the pull-out guide and assume their original form again. Vibrations occur initially as a result of the flattened portions and consequently to an increased running noise (“rumbling”).

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A pull-out guide for drawers is described in the publication EP **1 959 794** B**1**, in which rolling elements with different diameters are inserted. The pull-out rails of the pull-out guide are formed in such a way that in the closed state of the drawer only the first rolling element with the smaller diameter is loaded. For this purpose, one of the guide rails comprises an elevation facing the rolling elements in a front end region. After the opening of the drawers, the first rolling element leaves the region of the elevation so that subsequently the guide rails run on the second rolling elements with the greater diameter. In the closed state of the drawer, i.e. in a retracted state of the pull-out guide, only the first rolling element with the lower diameter is loaded, as a result of which only this rolling element is subjected to a deformation. Since subsequently guidance occurs by means of the greater second rolling element, the deformed first rolling element does not lead to an increased running noise.

It is disadvantageous in this assembly however that an additional rolling element is provided with the first rolling element, which is not loaded in the normal operation of the drawer. Said additional first rolling element leads to an increased input of material and thus additional costs with the consequence that it does not contribute to the running properties in normal operation. For example, it does not increase the maximum weight which can be carried by the pull-out guide.

It may be desirable to provide a pull-out guide in which an increased running noise after a prolonged idle time of the pull-out guide is suppressed, without providing additional rolling elements that are not used in normal operation. This may be achieved by a pull-out guide with the features described herein. Advantageous embodiments and further developments of the pull-out guide are described herein.

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SUMMARY

In one embodiment a pull-out guide of the type mentioned above is characterized in that at least one of the running surfaces has a free-running segment in which the at least one first rolling element is positioned in a retracted state of the pull-out guide, wherein the running surfaces have a greater distance from each other within the free-running segment than outside the free-running segment.

It is achieved by the free-running segment that in the retracted state of the pull-out guide the at least one first rolling element is taken from engagement of both running surfaces. Therefore, only the at least one second rolling element carries the load during the idle time. Accordingly, only the second rolling elements are potentially deformed during a prolonged idle time. If the pull-out guide is moved from the retracted state, the at least one first rolling element leaves the free-running segment, comes into engagement again with the two regular running surfaces and takes up the weight again that is carried by the pull-out rails or the load acting on the pull-out rails.

Since the first rolling elements have passed their idle time in the free-running segment, they do not contain any flattened portions, optionally in contrast to the second rolling elements. Even if the second rolling elements show flattened portions, said flattened portions do not impair the running properties because the distance of the pull-out rails from each other is determined by the first rolling elements. In the respective rotary position of the deformed second rolling elements, in which the flattened portions face the running rails, the upper carried pull-out rail does not follow the shape of the second rolling element but moves its weight entirely to the first rolling element.

In an advantageous embodiment of the pull-out guide, the free-running segment is formed as a bead, a recess, an embossed portion or as a ramp. The free-running segment thus formed is preferably integrated in one of the running surfaces. The

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aforementioned configurations represent embodiments of the free-running segment which are easy to realise and can be integrated in the running surfaces with ease.

In a further advantageous embodiment, the first rolling elements are not in contact with the two running surfaces in the retracted state of the pull-out guide, between which they are arranged. It is thus securely ensured that the first rolling elements are not deformed during an idle period.

In a further advantageous embodiment of the pull-out guide, the distance of the running surfaces within and outside the free-running segment differs by less than **10**% and preferably by less than **5**% of the diameter of the first and second rolling elements. These differences in distance have proven to be adequately large for relieving the first rolling elements. At the same time, these differences in distance of this magnitude are sufficiently small in order to be realised very well in the running surfaces and the guide rails without leading to influences on the dimensioning of the guide rails.

In a further advantageous embodiment of the pull-out guide, several first rolling elements and/or several second rolling elements are arranged within a rolling element cage one after the other in the longitudinal direction of the pull-out guide. The free-running segment preferably has a length which is at least as great as the maximum distance of two of the multiple first rolling elements. In addition, further rolling elements can be provided. As a result, the teachings herein can be used in rolling element arrangements with several rolling elements.

In a further advantageous embodiment of the pull-out guide, the first and/or second rolling elements and/or optionally the further rolling elements consist of plastic. A reduced rolling noise of the pull-out guide can be achieved with plastic rolling elements. Since the rumbling noises which occur in the plastic rolling elements after a prolonged idle time can be prevented by the free-running segment described herein, the plastic rolling elements are especially suitable. Since first rolling elements

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which are not deformed after a prolonged idle time determine the distance of the running surfaces of interacting guide rails, a potential flattening of the second rolling elements does not lead to a rumbling noise. Plastic can therefore also be selected as the material for the second rolling elements.

In a further advantageous embodiment of the pull-out guide, the first and second rolling elements and optionally the further rolling elements differ from each other with respect to their geometry, their material, their hardness and/or their width. The further rolling elements can further differ with respect to their diameter from the first and second rolling elements. The free-running segment, in the case of a nominally identical diameter of the first and the second rolling elements, leads to the desired relieving effect of the first rolling elements in the retracted state of the pull-out guide. Irrespective thereof, advantageous other material properties and/or geometries of the different rolling elements, and also different diameters for the further rolling elements, can be selected in order to achieve optimal running properties.

In one embodiment, there is provided a pull-out guide for furniture parts that can be moved in relation to each other. The pull-out guide includes at least two pull-out rails having at least one running surface, between which at least one first rolling element and at least one second rolling element are arranged. The rolling elements are rotatably retained in at least one rolling-element cage. One or more of the at least one first rolling elements are arranged within at least one of the at least one rolling-element cage, one after the other in a longitudinal direction of the pull-out guide and the at least one first rolling element and the at least one second rolling element in the at least one rolling element cage have an identical nominal diameter. At least one of the running surfaces has a free-running segment in which the at least one first rolling element is positioned, in a retracted state of the pull-out guide. The running surfaces have a greater distance from each other within the free-running segment than outside the free-running segment. The free-running segment has a length which is as at least as great as a maximum distance between any two of the at least one of the first rolling elements in the at least one of the at least one rolling-element cage.

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BRIEF DESCRIPTION OF THE DRAWINGS

The teachings herein will be explained below in closer detail by reference to embodiments shown in closer detail in the drawings, wherein:

Fig. **1** shows an embodiment of a pull-out guide in a cross-sectional view;

Fig. **2** shows a first longitudinal sectional view through the pull-out guide of Fig. **1**;

Fig. **3** shows a second longitudinal sectional view through the pull-out guide of Fig. **1**, and

Figs. **4**a to **4**c each show a schematic view of the bearing region of a pull-out guide in different pull-out positions.

DETAILED DESCRIPTION

Fig. **1** shows an embodiment of a pull-out guide in a cross-sectional view. The pull-out guide comprises three guide rails, i.e. an outer guide rail **10**, which is also referred to below as body rail **10**, a middle guide rail **20**, which is also referred to below as middle rail **20**, and an inner guide rail **30**, which is also referred to below as running rail **30**. The middle rail **20** is displaceably mounted via roller bearings relative to the body rail **10** and to the running rail **30**. The first rolling elements **1**, the second rolling elements **2** and further rolling elements **3** of the roller bearings are shown in Fig. **1** and are provided with reference numerals. The rolling elements **1**, **2** and **3** are retained in rolling-element cages **4**, which are only indicated in Fig. **1**. The configuration of the pull-out guide as a so-called full-pullout guide with three guide rails is provided merely by way of example. The configuration of a pull-out guide can also be implemented when using only two guide rails, i.e. a so-called partial-extension guide.

In the illustrated embodiment, the body rail **10** is formed in an approximately C-shaped manner, wherein the open side of the C-shaped profile faces to the right in

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the illustration according to Fig. **1**. Two or more mounting brackets **12** are fixed to the longitudinal side of the body rail **10** which is opposite the open side. They are used for fixing the body rail **10** to a furniture body such as a kitchen cabinet.

The running rail **30** is also formed in an approximately C-shaped manner in its profile, wherein it is downwardly open toward the middle rail **20**. The running rail **30** comprises fixing means **32**, with which they can be fixed to a movable furniture part such as a drawer.

The middle rail **20** is arranged vertically between the body rail **10** and the running rail **30**. The middle rail **20** is formed in an approximately U-shaped manner, wherein the base of the U-shaped profile is arranged in a vertical manner. The width of the base determines the vertical distance between the running rail **30** and the body rail **10**. The two legs of the U-shaped profile of the middle rail **20** each protrude into the inner region of the body rail **10** and the running rail **30**. The roller bearings are arranged in this region.

A retraction and damping apparatus **40** is vertically arranged in the remaining free space between the body rail **10** and the running rail **30** and horizontally between the base of the U-shaped profile of the middle rail **20** and the mounting brackets **12** of the body rail **10**. The arrangement of the guide rails **10**, **20**, **30** with respect to each other, as also the profiling of the said guide rails **10**, **20**, **30**, is provided merely as an example. The retraction and damping apparatus **40** represents an optional element.

Each of the roller bearings between the body rail **10** and the middle rail **20** and between the middle rail **20** and the running rail **30** comprises three rows of cylindrical rolling elements **1**, **2** and **3**, which are oriented in a triangular arrangement with respect to each other. The further rolling elements **3** are rotatably mounted about a horizontal axis. The first and the second rolling elements **1**, **2** are rotatably mounted in mutually V-like oriented rows with a rotational axis which is inclined in relation to the horizontal and the vertical. The rows with the first and second rolling elements **1**,

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2 are used for taking up the weight of the guided furniture part acting on the running rail **30**. The further rolling elements **3** with the horizontal rotational axis do not take up the weight itself but a tilting moment produced by the weight when the pull-out guide is extended.

The configuration of the roller bearings is shown in closer detail in the longitudinal sectional views in Figs. **2** and **3**. The position of the respective sectional view is designated in Fig. **1** with respective Roman numerals.

Fig. **2** shows the sectional view through the roller bearing arranged between the middle rail **20** and the running rail **30**. Only one row of the two rows of roller bearings with the roller bearings **1** and **2** is shown in this drawing, which row is provided with six rolling elements **1**, **2** which are cylindrical in this case. In the third row of the rolling elements, which is used for taking up tilting moments, two of the further rolling elements **3** are rotatably arranged, which are shown in Fig. **2** in a partly sectional view. All rolling elements **1**, **2**, **3** are retained in the rolling-element cage **4**. A further such rolling-element cage **4** with respective rolling elements **1** to **3** is provided between the running rail **30** and the middle rail **20**, which rolling element cage is coupled at a distance from the illustrated rolling-element cage **4** via a connecting element **5**. A part of the retraction and damping apparatus **40** can be recognised in the bottom region of Fig. **2**, as well as a driver **34** which interacts therewith and is fixed to the running rail **30**.

The first and the second rolling elements **1**, **2** of the illustrated row of rolling elements roll off on a running surface **21** of the middle rail **20** and a running surface **31** of the running rail **30**.

In the illustrated embodiment, three first rolling elements **1** and three second rolling elements **2** are provided. The first rolling elements **1** and the second rolling elements **2** each have the same diameter. They are preferably made of plastic, wherein the first rolling elements **1** and the second rolling elements **2** may be, but need not be,

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identical concerning their material. It is also possible to provide differently hard materials for the first rolling elements **1** and the second rolling elements **2**. Furthermore, the first rolling elements **1** and the second rolling elements **2** can differ with respect to their geometry (e.g. cylindrical roller, ball) and/or their width.

Fig. **2** shows the position of the rolling-element cage **4** in a fully retracted position of the pull-out guide. In this position, the three first rolling elements **1** are positioned in a region of the running surface **31** of the running rail **30** in which a free-running segment **33** is formed in the running rail **30**. The running surfaces **21** and **31** are spaced farther from each other within the free-running segment **33** than in the remaining region of the running rail **30** and the middle rail **20**. The free-running segment **33** is formed here by a bead or recess in the running rail. It would also be possible to provide a free-running segment in the running surface **21** of the middle rail **20**. The free-running segment **33** leads to the consequence that the first rolling elements **1** are relieved in the illustrated completely retracted position of the pull-out guide and only the second rolling elements **2** are loaded by the weight of the supported furniture part. The resulting advantages are explained in closer detail in connection with the schematic drawings of Fig. **4**.

Similar to Fig. **2**, Fig. **3** shows a section of a longitudinal sectional view through the pull-out guide of Fig. **1**. The illustration shows the region of the roller bearing between the body rail **10** and the middle rail **20**. The sectional view is positioned in such a way that a row of rolling elements equipped with the first rolling elements **1** and the second rolling elements **2** are shown by way of a full sectional view. The second one of the rolling element rows equipped with said rolling elements **1**, **2** is not shown. The row of rolling elements equipped with two of the further rolling elements **3** is shown in a partly sectional view.

Then again, three first rolling elements **1** and three second rolling elements **2** are provided in the illustrated row of rolling elements. They roll off between a running surface **11** of the body rail **10** and a running surface **21** of the middle rail **20**. A free-

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running segment **23** is formed as a recess or bead in said running surface **21** of the middle rail **20**. Fig. **3** shows the position of the rolling-element cage **4** in the retracted state of the pull-out guide, wherein the three first rolling elements **1** are arranged in this position of the pull-out guide in the free-running segment **23**. The free-running segment **23**, as also the free-running segment **33** of Fig. **2**, is characterized in that the respective running surfaces, which in this case are the running surfaces **11** and **21** of the involved guide rails, i.e. the guide rails **10**, **20** in this case, are further spaced from each other than in the remaining progression of the guide rails. The first rolling elements **1** are accordingly relieved in the illustrated retracted position of the pull-out guide and only the second rolling elements **2** carry the load of the guided furniture part.

Fig. **4** shows the region of one of the roller bearings of a pull-out guide for three different positions of the pull-out guide in three individual images a, b, c of the schematic drawing. Fig. **4** shows the bearing region between the running rail **30** and the middle rail **20** according to Fig. **2** by way of example. Fig. **4** can also similarly be applied to the body rail **10** and the middle rail **20** or to two random guide rails.

Fig. **4**a shows a partly extended position of the pull-out guide. In this position, none of the rolling elements **1**, **2** is situated in the free-running segment **33**. All six first and second rolling elements **1**, **2** roll off between the running surfaces **21** and **31** and contribute equally to the bearing. It is further assumed that none of the first or second rolling elements **1**, **2** is deformed. Fig. **4**a thus indicates the normal state during actuation of the pull-out apparatus.

Fig. **4**b shows the pull-out guide in a retracted state. In this state, the first rolling elements **1** are disposed in the region of the free-running segment **33**, whereas the second rolling elements **2** are disposed outside of the free-running segment **33** between the running surfaces **21** and **31**. Fig. **4**b shows the state of the second rolling element **2** after a longer idle time in this position. The second rolling elements **2** are deformed by the weight that is carried by them on the contact surfaces to the

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running surfaces **21** and **31**. The deformation is shown in a strongly exaggerated manner in comparison with reality in this schematic drawing of Fig. **4**b. In actual fact, the deformation lies in the magnitude of one-tenth or a few tenths of millimetres (mm), preferably less than or equal to **0**.**1** mm, at a typical diameter of the rolling elements **2** in the range of a few millimetres, e.g. **6** mm. Accordingly, a difference in the distance of the running surfaces **23**, **33** within and outside the free-running segment **33** in this magnitude of one-tenth or a few tenths of millimetres is sufficient to completely or at least substantially relieve the first rolling elements **1** in the free-running segment **33**.

The flattening of the second rolling elements **2** as shown in Fig. **4**b would lead to uneven running of the second rolling elements **2** and thus to an increased vibration and noise level during actuation of the pull-out guide according to the prior art in which the free-running segment **33** is not provided. This impairment is reversible in the case of a suitable selection of materials because the second rolling elements **2** assume their almost round shape again as a result of the kneading processes connected to the movement.

Fig. **4**c shows the effect of the free-running segment **33** when moving the pull-out guide from the idle position shown in Fig. **4**b. Already after a short relative movement of the guide rails **20**, **30** with respect to each other, the one of the first rolling elements **1** which is at the right in Fig. **4**c leaves the free-running segment **33**. During further extension of the pull-out guide, the middle and the left one of the first rolling elements **1** leave the free-running segment **33**. The distance between the running surface **21** of the middle rail **20** and the running surface **31** of the running rail **30** is determined by the diameter of the first rolling elements **1**. Since the first rolling elements **1** were not deformed as a result of the relief in the free-running segment **33** in the idle position, they are not provided with any flattened portions which could lead to vibrations and an increased running noise. The running rails **20** and **30** substantially maintain their distance as a result of the first rolling elements **1**, even in a position in which the second rolling elements **2** have carried out half a rotation and

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face the running surfaces **21** and **31** with their flattened portions. The flattened portions of the second rolling elements **2** may produce a slight elongation of the rolling elements in the direction extending transversely thereto, which does cause any disturbances with respect to vibration and noises, but which leads to a kneading of the second rolling elements **2**, as a result of which they assume their original round shape again after one or several actuations of the pull-out guide. Furthermore, a relaxation to the original shape can also occur without kneading after the relief from the position shown in Fig. **4**b.

The edges of the free-running segment **33** are shown by way of steps in Fig. **4** as an example. A softer transition such as a ramp can also be provided alternatively and advantageously, so as to facilitate the travel of the first rolling elements **1** out of the free-running segment **33** and to prevent that the user can feel the transfer.

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List of reference numerals

1 First rolling element
2 Second rolling element
3 Further rolling element
4 Rolling-element cage
5 Connecting element

10 Outer guide rail (body rail)
11 Running surface
12 Mounting brackets

20 Middle guide rail (middle rail)
21 Running surface
23 Free-running segment

30 Inner guide rail (running rail)
31 Running surface
32 Fastening means
33 Free-running segment
34 Driver

40 Retraction and damping apparatus

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EMBODIMENTS IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A pull-out guide for furniture parts that can be moved in relation to each other, the pull-out guide comprising:

at least two pull-out rails having at least one running surface, between which at least one first rolling element and at least one second rolling element are arranged, which rolling elements are rotatably retained in at least one rolling-element cage, wherein one or more of the at least one first rolling elements are arranged within at least one of the at least one rolling-element cage, one after the other in a longitudinal direction of the pull-out guide and wherein the at least one first rolling element and the at least one second rolling element in the at least one rolling-element cage have an identical nominal diameter, and

wherein at least one of the running surfaces has a free-running segment, in which the at least one first rolling element is positioned in a retracted state of the pull-out guide,

wherein the running surfaces have a greater distance from each other within the free-running segment than outside the free-running segment; and

wherein the free-running segment has a length which is as at least as great as a maximum distance between any two of the at least one of the first rolling elements in the at least one of the at least one rolling-element cage.

2. The pull-out guide according to claim **1**, wherein the free-running segment is formed as a bead, a recess, an embossed portion or a ramp.

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3. The pull-out guide according to claim **2**, wherein the free-running segment is integrated in one of the running surfaces.

4. The pull-out guide according to any one of claims **1** to **3**, wherein in the retracted state of the pull-out guide the first rolling elements are not in contact with the two running surfaces between which they are arranged.

5. The pull-out guide according to any one of claims **1** to **4**, wherein the distance of the running surfaces differ within and outside the free-running segment by less than **10**% and less than **5**% of the diameter of the first and the second rolling element.

6. The pull-out guide according to any one of claims **1** to **5**, wherein one or more of the second rolling elements are arranged within at least one of the at least one rolling-element cage, one after the other in the longitudinal direction of the pull-out guide.

7. The pull-out guide according to any one of claims **1** to **6**, wherein further rolling elements are present in addition to the first and second rolling elements.

8. The pull-out guide according to any one of claims **1** to **7**, wherein one or more of the first rolling elements, the second rolling elements and the further rolling elements are comprised of plastic.

9. The pull-out guide according to any one of claims **1** to **8**, wherein the first and the second rolling elements and the further rolling elements differ with respect to one or more of their geometry, their material, their hardness and their width.

10. The pull-out guide according to claim **8** or **9**, wherein the further rolling elements differ with respect to their diameter from the first and second rolling elements.

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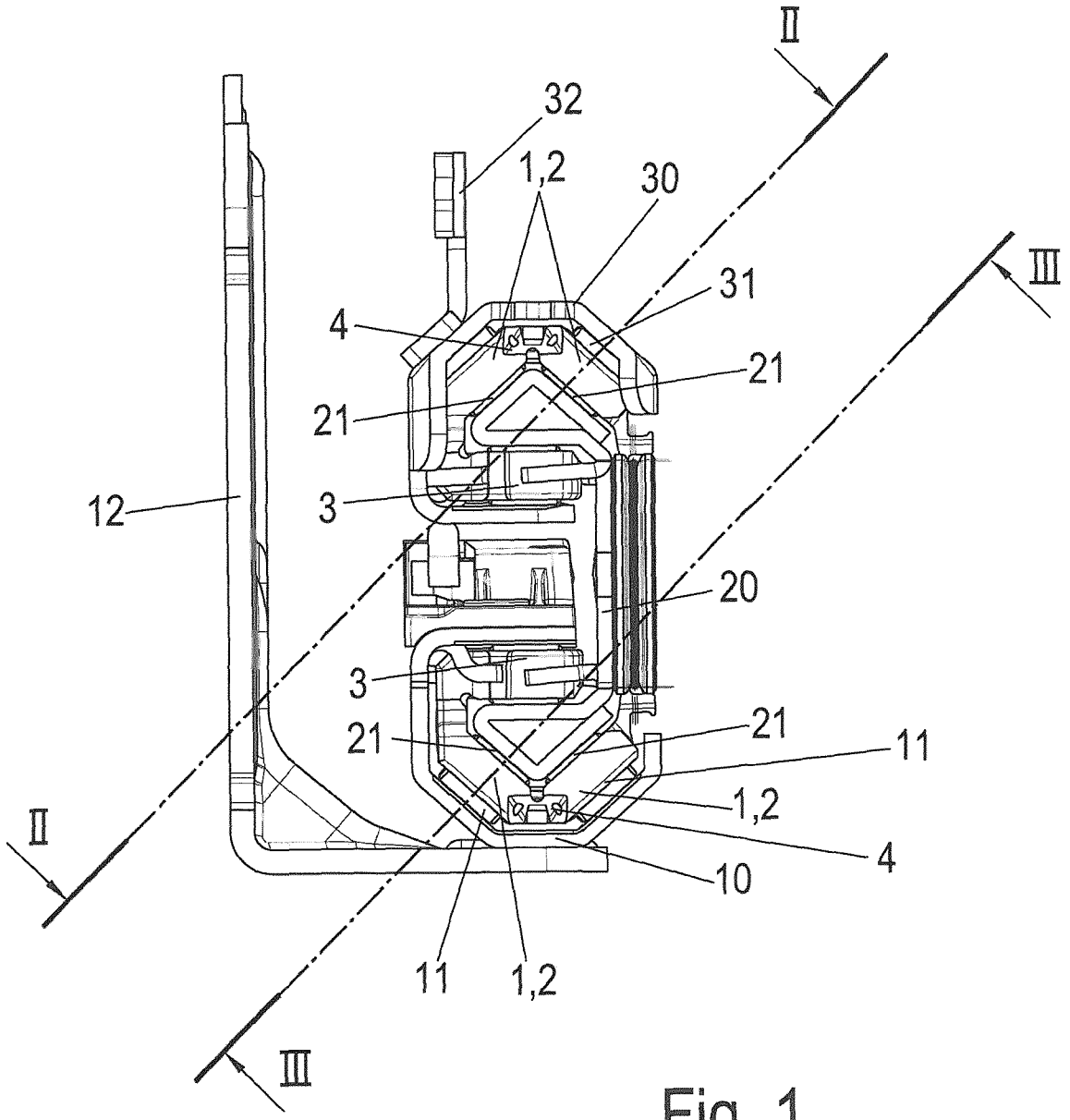


Fig. 1

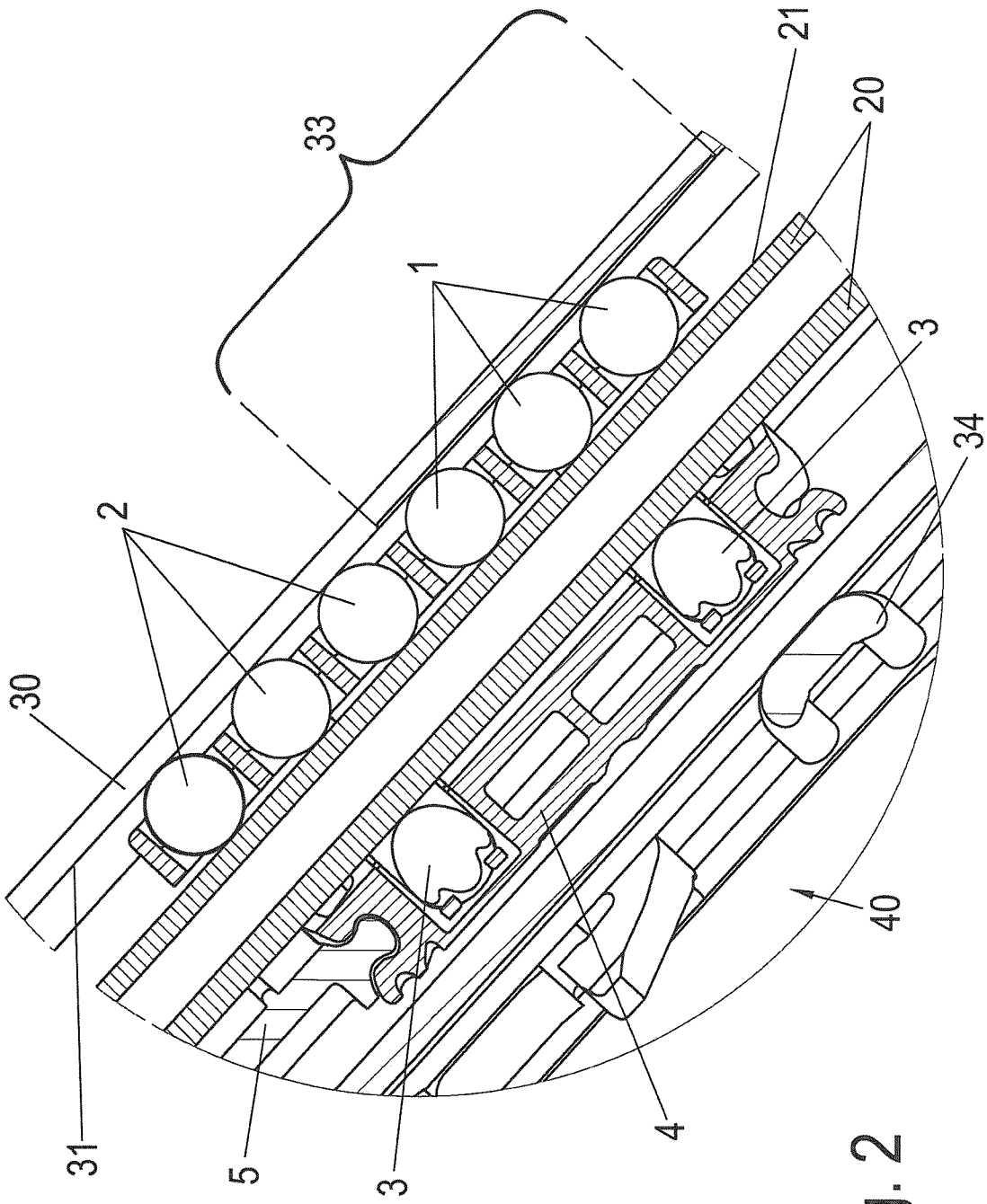


Fig. 2

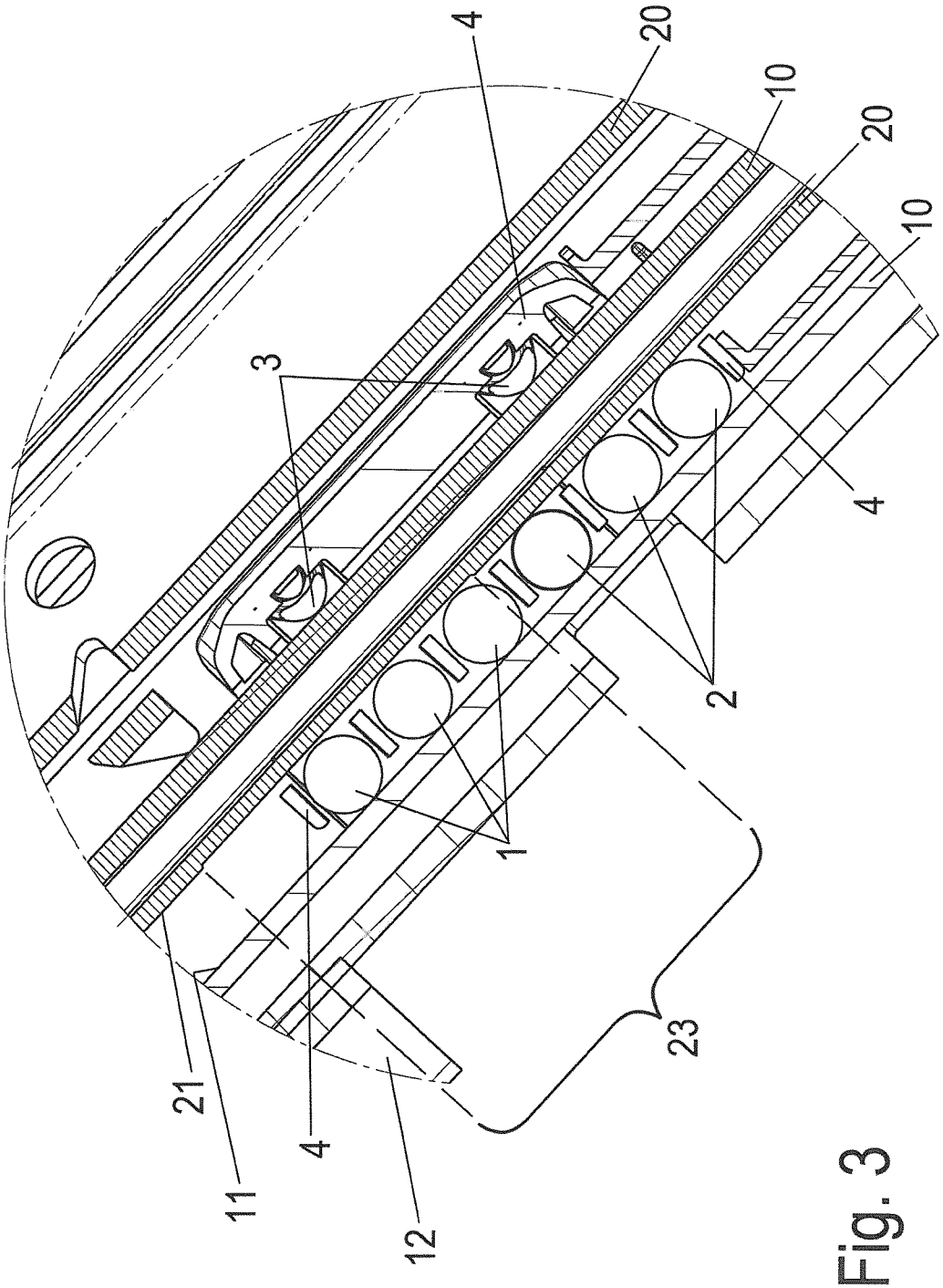


Fig. 3

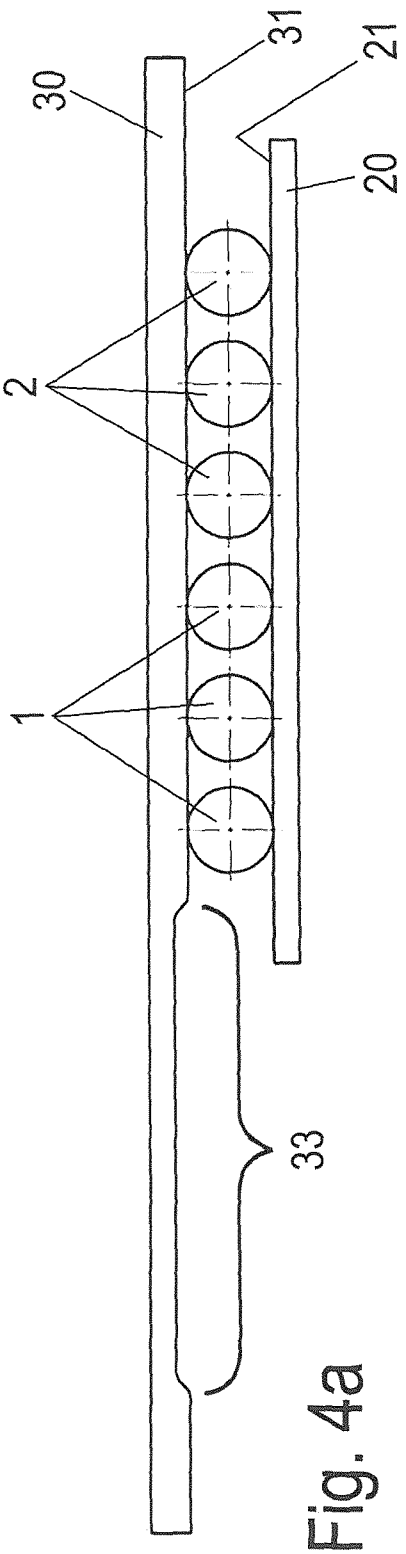


Fig. 4a

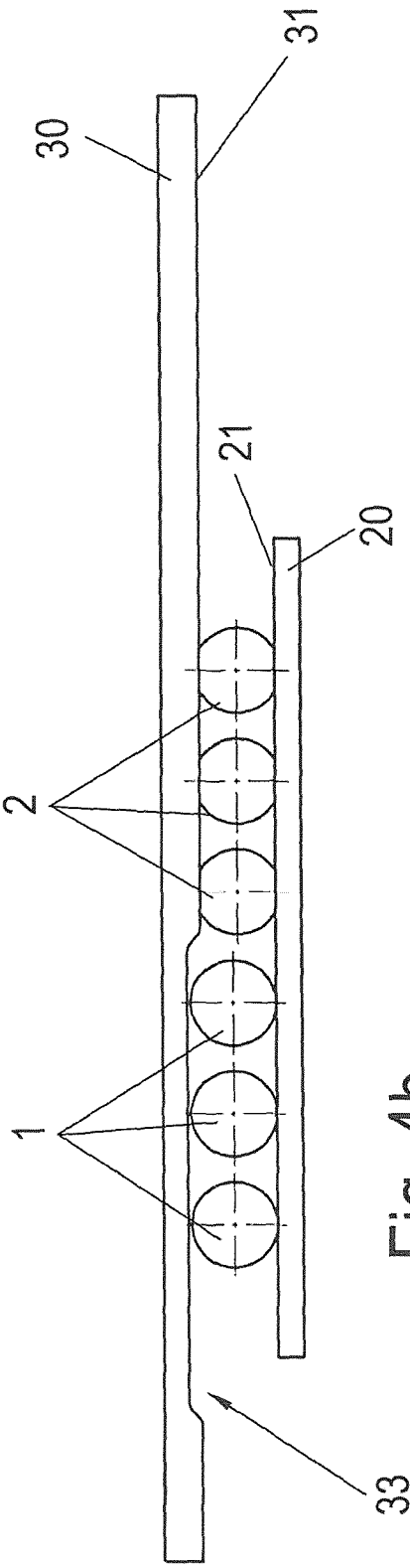


Fig. 4b

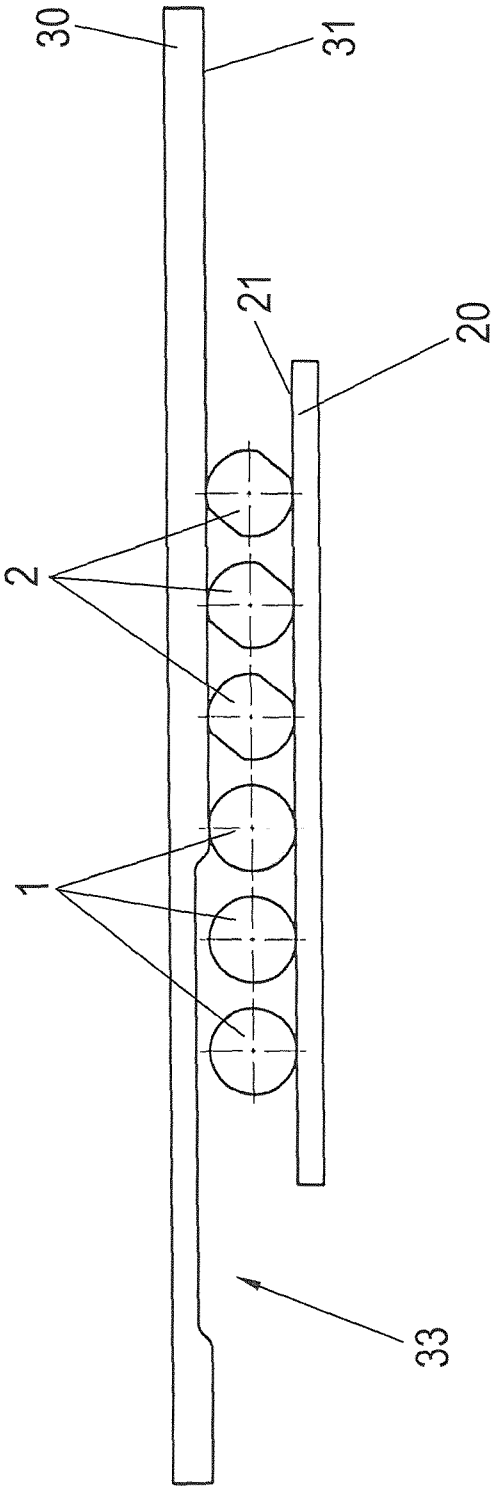
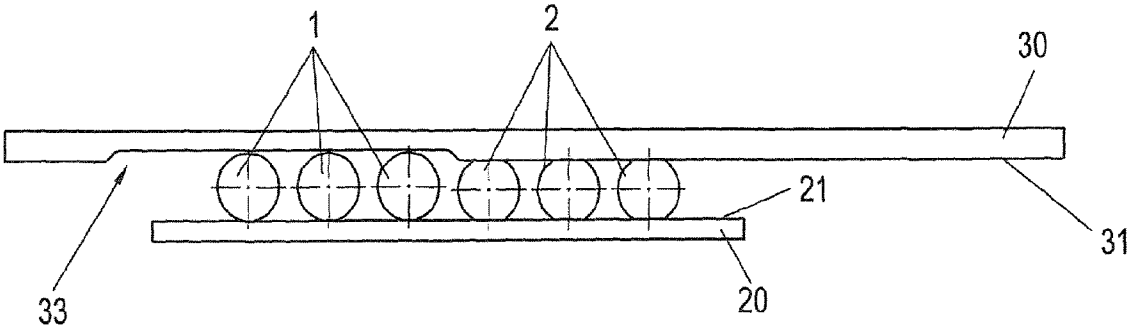


Fig. 4c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