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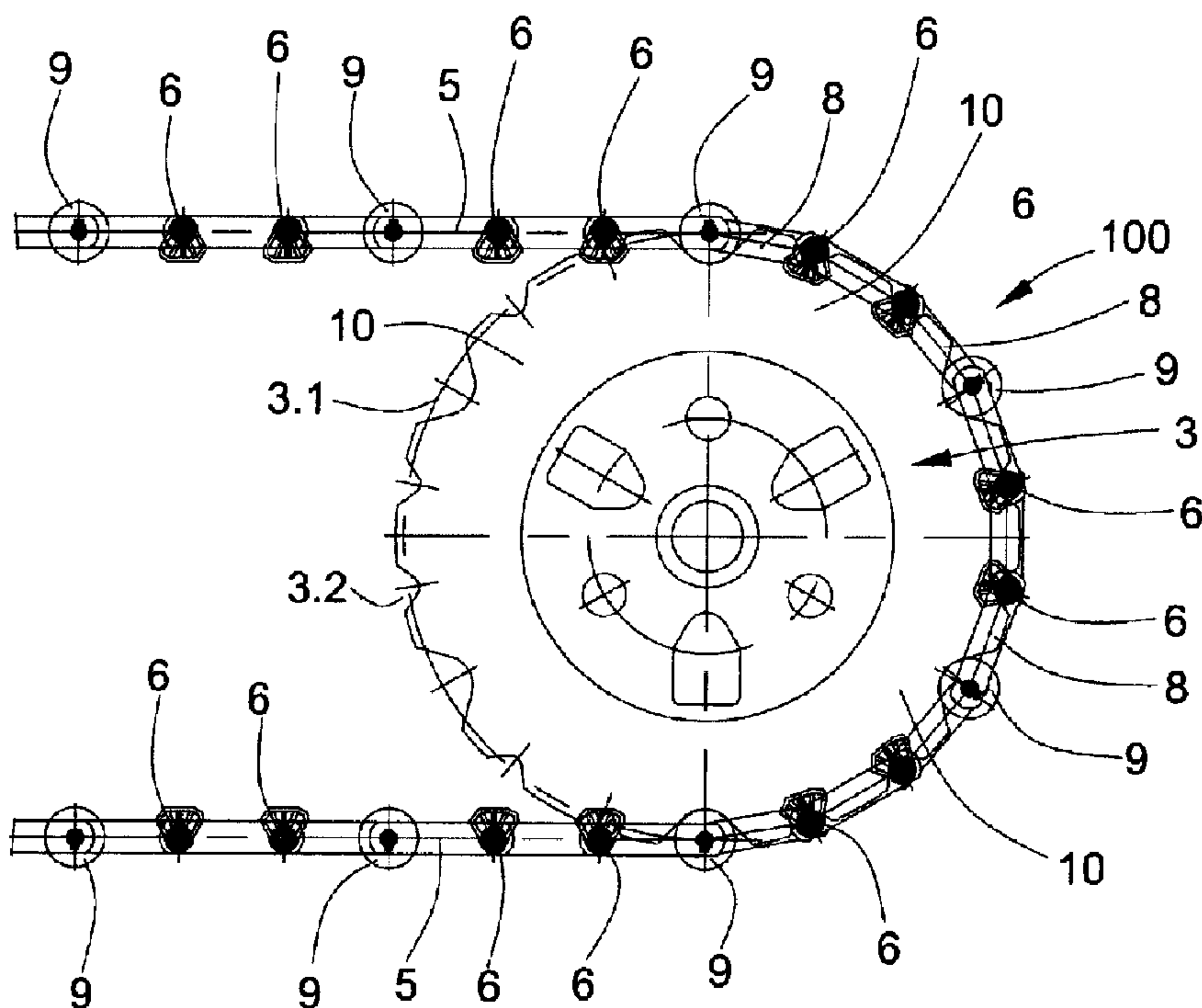
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(54) Titre : SYSTEME DE TRANSMISSION AVEC CHAÎNE A MARCHES OU CHAÎNE A TAQUETS POUR PALETTES
POUR DISPOSITIF DE TRANSPORT ET DISPOSITIF DE TRANSPORT AINSI EQUIPE

(54) Title: DRIVE SYSTEM WITH STEP CHAIN OR PALLET CHAIN FOR A TRANSPORTATION DEVICE AND
TRANSPORTATION DEVICE WITH A CORRESPONDING DRIVE SYSTEM



(57) Abrégé/Abstract:

Transportation system (100) for transportation device (1) with a transportation chain (5), which has a number of chain links (8) that are also joined to form an articulated endless chain, and with a sprocket (10) to reverse the chain (5). The transportation chain (5) has several equally spaced guide elements (9, 6) which in a transportation area (106) of the transportation device (1) are guided along a guiderail (7). As guide elements (9, 6), the transportation system (100) contains several sliding elements (6) that are mechanically linked to the transportation chain (5) and slide along the guiderail (7) when the transportation system (100) of the transportation device (1) is in motion. On its outer circumference, the sprocket (10) has recesses (3.2) which at least partly accommodate the sliding elements (6).

Abstract

Transportation system (100) for transportation device (1) with a transportation chain (5), which has a number of chain links (8) that are also joined to form an articulated endless chain, and with a sprocket (10) to reverse the chain (5). The transportation chain (5) has several equally spaced guide elements (9, 6) which in a transportation area (106) of the transportation device (1) are guided along a guiderail (7). As guide elements (9, 6), the transportation system (100) contains several sliding elements (6) that are mechanically linked to the transportation chain (5) and slide along the guiderail (7) when the transportation system (100) of the transportation device (1) is in motion. On its outer circumference, the sprocket (10) has recesses (3.2) which at least partly accommodate the sliding elements (6).

(Fig. 4A)

**Drive System with Step Chain or Pallet Chain for a
Transportation Device and Transportation Device with a
Corresponding Drive System**

5 The invention relates to a drive system with step chain or
pallet chain for a transportation device, and a
correspondingly equipped transportation device.

Transportation devices in the sense of the invention are
10 escalators and moving walks with a plurality of tread units,
escalator steps, or moving-walk pallets, which are joined to
form an endless transporter. Users of the transportation
devices stand on tread surfaces of the tread units, or stand
or walk on the moving walk-pallets in the same direction as
15 the transportation devices themselves.

On escalators, the escalator steps form tread units,
hereinafter referred to as 'steps', and on moving walks the
moving-walk pallets form step units, hereinafter referred to
20 as 'pallets'. Escalators have a relatively large angle of
inclination to overcome relatively large height differences
such as complete stories or more. Moving walks run
horizontally, or at a slight inclination, but generally with
a smaller angle of inclination than escalators.

25 Such transportation devices typically contain step chains or
pallet chains, by means of which the steps or pallets are
moved in the direction of transportation. Hereinafter,
reference will only be made to step chains, but this should
30 be understood to refer also to pallet chains. These step
chains are driven, and at equal intervals they are provided
with so-called rollers. The rollers roll or travel along
tracks. In the area of the ends of the transportation
devices, the step chains with the rollers pass around

sprockets, or reversers, and thereby execute a change in direction of 180 degrees.

5 A transportation device with step chains or pallet chains is known from patent application DE-100 63 844. In that patent application, the primary objective is to reduce the number of chain elements, or chain links, that are used per step or pallet.

10 It is regarded as a disadvantage of transportation devices hitherto that the step chains, along with numerous rollers, are composed of many individual parts that are expensive as well as cost- and work-intensive. On the other hand, the step chain, along with the elements mounted on it, is one of the
15 most important components of the transportation system of a transportation device, and certain changes to this complex drive system or transportation system can have undesired consequences such as reduced ride comfort and possibly also uneven running or increased noise production.

20

The object of the invention it therefore

- to create a drive system of the type stated at the outset with which the said disadvantages are avoided, but which nevertheless enables smooth, jerk-free running, is
25 not prone to faults, and has a long service life; and
- to propose a transportation device that is equipped with such a transportation or drive system.

Accordingly, in one aspect a transportation system for a
30 transportation device, comprising a transportation chain with a plurality of chain links joined into an articulated endless chain and a sprocket to reverse a direction of the transportation chain, the transportation chain having a plurality of equally spaced guiding elements which, in a

transportation area of the transportation device are guided along a guide rail, wherein a plurality of rollers are mechanically linked to the transportation chain and oriented in such a manner as to roll along the guide rail when the drive system of the transportation device is in motion, the sprocket having on its outer circumference recesses to at least partly accommodate the rollers, a guide element comprises at least one sliding element mechanically linked to the transportation chain and oriented in such a manner as to slide along the guide rail when the transportation system of the transportation device is in motion, and the sprocket has on an outer circumference recesses to at least partly accommodate the at least one sliding element.

15 In another aspect, a transportation system for a transportation device, comprising a transportation chain with a plurality of chain links joined into an articulated endless chain and a sprocket to reverse a direction of the transportation chain, the transportation chain having a plurality of equally spaced guiding elements which, in a transportation area of the transportation device are guided along a guide rail, wherein a guide element comprises at least one sliding element mechanically linked to the transportation chain and oriented in such a manner as to slide along the guide rail when the transportation system of the transportation device is in motion, the sprocket has on an outer circumference recesses to at least partly accommodate the at least one sliding element, and the transportation chain has a transitional arc area, a chain counter-pressure guide being adapted and oriented to exert a directed pressure on the transitional arc area.

3a

Preferred further developments of the transportation system and the transportation device according to the invention are described herein.

5 BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in detail below in relation to examples and by reference to the drawings. Shown are in

- Fig. 1 a transportation device in the form of an escalator
10 viewed from the side, partly cut away;
- Fig. 2 a part of a transportation chain or transportation system in a first embodiment, viewed from the side;
- Fig. 3 a part of a transportation chain or system in a second embodiment, viewed from the side, with steps
15 when they are moving horizontally;
- Fig. 4A a part of a transportation system viewed from the side, enlarged, near the drive wheel;
- Fig. 4B a view of part of the system according to Fig. 4A or Fig. 3;
- 20 Fig. 5A a sliding element viewed from the side, enlarged, in elevation;
- Fig. 5B a cross-section through the sliding element of Fig. 5A along the line Z-Z;
- Fig. 6A the sliding element of Fig. 5A in the area of a reversing radius, a first embodiment of a chain
25 counterpressure guide being provided, in a cross section along the line B-B of Fig. 1;
- Fig. 6B a roller in the area of the reversing radius, here also there being provided a first embodiment of a
30 chain counterpressure guide, in the same view as Fig. 6A;
- Fig. 6C a sliding element undergoing reversal, a second embodiment of a chain counterpressure guide being provided, in the same view as Fig. 6A; and

3b

Fig. 6D a roller undergoing reversal, a second embodiment of a chain counterpressure guide being provided, in the same view as figures 6A and 6B.

The transportation device shown in Fig. 1 is an escalator 1 that connects a lower level E1 with an upper level E2. The
5 transportation device 1 has side balustrades 2, and as visible moving parts, the step chain 5 and an endless handrail 101. The step chain or pallet chain 5, hereinafter referred to as the chain 5, and the handrail 101, can be moved as one, or simultaneously.

10

The escalator, or endless transporter, essentially comprises a plurality of steps or tread elements 4 with the step chain or pallet chain 5 that connects the steps 4, a not-shown motor plus gear, and an upper reverser 102 and a lower reverser 103 which
15 are located in the upper and lower end area of the escalator respectively, only the axle of the upper reverser 102 being shown in the interest of clarity. Here, the pallets or steps or tread units 4 are embodied and shown as steps, and have tread surfaces 104.

20

As indicated in Fig. 1, the transportation chain 5 of the lower reverser 103, which is in the area of the lower level E1, runs diagonally upward to the upper reverser 102 which is located in the area of the upper level E2. Hereinafter, the area that leads
25 from the lower reverser 103 to the upper reverser 102 is also referred to as the transportation area 106 of the transportation device 1, since in this area, the tread surfaces 104 of the steps or tread units 4 face upward and can therefore accommodate persons. The return of the transportation chain 5 of the upper
30 reverser 102 to the lower reverser 103 takes place in a return area 105 that lies below the said transportation area 106. During the return, in other words in the return area 105, the tread surfaces 104 of the tread units or steps 4 face down.

Chains of the same type as the chains 5, which are known from the prior art, comprise a plurality of chain links to which so-called rollers are fastened at equal intervals.

5 According to a first embodiment of the invention that is shown in Fig. 2, a chain 5 is now used which, instead of the rollers, has so-called guide elements or sliding elements 6. These sliding elements 6 are mechanically connected to the chain 5 in such manner that they slide, or skid, or surf, along a guiderail
10 7. The guiderails or rails 7, and the chain 5 with the sliding elements 6, are shown in horizontal direction in Fig. 2. The chain 5 with the sliding elements 6 slides with the same inclination as the chain track 5 in Fig. 1 from the lower level E1 to the upper level E2. Provided in at least one of the areas
15 of the reversers 102 and 103 is a sprocket 10 with a circumferential area 3 that has on its outer circumference recesses 3.1 to at least partly accommodated the sliding elements 6 of the chain 5. According to the first embodiment, this sprocket 10 is executed very similarly to the sprocket 10
20 that is described in association with the second embodiment and shown in Fig. 4A.

A second embodiment of the invention is described below by reference to Figures 3, 4A, and 4B, identical references being
25 used for identical, or identically functioning, elements in all embodiments. In Fig. 3, tread elements or steps 4 are shown with tread surfaces whose dimensions in the direction of transportation correspond to letter C. Also shown is a section of the transportation chain 5 which has several equally spaced
30 guiding or sliding elements as well as rollers 9, which in the transportation range of the transportation device 1 slide, or are slid, along the guiderail 7. As can be seen in Fig. 3, two types of element 6 and 9 are used. On the one hand, elements are used as rollers 9 that are known from the prior art. Different
35 from the prior art, the distance A between two adjacent rollers

9 is considerably greater than in conventional solutions. Arranged on the chain 5 between adjacent rollers 9 is at least one element that is embodied as a sliding element 6, but preferably two such sliding elements 6 are arranged on the chain 5.

As can be seen from Fig. 4B, the rollers 9 also have axles 9.1, and the sliding elements 6 other axles 6.1. These axles or chain pins 9.1 and 6.1 run essentially parallel to each other and perpendicular to the plane of the drawing. The rollers 9 and the sliding elements 6 are mechanically arranged on the transportation chain 5 in such manner that sliding zones 6.2 of the sliding elements 6 lie in a tangential plane 7.1 of the rollers 9. The rollers 9 thus roll along the guiderail 7, while the sliding elements 6 with their sliding zones 6.2 skid or slide along the guiderail 7.

In Fig. 4A, further details of the transportation system or drive system 100 can be seen. The part of the transportation system 100 that is shown in Fig. 4A is also shown both in elevation and built into an escalator. In a moving walk or pallet transporter, the elements of the transportation system or drive system 100 that are shown run essentially approximately horizontal or at a slight inclination. The chain 5 that is shown comprises several chain elements or chain links 8. These chain links 8 are joined to each other in articulated manner and form an endless chain. In the embodiment shown, each of the chain links 8 extends from axle or chain pin to axle or chain pin, i.e. between two axles or chain pins 9.1 and 6.1 of a roller 9 and of the adjacent sliding element 6, or between two axles or chain pins 6.1 of adjacent sliding elements 6. The distance between one of the axles or chain pins 9.1 to the nearest axle 6.1, or the distance between two successive axles or chain pins 6.1, determines the length of the chain links 8. Since, in the example shown, successive axles are equidistant with an axle

interval of $A/3$, all chain links 8 are of equal length. This substantially simplifies the construction of the entire transportation chain 5, since only one or two types of chain link 8 are needed.

5

The distance A between the axles of two adjacent rollers 9 is preferably equal to the length C of the tread element or tread unit or step 4, i.e. A is approximately equal to C , as can be seen in Fig. 3. Provided per tread unit or step 4 is one roller 10 9, and in the area of the chain pin or axle 9.1, the tread unit or step 4 is preferably connected to the roller 9 and thus also to the transportation chain 5, as shown in Fig. 3.

Also shown in Fig. 4A is how the transportation chain 5 is 15 passed around the sprocket 10 to change the direction of the transportation chain 5. The recesses 3.1 that are provided on the outer circumference of the sprocket 10 are for the rollers 9, and the recesses 3.2 for the sliding elements 6. Since, as in the embodiment that is shown as variant or example, arranged 20 between two rollers 9 there are always two sliding elements 6, provided on the sprocket between two recesses 3.1 for rollers 9 are two corresponding recesses 3.2 for the sliding elements 6. The number of recesses 3.2 between two recesses 3.1 is arbitrary.

25

In another embodiment that is not shown, the sprocket 10 has recesses that are arranged at equal angular intervals and which are all executed identically, or the same size, or similarly. These recesses then accommodate both the rollers 9 and the 30 sliding elements 6.

Shown in figures 5A and 5B are further details of a possible embodiment of a sliding element 6. Fig. 5A shows an elevation or front view, and Fig. 5B a cross section along the line Z-Z of 35 Fig. 5A. The sliding element 6 that is shown has a sliding zone

6.2 that is designed for optimal sliding. In the example that is shown, the sliding zone 6.2 is designed skid-shaped to allow problem-free insertion, or sliding, into the guiderail 7. In addition to the sliding zone 6.2, the sliding element 6

5 comprises a supporting body or base body 6.3, for example with struts or webs. In addition, in a new variant of the sliding element 6, an area can be provided to accommodate an inset bushing 6.4 or a sliding bearing bushing.

10 It is preferable for the sliding zone 6.2 to be coated with a material, or for the sliding zone 6.2 to consist of a material, that has a low coefficient of friction. Especially suitable is a sliding zone 6.2 with a polytetrafluorethylene (PTFE) bandage or with a polyurethane bandage. Use can also be made of an aramid,

15 or of thermoplastic elastomers (TPE), or of thermoplastic polyurethane (TPU), or of any thermoplastic plastic. These bandages are preferably executed hydrolyte-resistant or hydrolyte-stabilized.

20 PTFE is particularly suitable on account of its suitable material combinations, low coefficient of friction, and robustness. Since PTFE slides particularly frictionlessly, also on PTFE, in a preferred embodiment a guiderail 7 is used which, in the area of the sliding zone, is also provided with PTFE or

25 coated with Teflon. Furthermore, with suitable material combinations, the static friction of PTFE is exactly the same as the sliding friction, so that the transition from standstill to movement takes place without jerk, which for applications in the area of the transportation devices is particularly advantageous.

30 Described in figures 6A and 6B are further details of a possible embodiment or chain variant. This is again a chain variant in which rollers 9 and sliding elements 6 are used on one and the same chain 5. As indicated in Fig. 1, there are transitional

35 areas where a transition arc 4.1 or 4.2 with a transition radius

is present. This is particularly the case when in one travel direction 1 a transition is provided between two differently inclined parts of the transportation area. Due to the pretension on the transport chain 5, in the area of the transition arc 4.1
5 the chain 5 runs like a chord of the circle whose radius is equal to the transition radius. Here, to prevent lifting of the rollers 9 and/or of the sliding elements 6, according to the invention a chain counterpressure guide 14 is provided. As can be seen in Fig. 6A and Fig. 6B, the chain counterpressure guide
10 14 has a cross section in the form of a U or a C. The chain counterpressure guide 14 is installed in such manner that it presses against two side plates of the chain links 8 so as to press the roller 9 or the sliding element 6 against the guiderail 7. The chain counterpressure guide 14 prevents the
15 transmission chain 5 from running in the form of the chord described above.

Alternatively, or additionally, a further chain counterpressure guide 15, 16, 17 can be used, as shown in figures 6C and 6D. In
20 this case, pressure guide elements 15 are used, on which a spring 16 acts, and which press against the rollers 9 or sliding elements 6. On account of the spring 16, automatic adjustment of the position or height of the pressure guide elements takes place. In Fig. 6C, the pressure guide element is moved further
25 in the direction of the guide rail 7 than in Fig. 6D.

Instead of arranging three chain links 8 between two successive rollers, as described above, a smaller or larger number of chain divisions or chain links can be used. The longer the chain
30 links, the more necessary the use of a suitable chain counterpressure guide, as described, since chains with longer chain links are less articulated and flexible.

In a proven embodiment, via corresponding bushings, the sliding
35 elements 6 are mechanically linked to the transportation chain 5

in such manner that they permit certain articulations, chain oscillations, or swinging movements about the axle 6.1 and/or perpendicular direction.

5 The present invention allows a completely new generation of escalators to be realized that completely, or at least partly, dispenses with rollers. The new transportation device is more advantageous, beneficial, and inexpensive since, instead of three rollers 9 per step 4 or pallet as formerly, now only one
10 roller, as in the embodiment according to Fig. 3, or absolutely no rollers, as in the embodiment according to Fig. 2, is/are used. This has the advantage of saving expensive ball bearings that are required to join the rollers 9 to the transportation chain 5.

15

If several sliding elements 6 are used, a more even distribution of wear and load is obtained. Reduced wear is thereby assured or defined or determined.

20 The invention as described is equally applicable to escalators and moving walks.

We claim:

1. A transportation system for a transportation device,
comprising a transportation chain with a plurality of chain
5 links joined into an articulated endless chain and a sprocket
to reverse a direction of the transportation chain, the
transportation chain having a plurality of equally spaced
guiding elements which, in a transportation area of the
transportation device are guided along a guide rail, wherein
10 a plurality of rollers are mechanically linked to the
transportation chain and oriented in such a manner as to roll
along the guide rail when the drive system of the
transportation device is in motion, the sprocket having on
its outer circumference recesses to at least partly
15 accommodate the rollers, a guide element comprises at least
one sliding element mechanically linked to the transportation
chain and oriented in such a manner as to slide along the
guide rail when the transportation system of the
transportation device is in motion, and the sprocket has on
20 an outer circumference recesses to at least partly
accommodate the at least one sliding element.

2. A transportation system according to claim 1,
characterized in that the transportation device has a
25 plurality of steps or pallets and the plurality of rollers
corresponds in number to the plurality of steps or pallets,
the rollers being equally spaced along the transportation
chain.

30 3. A transportation system according to claim 1 or claim 2,
wherein at least one sliding element is arranged on the
transportation chain between two adjacent rollers.

4. A transportation system according to claim 3, wherein two sliding elements are arranged between two rollers.

5. A transportation system according to claim 1, or claim 2,
5 wherein the sliding elements are in the form of a skid.

6. A transportation system according to claim 1, or claim 2,
wherein the one sliding elements have a sliding zone with a
low coefficient of friction.

10

7. A transportation system according to claim 1, or claim 2,
wherein the transportation chain has a transitional arc area,
and further comprising a chain counter-pressure guide adapted
and oriented to exert a directed pressure on the transitional
15 arc area of the transportation chain.

8. A transportation device, having a transportation system
according to claim 1, or claim 2 and further comprising at
least one guide rail along which at least one of the sliding
20 elements and a roller travel when the transportation system
of the transportation device is in motion.

9. A transportation device according to claim 8,
characterized in that provided in an area of the
25 transportation chain is a chain counter-pressure guide to
prevent local lifting of at least one of the sliding elements
and a roller.

10. A transportation device according to claim 8, wherein the
30 guide rail has a low friction sliding surface.

11. A transportation system for a transportation device,
comprising a transportation chain with a plurality of chain
links joined into an articulated endless chain and a sprocket

to reverse a direction of the transportation chain, the transportation chain having a plurality of equally spaced guiding elements which, in a transportation area of the transportation device are guided along a guide rail, wherein
5 a guide element comprises at least one sliding element mechanically linked to the transportation chain and oriented in such a manner as to slide along the guide rail when the transportation system of the transportation device is in motion, the sprocket has on an outer circumference recesses
10 to at least partly accommodate the at least one sliding element, and the transportation chain has a transitional arc area, a chain counter-pressure guide being adapted and oriented to exert a directed pressure on the transitional arc area.

1/3

Fig. 1

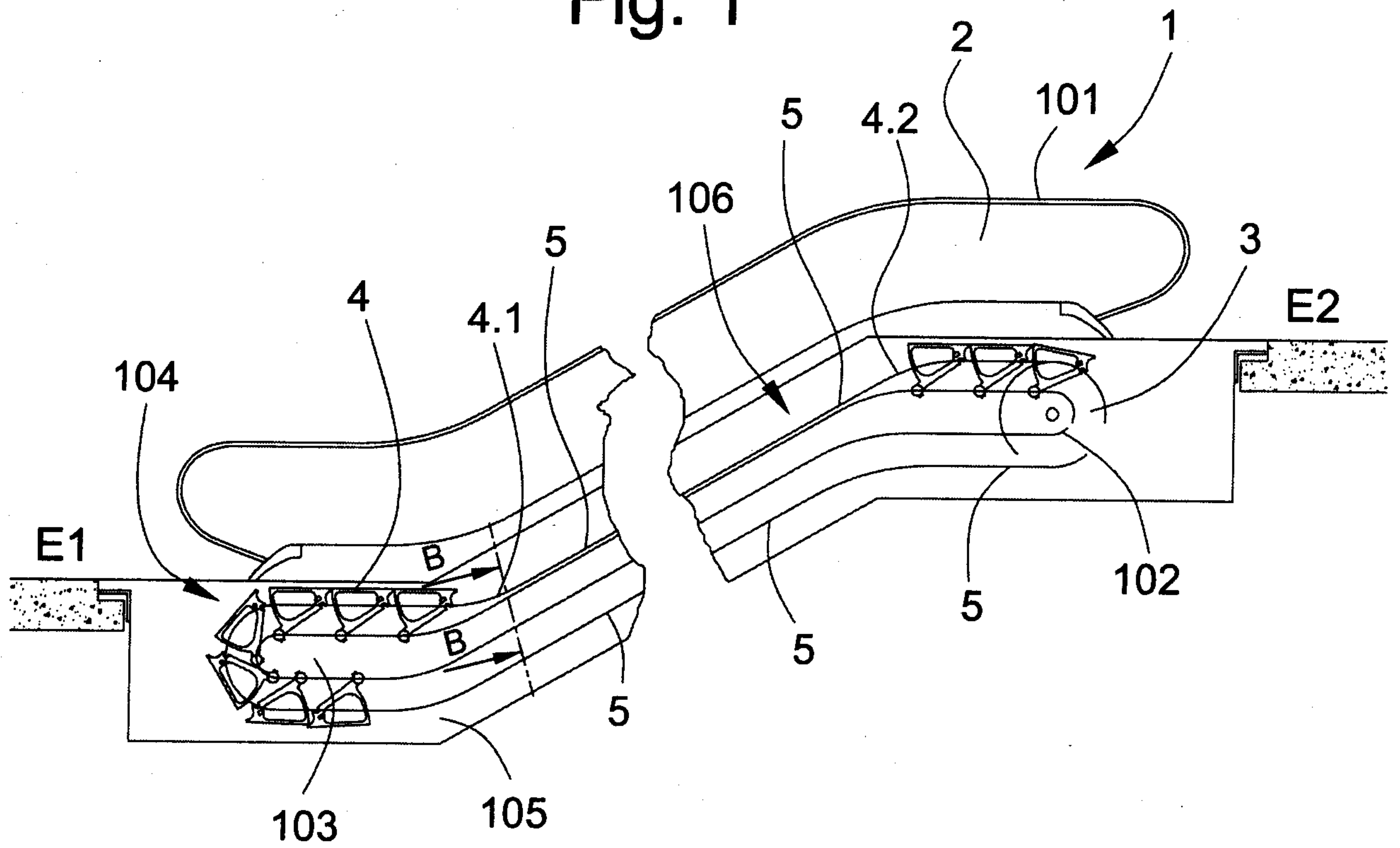


Fig. 2

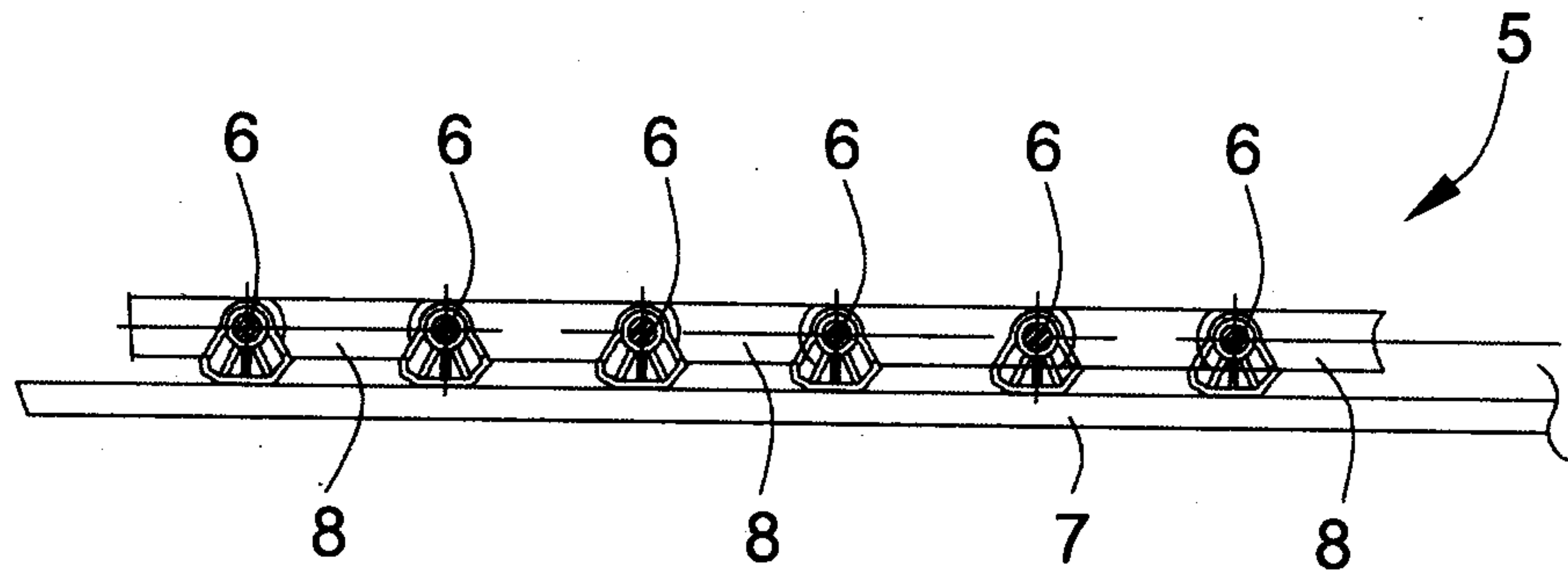
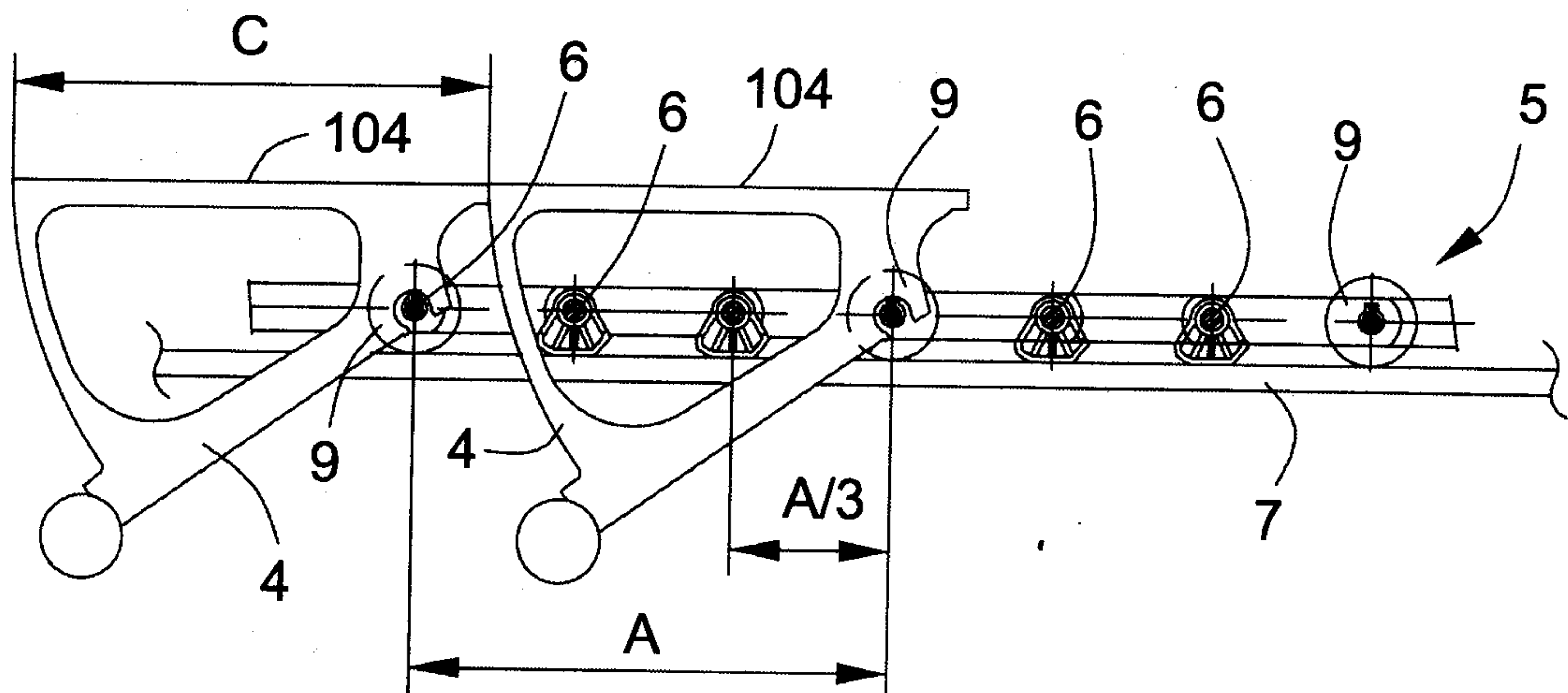


Fig. 3



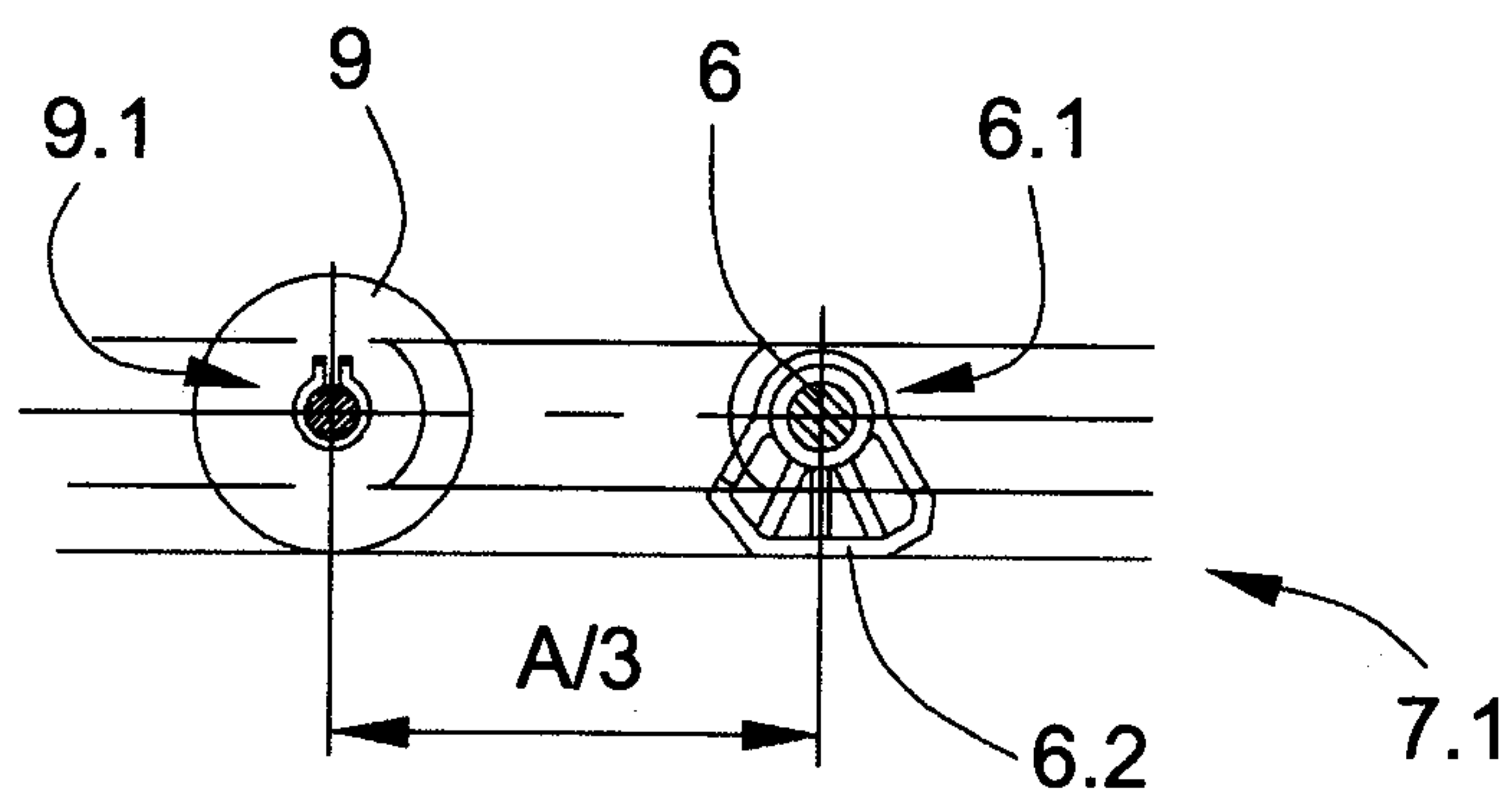
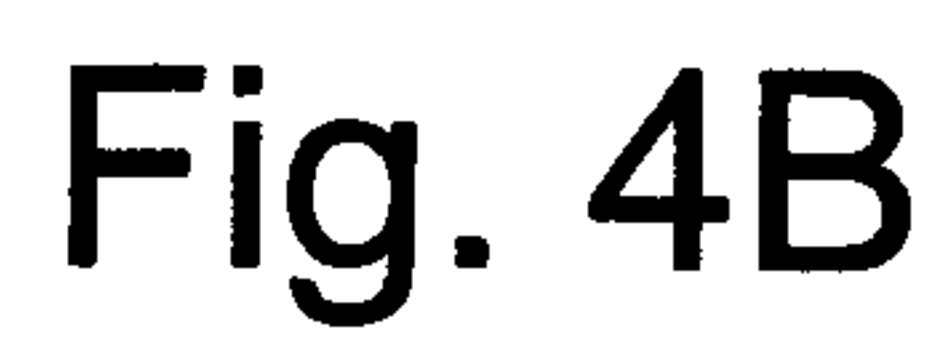


Fig. 5A

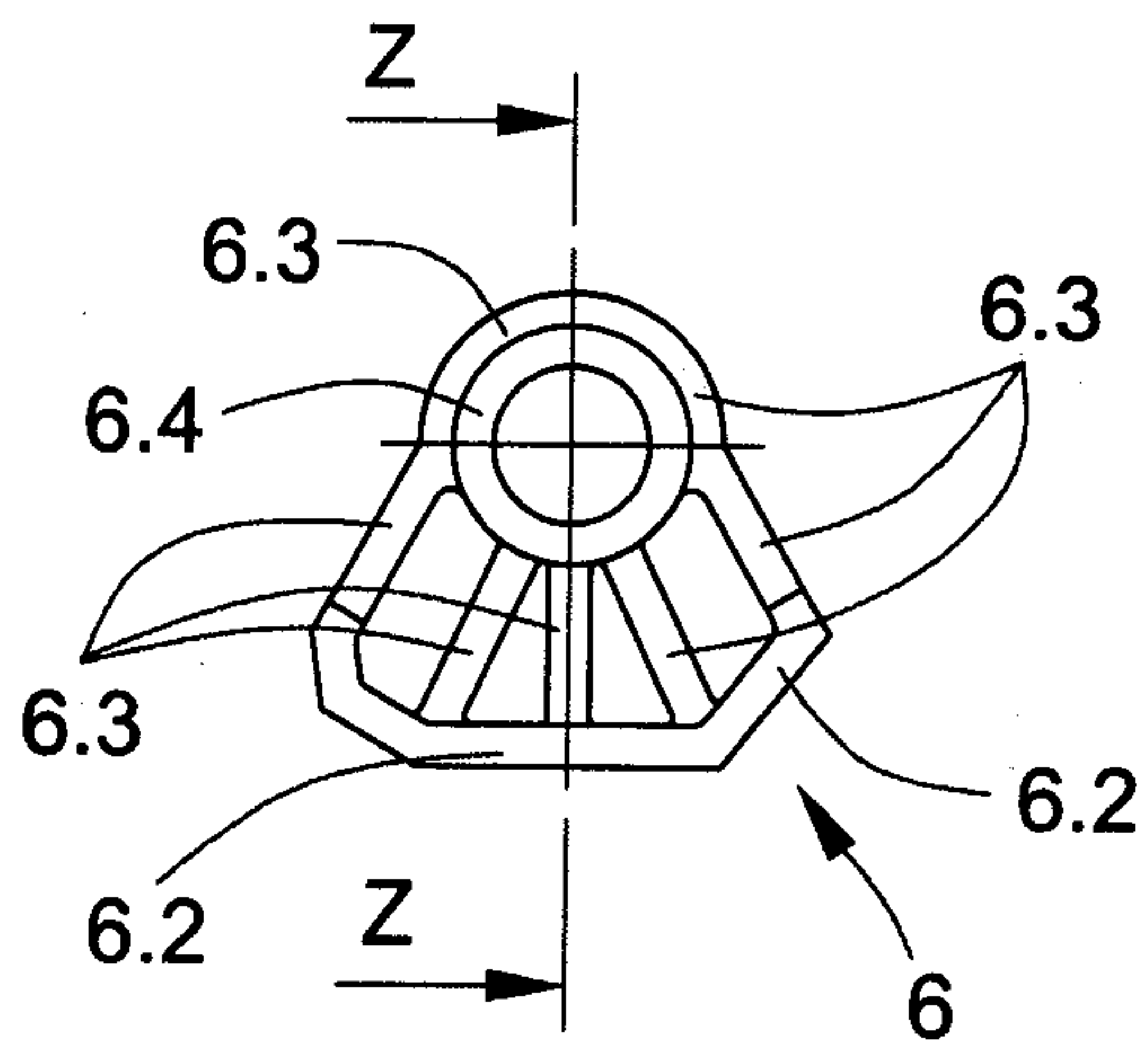


Fig. 5B

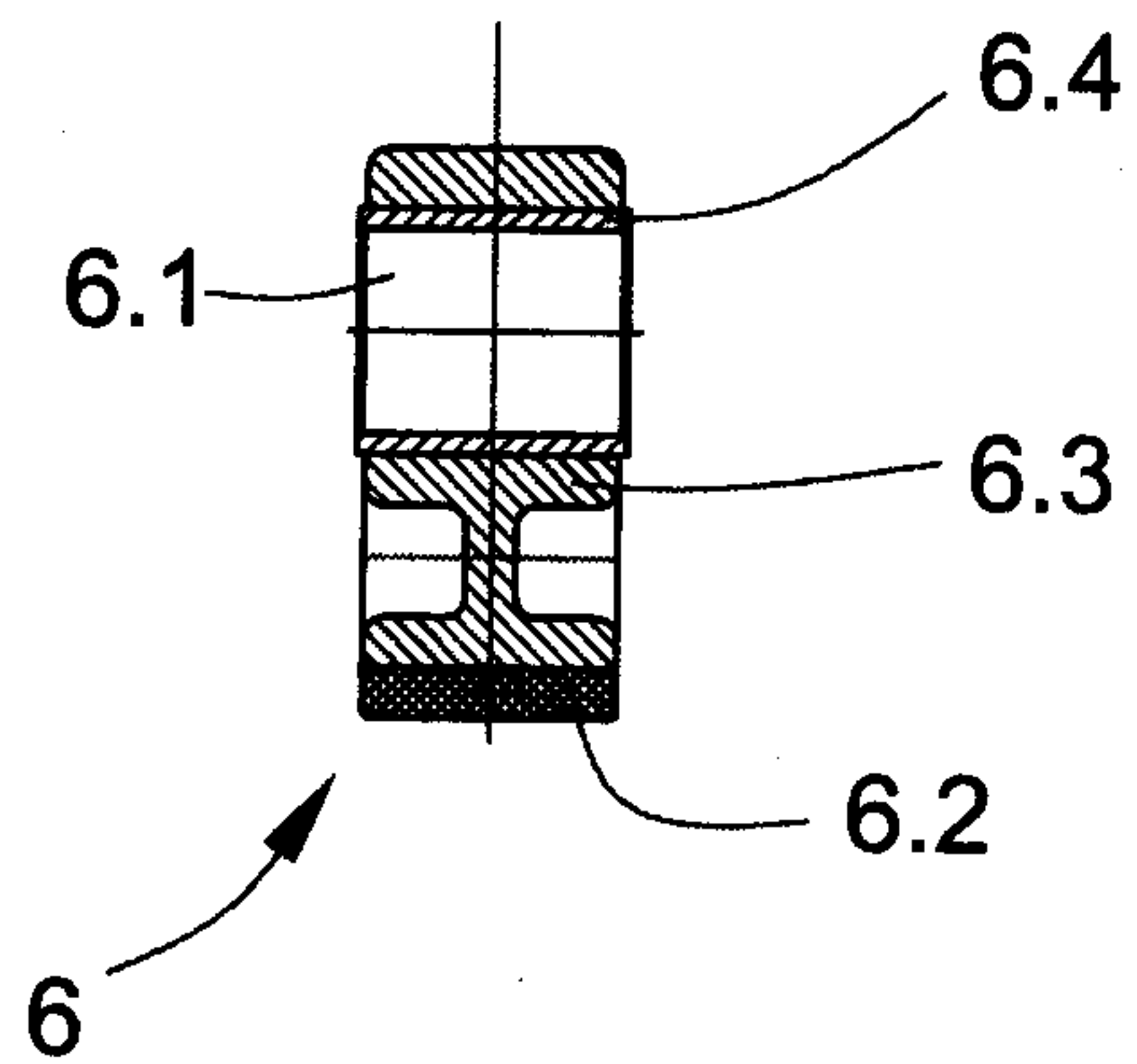


Fig. 6A

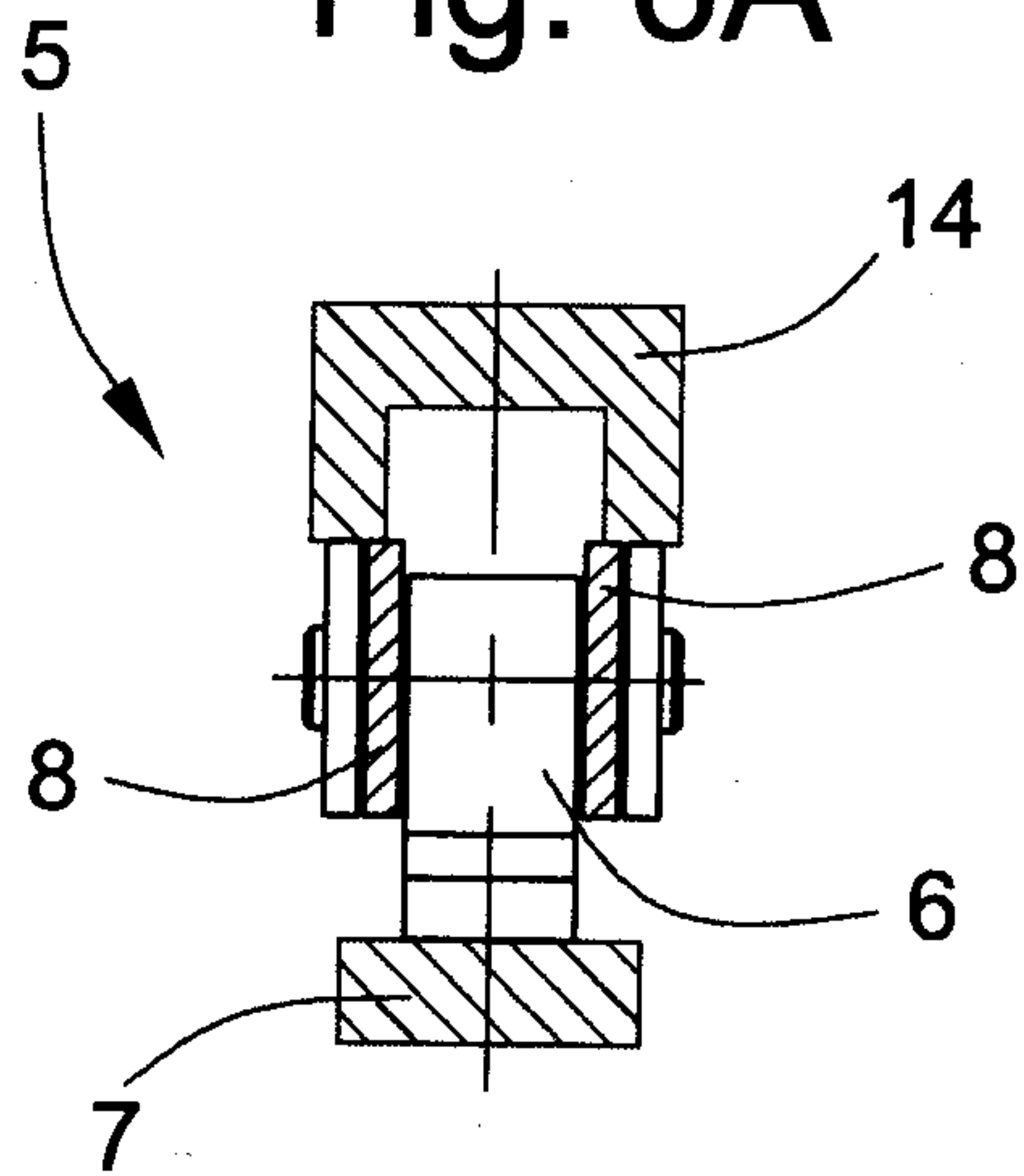


Fig. 6B

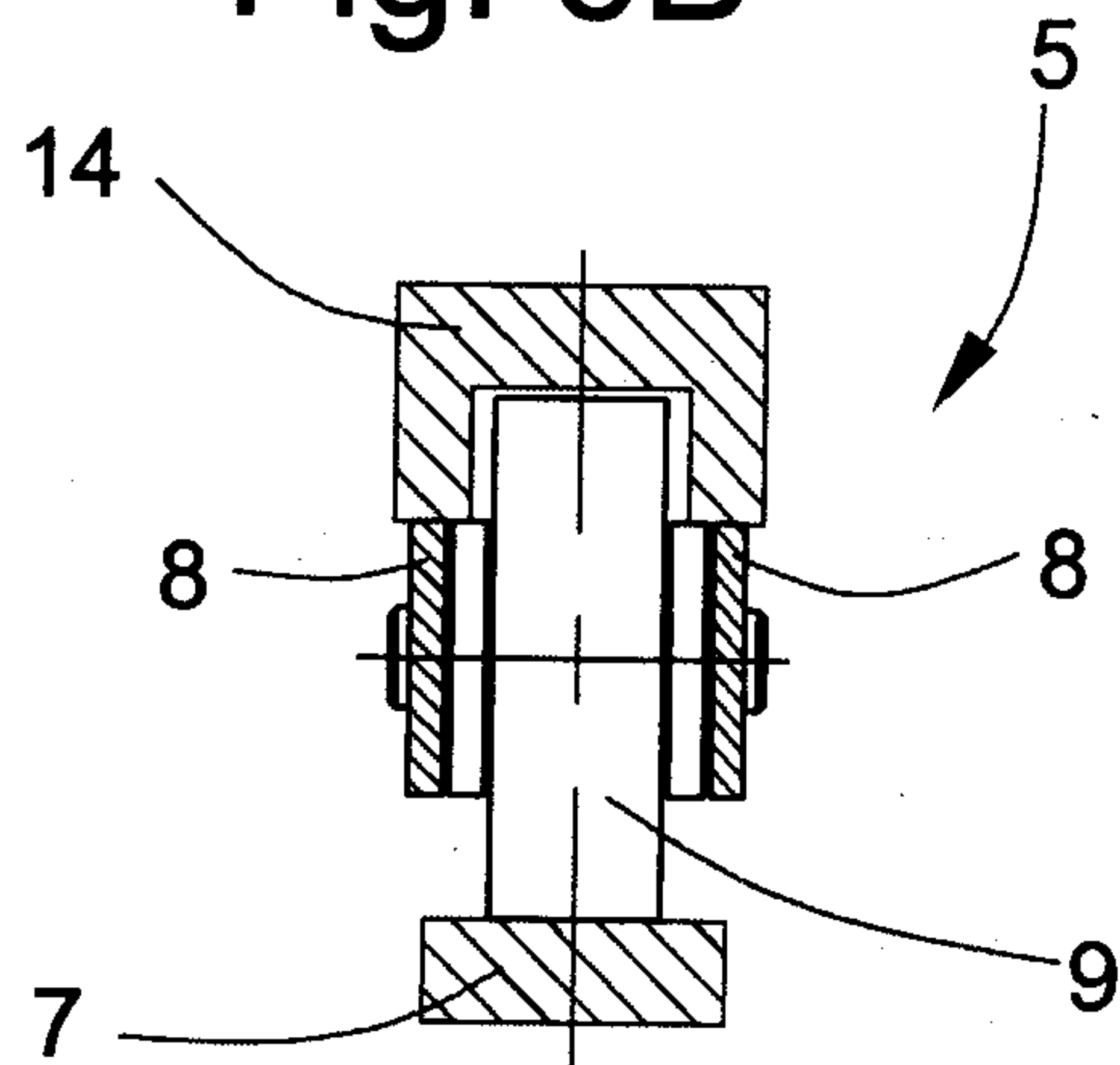


Fig. 6C

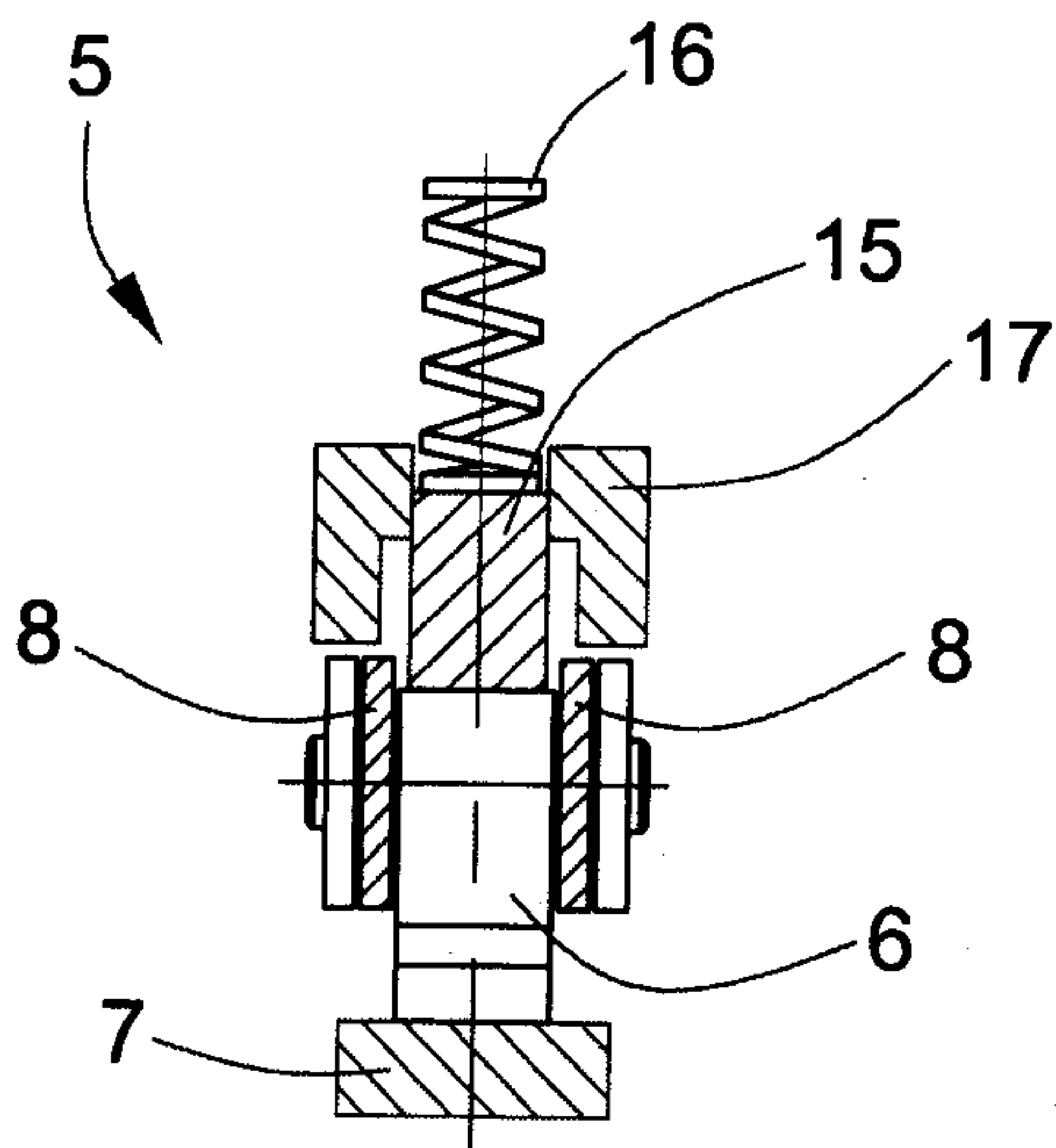


Fig. 6D

