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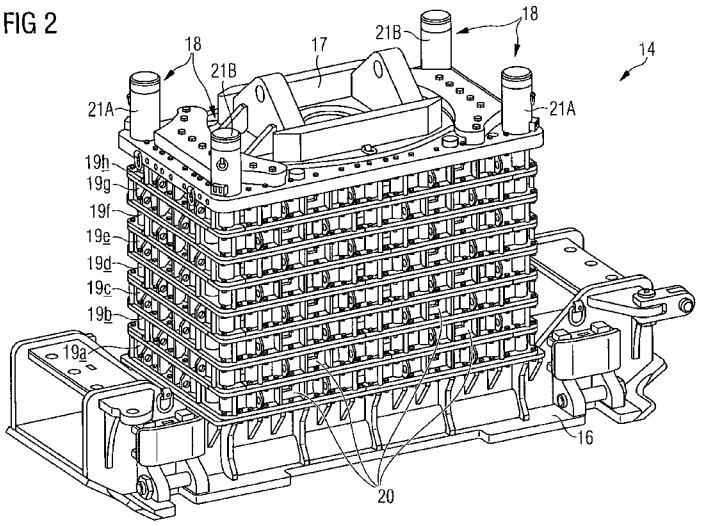
(54) Title: SUPPORT STRUCTURE

FIG 2



(57) Abstract: A support structure (14) for drive or reversing stations of conveyor or extraction devices in underground mining is described. The support structure (14) has a substructure and an articulated support which may be configured to be vertically adjustable relative thereto by means of a lifting device. At least one spacer element is provided which is configured to be installed between the substructure and the articulated support. A lifting device (18) has two pairs (21A, 21B) of lifting cylinders (21) whose lifting cylinders are arranged diagonally opposite one another in corner areas of the articulated support (17) and can be actuated in pairs, and that as the spacer element (20) for a lifting stage at least four, preferably six, distance members (23) are provided of which two in each case are placeable in pairs underneath the pair (21A, 21B) of lifting cylinders (21) which is not loaded during a lifting process.

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Description

SUPPORT STRUCTURE

Background

[01] The present disclosure relates to a support structure for drive or reversing stations of conveying or extracting devices particularly in underground mining operations, with a substructure in particular resting on the floor, and an articulated support vertically adjustable relative to this by means of a lifting device, as well as with at least one spacer element which can be installed between the substructure and articulated support.

Technical Field

[02] In the area of the transition between the longwall face and the gallery, where the coal or the like which has been brought up by the (armoured) face conveyor is transferred to the gallery conveyor for onward transportation, it is necessary to support the armoured face conveyor (AFC) in the area of its machine frame at the end which projects into the gallery so that the material discharge is located at the desired height above the gallery conveyor. The conditions which change constantly as mining advances at the transition from the face to the gallery, more particularly changes to the incident angle of the face and/or its load base level above the gallery floor, make it necessary to design the support structure supporting the armoured face conveyor variable in order to be able to adjust the position of the supported machine frame as the conditions change.

[03] From DE 85 18 433 U a face-gallery transfer is known where the support structure for the machine frame of the AFC consists essentially of two adjusting cylinders and a transfer table attached for articulated movement to their top end and on which the machine frame of the AFC rests. With this known construction the consequently high supporting forces must be passed down into the base plate by the adjusting cylinders wherefore these have to be permanently pressurized during operation. A further drawback with the known device is that with the face becoming more severe the downhill-slope forces acting on the AFC exert on the transfer table a horizontal force which can be taken up in only a restricted amount by the adjusting cylinders so that care must be taken for additional support in the horizontal direction.

[04] A further support structure for a drive station in underground mining is known from DE 202 07 017 U1. The known support structure has a base plate resting on the floor or on a bed, as well as an articulated support to which the drive station which is to be supported can be attached. Between the base plate and the articulated support are several support boxes arranged one above the other and preferably forming two support columns spaced out relative to one another. The support boxes are locked to one another by screw connections. The base plate and the articulated support are also locked to the relevant support box adjoining same by screw connections. Through the assembly or dismantling of single or several support boxes between the base plate and articulated support, it is possible to change the height of the support columns and, thus, the distance between the base plate and articulated support. The support structure can thus be easily adapted as regards its height to the conditions which are constantly changing as the extraction advances in the mine. In order in the case of the support structure to build in further support boxes, an assembly or dismantling tool is provided, such as for example a vertically operating cylinder. Through this auxiliary tool the articulated support is raised (lifted) so that a gap is formed between the support columns and the articulated support. Further support

boxes can be inserted into this gap. The articulated support is then lowered again until it sits on the support columns which are now raised. With DE 203 13 946 U1 a similar construction is proposed in which the at least one support box, a further support box arranged above or below same, the base plate and/or the articulated support are all locked relative to one another by means of at least one wedge connection.

[05] The known constructions have indeed proved themselves in practice but have drawbacks conditioned by the system and which the present disclosure aims to overcome. Thus with the known support structures it is necessary to uncouple the lifting cylinders from a connecting flange on a lower support box as they reach their maximum extension, then to move them in (to retract them) and to connect them again to correspondingly designed connecting flanges on the support boxes located above same, before a further lift can be executed for installing further support boxes. Correspondingly the reverse happens, when dismantling the support boxes to reduce the height of the support structure. The object of the present disclosure is thus to provide a simpler and faster method of raising and lowering the articulated support relative to the substructure.

[06] The present disclosure is directed, at least in part, to improving or overcoming one or more aspects of prior systems.

Summary of the Disclosure

[07] According to a first aspect of the present disclosure, a support structure for drive or reversing stations of conveyor or extraction devices is disclosed. The support structure may comprise a substructure, an articulated support, and a lifting device. The lifting device may be configured to vertically adjust the articulated support relative to the substructure. The lifting device may include two pairs of lifting cylinders to be actuated in pairs. Each pair of lifting cylinders may be arranged diagonally opposite one another in corner areas of the

articulated support. The support structure may further comprise at least one spacer element configured to be installed between the substructure and the articulated support. Each spacer element may comprise at least four distance members of which two in each case are placeable in pairs underneath the pair of lifting cylinders which is not loaded during a lifting process.

[08] According to another aspect of the present disclosure, a method for vertically adjusting a support structure for drive or reversing stations of conveyor or extraction devices is disclosed. The support structure may comprise an articulated support to be vertically adjusted relative to a substructure. The method may comprise supporting the articulated support solely at two diagonally opposite corner areas of the articulated support. The method may further comprise, if increasing a height, placing a pair of distance members underneath the other two diagonally opposite corner areas of the articulated support at which the articulated support is not supported. The method may further comprise, if decreasing a height, removing a pair of distance members from underneath the other two diagonally opposite corner areas of the articulated support at which the articulated support is not supported.

[09] Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

Brief Description of the Drawings

[10] Further features and advantages of the present disclosure are apparent from the drawings and the following description, in which preferred embodiments of the present disclosure will be illustrated and explained in further detail using examples. In the drawings:

[11] Fig. 1 shows in side view a reversing station of an armoured face conveyor used in underground mining with a transfer to a gallery conveyor arranged underneath with a support structure according to the present disclosure in a construction stage;

[12] Fig. 2 is a perspective view of a support structure according to the present disclosure in an elevated construction stage;

[13] Fig. 3 shows the subject of Fig. 2 in a vertical sectional view;

[14] Fig. 4 shows the subject of Figs. 2 and 3 in horizontal sectional view;

[15] Fig. 5 shows a perspective view of a first embodiment of a distance member being used with the support structure according to the present disclosure;

[16] Fig. 6 shows the subject of Fig. 5 in a cross-section along the line VI-VI;

[17] Fig. 7 shows a second embodiment of a distance member being used with the support structure according to the present disclosure in an illustration corresponding to Fig. 5; and

[18] Fig. 8 shows a section of an elevating structure comprised of several distance members of the second embodiment and arranged between the substructure and the articulated support of the support structure according to the present disclosure in a perspective view.

Detailed Description

[19] The following is a detailed description of exemplary embodiments of the present disclosure. The exemplary embodiments described therein and illustrated in the drawings are intended to teach the principles of the present disclosure, enabling those of ordinary skill in the art to implement and use the present disclosure in many different environments and for many different applications. Therefore, the exemplary embodiments are not intended to be, and should not be considered as, a limiting description of the scope of patent protection. Rather, the scope of patent protection shall be defined by the appended claims.

[20] Fig. 1 shows a transfer marked as a whole by 10 between an armoured face conveyor 11 and a gallery conveyor 12 in an underground mining extraction plant.

[21] The armoured face conveyor 11 is provided at its end area lying above the gallery conveyor 12 with a reversing station 13 which is supported at the desired height above the gallery conveyor 12 by means of a support structure 14. This support structure 14 is the subject of the present disclosure and is illustrated in more detail in Figs. 2 ff.

[22] As can be seen, the support structure 14 has a lower substructure 16 which is supported relative to the floor 15, and an upper articulated support 17 which is vertically adjustable relative to the substructure and on which the reversing station 13 is mounted for articulated movement, as can be seen in Fig. 1. The articulated support 17 can be adjusted in its height relative to the substructure 16 by means of a lifting device 18 in order to install between the substructure and the articulated support one or more layers 19 a – h of spacer elements 20 in order to be able to adjust the vertical position of the articulated support 17 and thus the reversing station 13 which is attached for articulated movement to same.

[23] The lifting device 18 consists essentially of four lifting cylinders 21 in total which are mounted in the corner areas of a roughly rectangular base plate 22 of the articulated support 17. The four lifting cylinders 21 are combined into two lifting cylinder pairs A, B so that the two lifting cylinders of each one lifting cylinder pair lie diagonally opposite one another. The lifting cylinders 21 of each lifting cylinder pair A and B respectively can be actuated in pairs, for example, the lifting cylinder in the left front corner and the lifting cylinder in the right rear corner are actuated simultaneously or the lifting cylinder in the left rear corner and the lifting cylinder in the right front corner are actuated simultaneously.

[24] The spacer elements 20, to which the articulated support 17 can be mounted off-set by the different layers 19 relative to the substructure 16, consist of identically configured distance members 23 which can be locked with positive engagement to one another and to the substructure 16 as well as to the articulated support 17. For each lifting stage or layer 19 a-h a total of six distance members are provided whose length and width are each dimensioned so that the sum of the length of one distance member and its width is adapted (matched) to the width of the support structure 14 and the length of two distance members plus the width of one distance member is adapted to the length of the support structure 14 (Fig. 4). The distance members are formed in cross-section as roughly I-shaped profiled strips which can be seen particularly clearly in Figs. 5 to 7. To lock the distance members to one another or to the substructure and the articulated support, there are at the bottom on the distance members 23 and the base plate 22 of the articulated support 17 projecting bolt pins 24 which in the installed state fit in adapted bolt sockets 25 in further distance members or in the substructure 16 mounted underneath. The bolt pins 24 are formed as tubular sleeves which are inserted between the arm 26 at the top and the arm 27 at the bottom of the distance members 23 as part of the web 28 connecting these together, wherein they project down a little further over the lower arm 27, as can be best seen from Fig. 6.

[25] Whilst the bolt pins 24 in the illustrated embodiments of the distance members 23 are only located in their end areas at the relevant right and left end of the distance members, the bolt sockets 25 are provided on the upper arm 26 not only on the right and left in the end areas, but additional bolt sockets 25' are located off-set inwards about an amount which is adapted to the width of one distance member.

[26] In order to be able to fixedly connect the distance members to one another and to the upper articulated support or the lower substructure, in the case of the first embodiment of the distance members, as shown in Figs. 5 and 6,

several cylinder screws 29 are provided each time which are pushed through bores 30 provided in the upper and lower arms 26, 27 and are screwed to securing nuts 31. In the case of the embodiment illustrated in Figs. 7 and 8, the securing elements are formed as bolt pins 33 provided with an oblong head 32 wherein the oblong heads 32 can be pushed through oblong holes 34 arranged on the relevant distance members above or on the articulated support and can be turned by one quarter turn to produce a positive locking connection. The bolt pins are provided with a threaded section 35 on which a locking nut 36 can be screwed. The locking nuts are designed as hammer nuts with four hammer noses 37 arranged spaced out round the perimeter to which a tool such as a hammer or chisel can be fitted in order to be able to particularly tighten up the locking nuts and also to enable subsequent release by means of the hammer and/or chisel.

[27] The design of the distance members described enables advantageously the distance members of two superposed layers 19 a-h to be arranged off-set relative to one another, namely by an amount which corresponds to the width of the distance members.

[28] In order to raise the articulated support 17 by one layer, first the securing elements, thus the screw connections 29, 31 and 33, 36 between the articulated support and the layer of distance members underneath or (in the lowest position) the substructure, are to be released. One of the pairs 21A or 21B of lifting cylinders is then actuated so that the downwardly extending piston rods 38 of the diagonally opposite actuated lifting cylinders 21 move into the bolt sockets 25 located directly underneath and then become supported on the upper edge of the sleeve inserted there or on the top side of the upper arm 26. As the two actuated lifting cylinders of the relevant active lifting cylinder pair A or B extend further out, the articulated support 17 is raised further up so that then two distance members can be placed in pairs, thus diagonally opposite one another underneath the lifting cylinder of the other lifting cylinder pair B, A, which is not active in this lifting process, wherein preferably a locking of these two distance

elements with the layer underneath immediately takes place. The cylinders of the second cylinder pair are then loaded and extend out downwards whereby they fit into bolt sockets at the ends of the distance members installed immediately before and during subsequent inward movement of the piston rods of the cylinders of the first lifting cylinder pair take over their function and thus hold the articulated support 17 furthermore in a position raised up so that now the remaining four distance members can be installed and locked with the layer underneath. The lifting cylinders of the second cylinder pair then move in again and hereby set the articulated support down on the newly installed spacer element layer whereupon the locking then takes place between the articulated support and the new layer.

[29] In other words, if increasing or decreasing a height of the articulated support 17, the same may be supported solely at two diagonally opposite corner areas of the articulated support 17 by means of a pair 21A, 21B of lifting cylinders 21. Then, if increasing a height, a pair of distance members 23 is placed underneath the other two diagonally opposite corner areas of the articulated support 17 at which the articulated support 17 is not supported. Afterwards, the supporting of the articulated support 17 is translocated from the two diagonally opposite corner areas of the articulated support 17 to the other two diagonally opposite corner areas of the articulated support 17 by means of an other pair 21A, 21B of lifting cylinders 21. The articulated support 17 is now supported on the placed pair of distance members 23. Underneath the two diagonally opposite corner areas of the articulated support 17 at which the articulated support 17 is not supported, a further pair of distance members 23 is placed. Thus, the articulated support 17 can be supported on a new layer of distance members 23.

[30] On the other hand, if decreasing a height of the articulated support, a pair of distance members 23 is removed from underneath the other two diagonally opposite corner areas of the articulated support 17 at which the articulated support 17 is not supported. Then supporting is translocated to the

other two diagonally opposite corner areas of the articulated support 17, and a further pair of distance members 23 can be placed underneath the two diagonally opposite corner areas of the articulated support 17 at which the articulated support 17 is not supported. Thus, the articulated support 17 can be lowered to be supported on a lower layer of distance members 23.

[31] It can be seen that the distance members which are all formed the same, can be used in all possible installation positions which makes their handling much easier. Since the distance members of one layer are each off-set by an amount corresponding to their width relative to the distance members of the layer lying below or above same, a very stable construction is obtained which makes it possible to build up the support structure 14 even to a level which for reasons of stability was not reached with the hitherto known constructions.

Industrial Applicability

[32] The present disclosure discloses a lifting device that has two pairs of lifting cylinders whose lifting cylinders are arranged diagonally opposite one another in corner areas of the articulated support and can be actuated in pairs and in that as a spacer element for a lifting stage at least four distance members are provided of which two in each case can be placed in pairs underneath the lifting cylinders of the pair of lifting cylinders which are not loaded during a lifting process.

[33] With such a construction by alternating actuation of the lifting cylinders of the two pairs of cylinders arranged diagonally to one another in the corner areas of the articulated support, it may become possible to lift the articulated support relative to the substructure underneath same or the distance elements located thereon by as a general rule roughly more than one height stage, then to install each two distance members in the resulting free space underneath the (retracted) lifting cylinder, which is non-active with this lifting process, of the other cylinder pair and then to load this, whilst (at the same time or immediately

afterwards) the cylinders of the first cylinder pair are retracted again so that then distance members can also be installed in these corner areas. It may be thereby not necessary that the lifting cylinders are fixedly attached before each lifting process on the structural element (articulated support or distance member) arranged underneath same, since the active lifting forces act practically exclusively vertically and are reliably dissipated downwards even without any solid connection. In order thus to increase the stability, it may be advantageous if the distance members and/or the substructure are provided in their areas located underneath the lifting cylinders with guide recesses or bolt sockets into which the extending piston rods of the lifting cylinders positively engage by their relevant end area and are supported on a stop face located preferably a little underneath the top side of the distance members or substructure.

[34] It may preferable if the distance members may be formed identical so that each distance member can be inserted at any point in the support structure. It may be also advantageous if the distance members can be locked positively with one another and/or with the substructure and the articulated support, which can be implemented for example in that the distance members may be provided with downwardly or upwardly projecting bolt pins which in the installed state fit into conforming bolt sockets in further distance members arranged below or above same or in the substructure or in the articulated support. So that an unintended removal of the articulated support or the distance members from the relevant parts of the structure located below cannot happen, it is preferably proposed that the distance members can be locked relative to one another and/or to the substructure or the articulated support by means of securing elements such as by way of example safety screw connections or bolt wedges.

[35] A very advantageous configuration may be reached if the securing elements may be designed as bolt pins provided with an oblong head wherein the oblong heads can be pushed through oblong holes arranged on the distance members and/or the substructure or articulated support, and can then be turned

about roughly 90° for a positive locking engagement. The arrangement can thereby be produced so that the bolt pin may be provided with a threaded section on which a locking nut can be screwed. This design may enable a very rapid assembly of the securing elements to connect the distance members which are arranged one above the other to one another and to the substructure or the articulated support, since the locking nut can hereby be already screwed on the threaded section when the bolt pin is pushed with its oblong head through two mutually aligned oblong holes of the structural parts which lie one above the other and which are to be locked to one another. The bolt element need then only be turned by a quarter turn so that the areas of the oblong head projecting at the sides fit behind the narrow sides of the relevant oblong hole. The locking nut which is already screwed onto the threaded section can then be tightened up firmly. In order hereby to enable a particularly solid screw connection which can however also become released again without difficulty, it may be advantageous if the securing elements or their bolt pins can be screwed to locking nuts provided as hammer nuts for securing the distance members to one another or to the substructure and the articulated support.

[36] It may be particularly advantageous if the distance members of two superposed spacer element layers are/become arranged off-set relative to one another. This then produces a very stable structure for the support structure even with very great construction heights. It may be possible that for each lifting stage six distance members are/become provided wherein the width to length ratio of the sides of the support structure then amounts to about 2:1. The distance members may be preferably designed as profiled strips shaped with a double T or I-shaped cross-section.

[37] Although the preferred embodiments of the present disclosure have been described herein, improvements and modifications may be incorporated without departing from the scope of the following claims.

Claims

1. A support structure (14) for drive or reversing stations (13) of conveyor or extraction devices (11), the support structure (14) comprising:

a substructure (16);

an articulated support (17);

a lifting device (18) configured to vertically adjust the articulated support (17) relative to the substructure (16), the lifting device (18) including two pairs (21A, 21B) of lifting cylinders (21) to be actuated in pairs, each pair (21A, 21B) of lifting cylinders (21) being arranged diagonally opposite one another in corner areas of the articulated support (17); and

at least one spacer element (20) configured to be installed between the substructure (16) and the articulated support (17), each spacer element (20) comprising at least four distance members (23) of which two in each case are placeable in pairs underneath the pair (21A, 21B) of lifting cylinders (21) which is not loaded during a lifting process.

2. The support structure (14) according to claim 1, wherein the distance members (23) and/or the substructure (16) are provided in their areas located underneath the lifting cylinders (21) with guide recesses or bolt sockets (25) in which extending piston rods (38) of the lifting cylinders (21) engage with positive locking action by their relevant end areas and are supported on a stop face which is located a little underneath the upper side of the distance members (23) or substructure (16).

3. The support structure according to claim 1 or 2, wherein the distance members (23) are of identical design.

4. The support structure (14) according to one of claims 1 to 3, wherein the distance members (23) are lockable positively to one another, to the substructure (16), and/or to the articulated support (17).

5. The support structure (14) according to one of claims 1 to 4, wherein the distance members (23) are provided with downwardly or upwardly projecting bolt pins (24) which in the installed state fit into matching bolt sockets (25, 25') in further distance members (23) arranged above or below or in the substructure (16) or in the articulated support (17).

6. The support structure (14) according to one of claims 1 to 5, wherein the distance members (23) are lockable to one another and/or to the substructure (16) or to the articulated support (17) by means of securing elements such as, for example, safety screw connections (29, 31) or bolt wedges.

7. The support structure (14) according to one of claims 1 to 6, wherein the securing elements are formed as bolt pins (33) with an oblong head (32), the oblong heads (32) being pushable through oblong holes (34) arranged on the distance members (23), the substructure (16), and/or the articulated support (17), and being turnable by about 90° for positive locking connection.

8. The support structure (14) according to claim 7, wherein the bolt pin (33) is provided with a threaded section (35) onto which a locking nut (36) is screwable.

9. The support structure (14) according to one of claims 6 to 8, wherein the securing elements or their bolt pins are screwable to locking nuts

(36) provided as hammer nuts (37) in order to secure the distance members (23) to one another or to the substructure (16) and to the articulated support (17).

10. The support structure (14) according to one of claims 1 to 9, wherein the distance members (23) of two superposed spacer element layers (19 a-h) are arranged off-set relative to one another.

11. The support structure (14) according to one of claims 1 to 10, wherein six distance members (23) are provided for each lifting stage.

12. The support structure (14) according to one of claims 1 to 11, wherein the distance members (23) are formed as profiled strips having a roughly double T- or I-shaped cross-section.

13. A method for vertically adjusting a support structure (14) for drive or reversing stations (13) of conveyor or extraction devices (11), the support structure (14) comprising an articulated support (17) to be vertically adjusted relative to a substructure (16), the method comprising:

supporting the articulated support (17) solely at two diagonally opposite corner areas of the articulated support (17); and

if increasing a height, placing a pair of distance members (23) underneath the other two diagonally opposite corner areas of the articulated support (17) at which the articulated support (17) is not supported; and

if decreasing a height, removing a pair of distance members (23) from underneath the other two diagonally opposite corner areas of the articulated support (17) at which the articulated support (17) is not supported.

14. The method of claim 13, further comprising:

translocating the supporting of the articulated support (17) from the two diagonally opposite corner areas of the articulated support (17) to the other two diagonally opposite corner areas of the articulated support (17);

if increasing a height, placing another pair of distance members (23) underneath the two diagonally opposite corner areas of the articulated support (17) at which the articulated support (17) is not supported; and

if decreasing a height, removing another pair of distance members (23) from underneath the two diagonally opposite corner areas of the articulated support (17) at which the articulated support (17) is not supported.

15. The method of claim 13 or 14, wherein the step of supporting is performed by means of a pair (21A, 21B) of lifting cylinders (21).

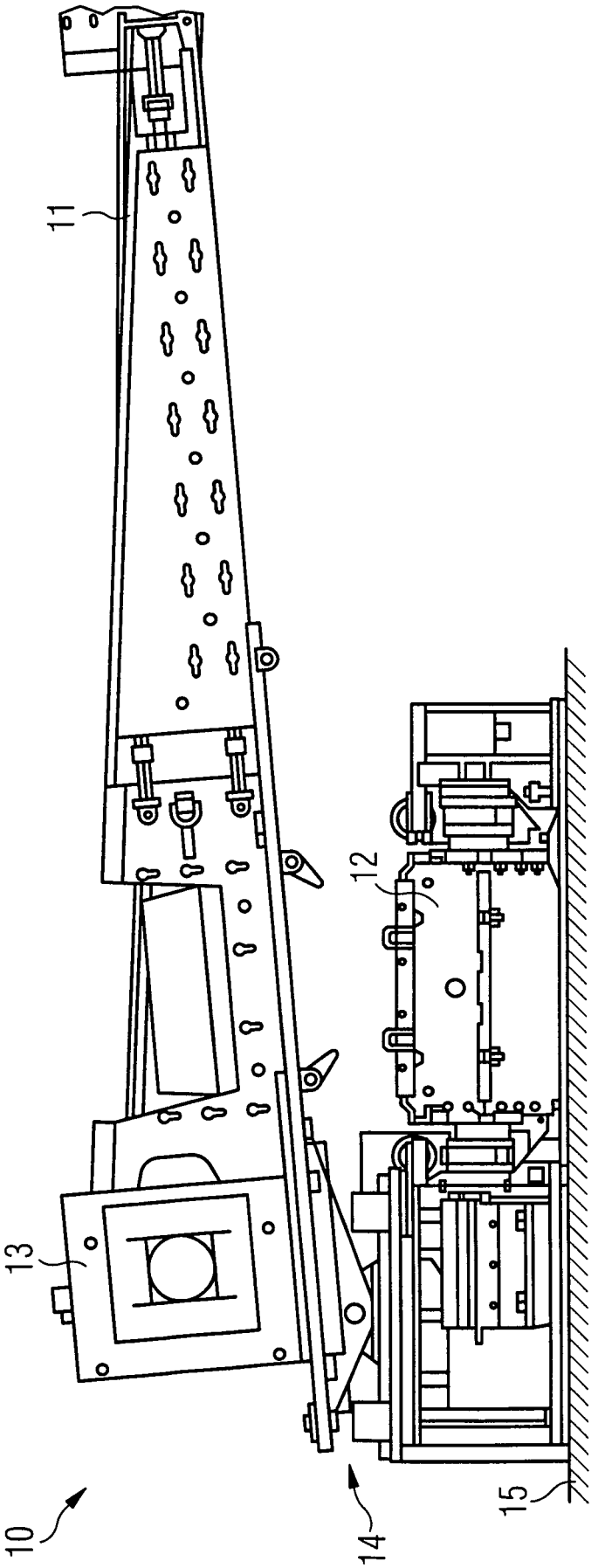

FIG 1

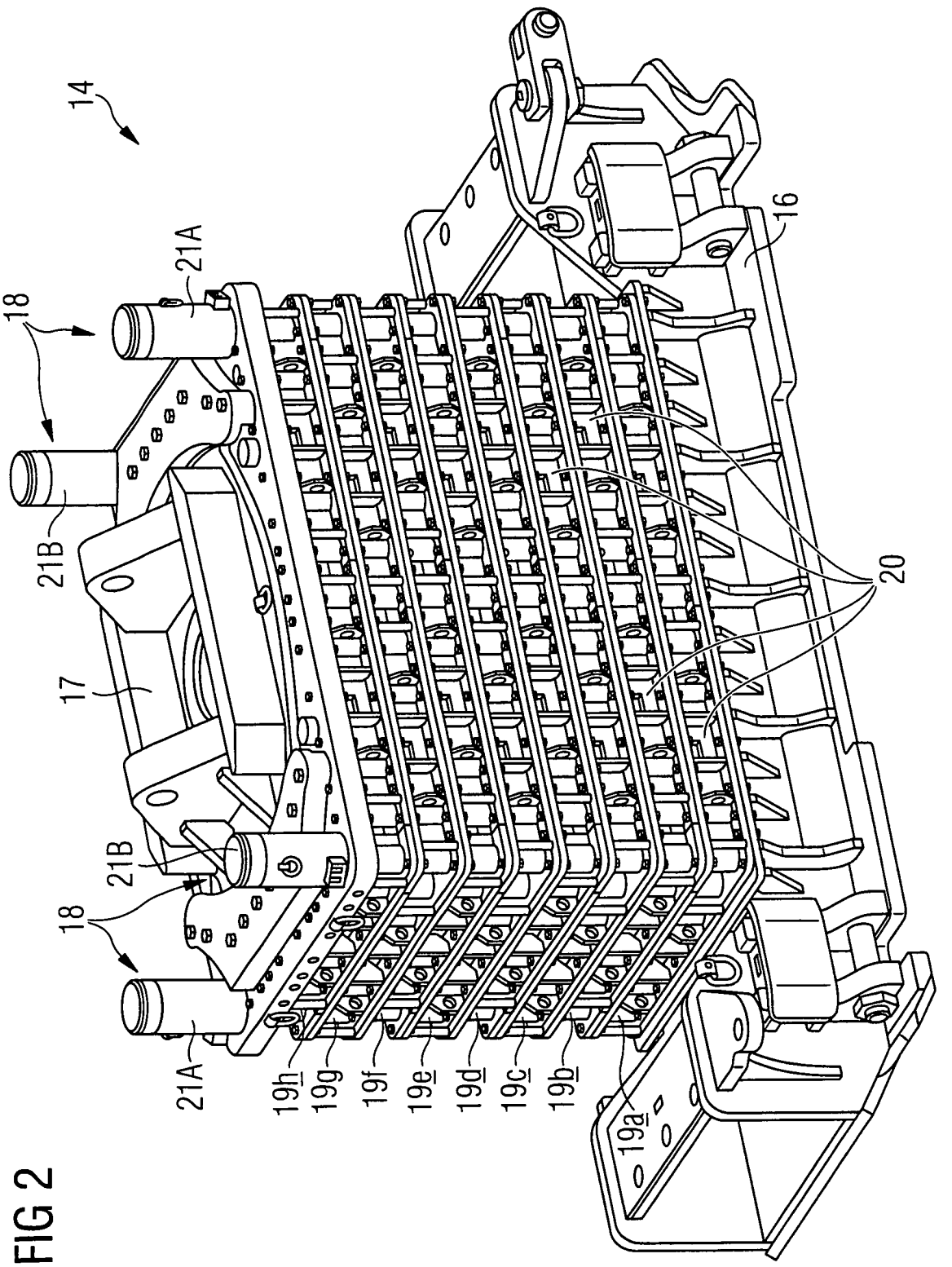

FIG 2

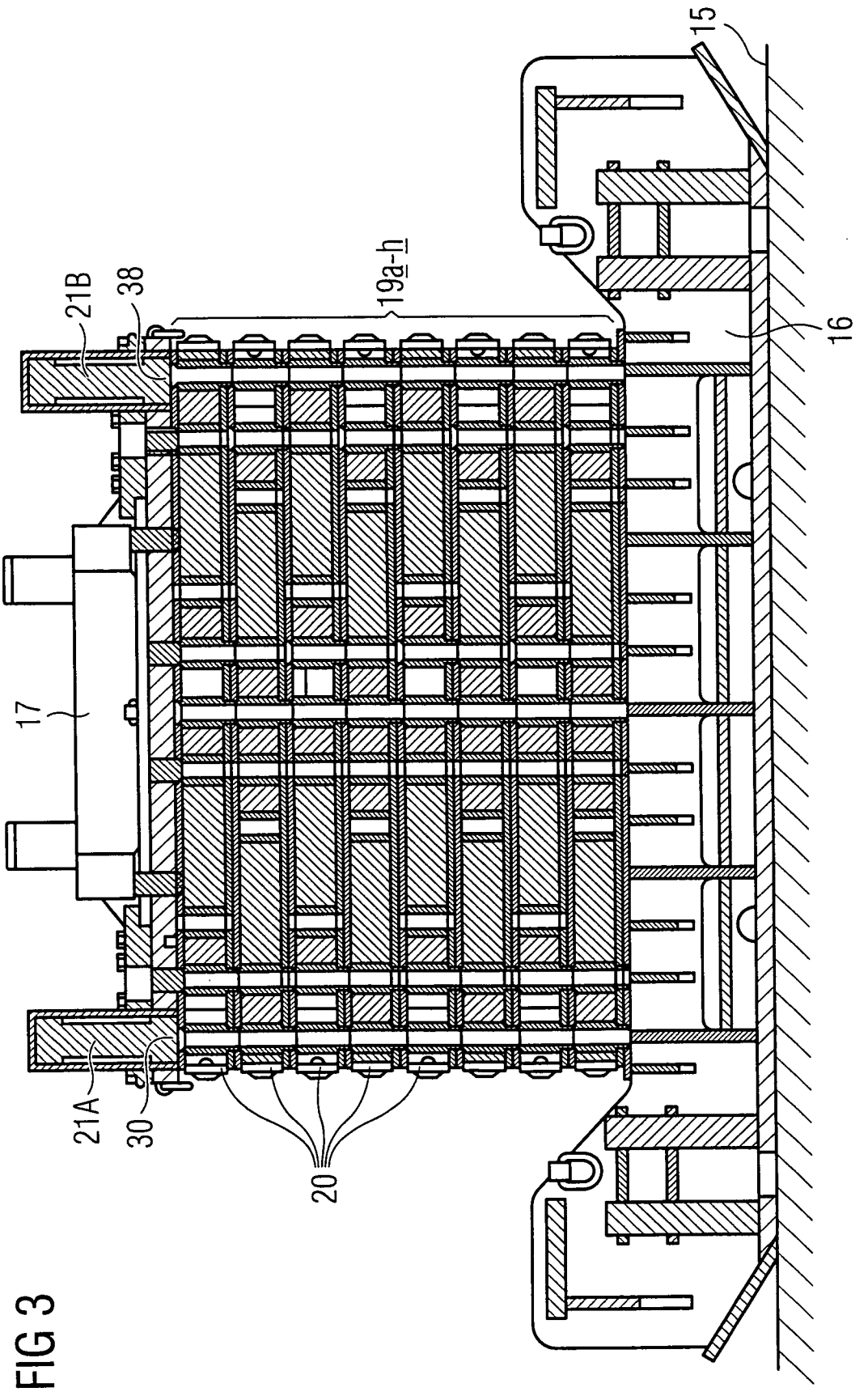

FIG 3

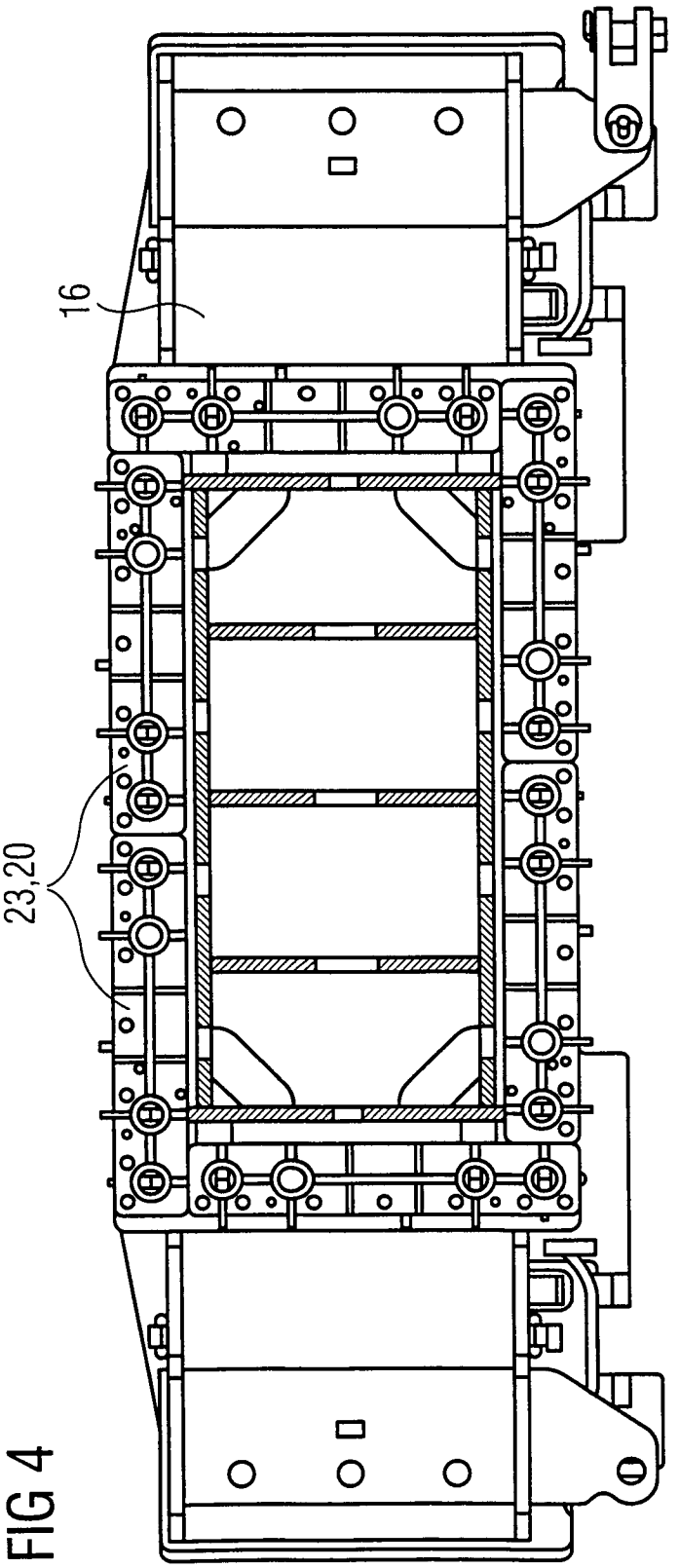

FIG 4

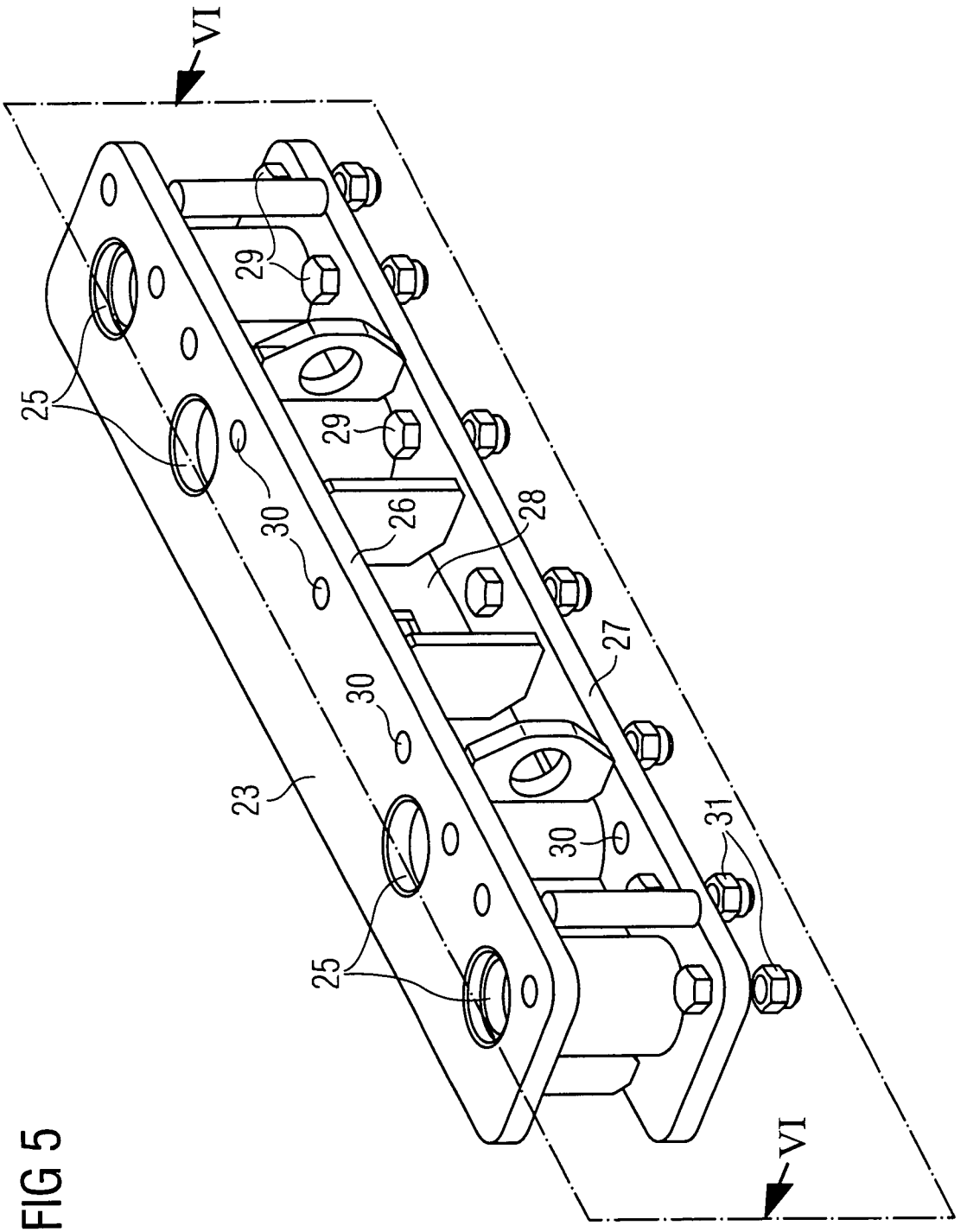

FIG 5

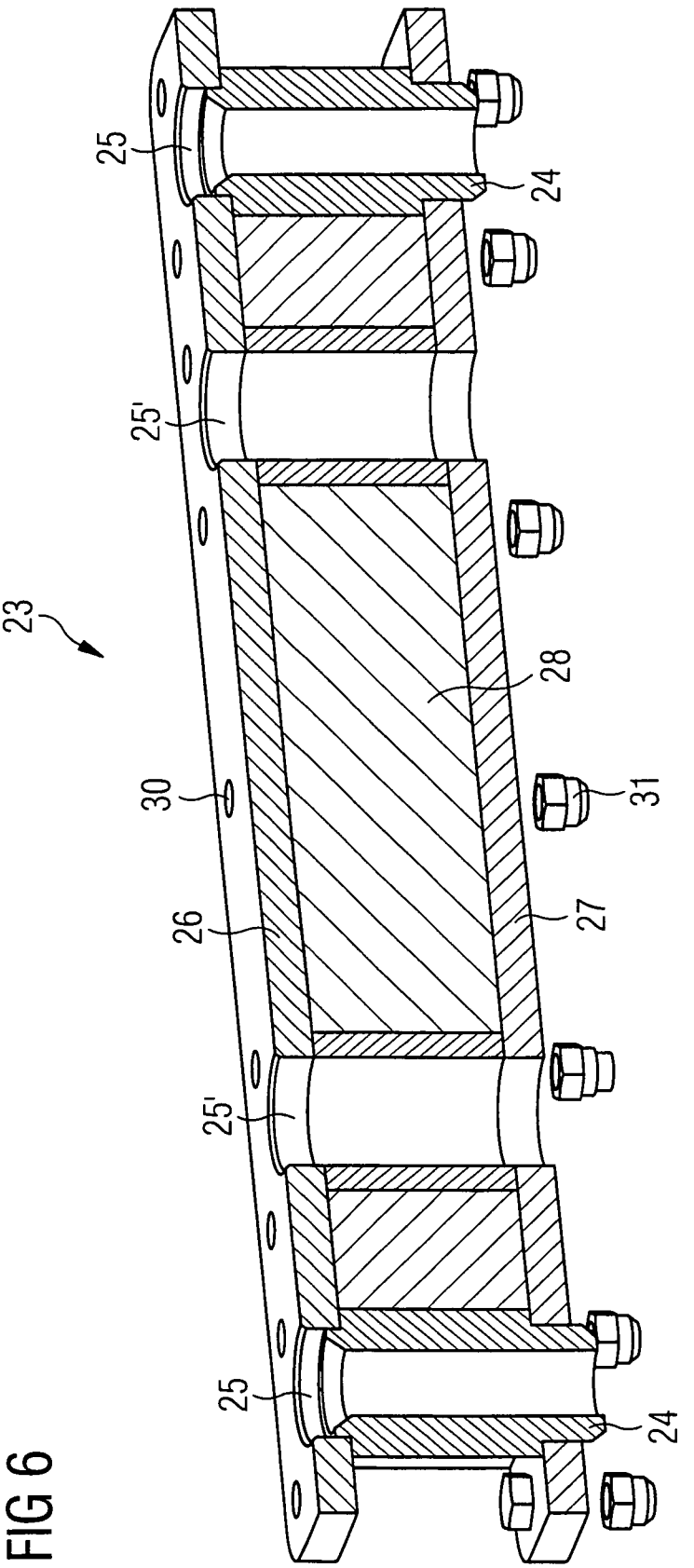

FIG 6

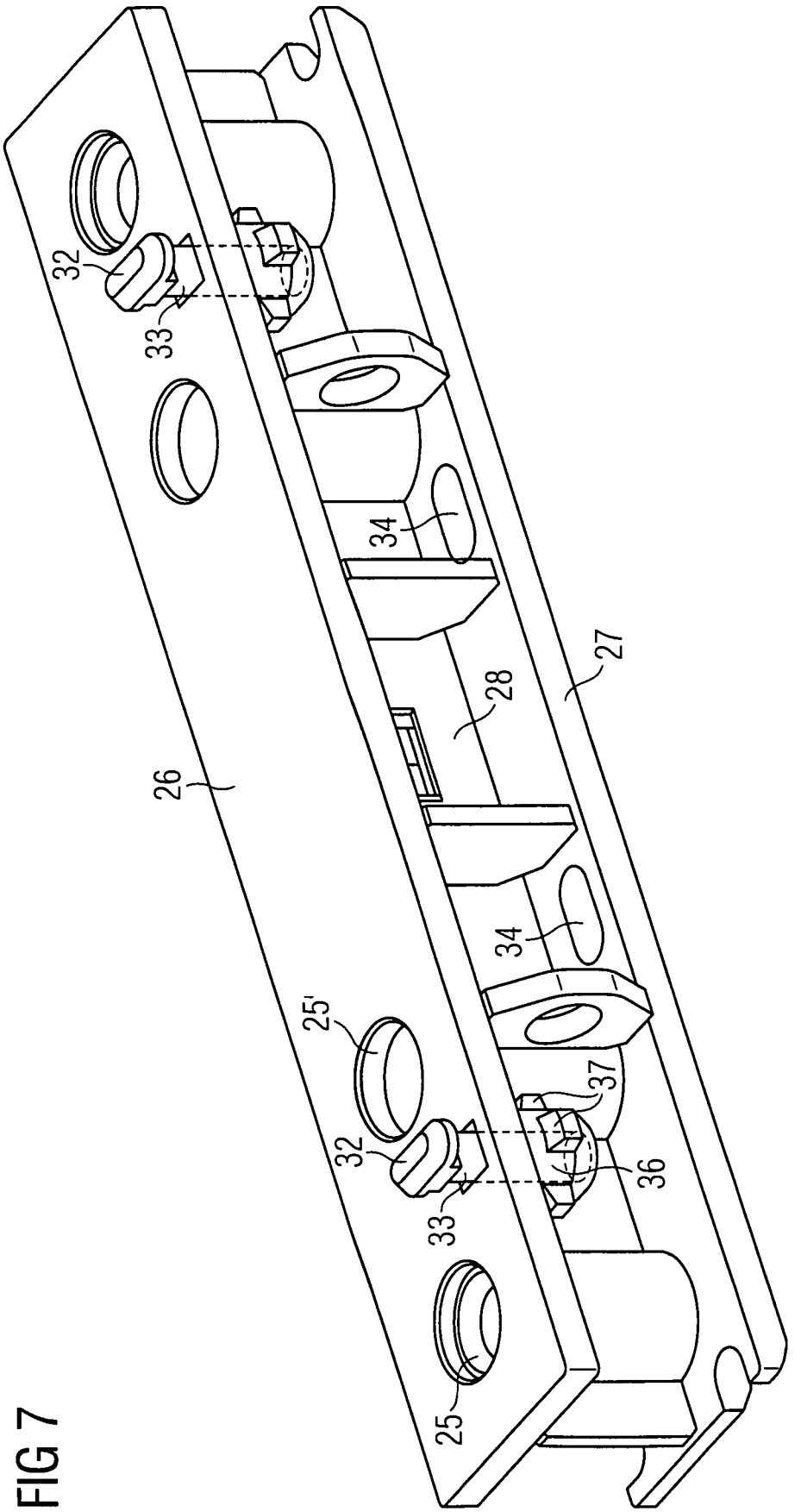

FIG 7

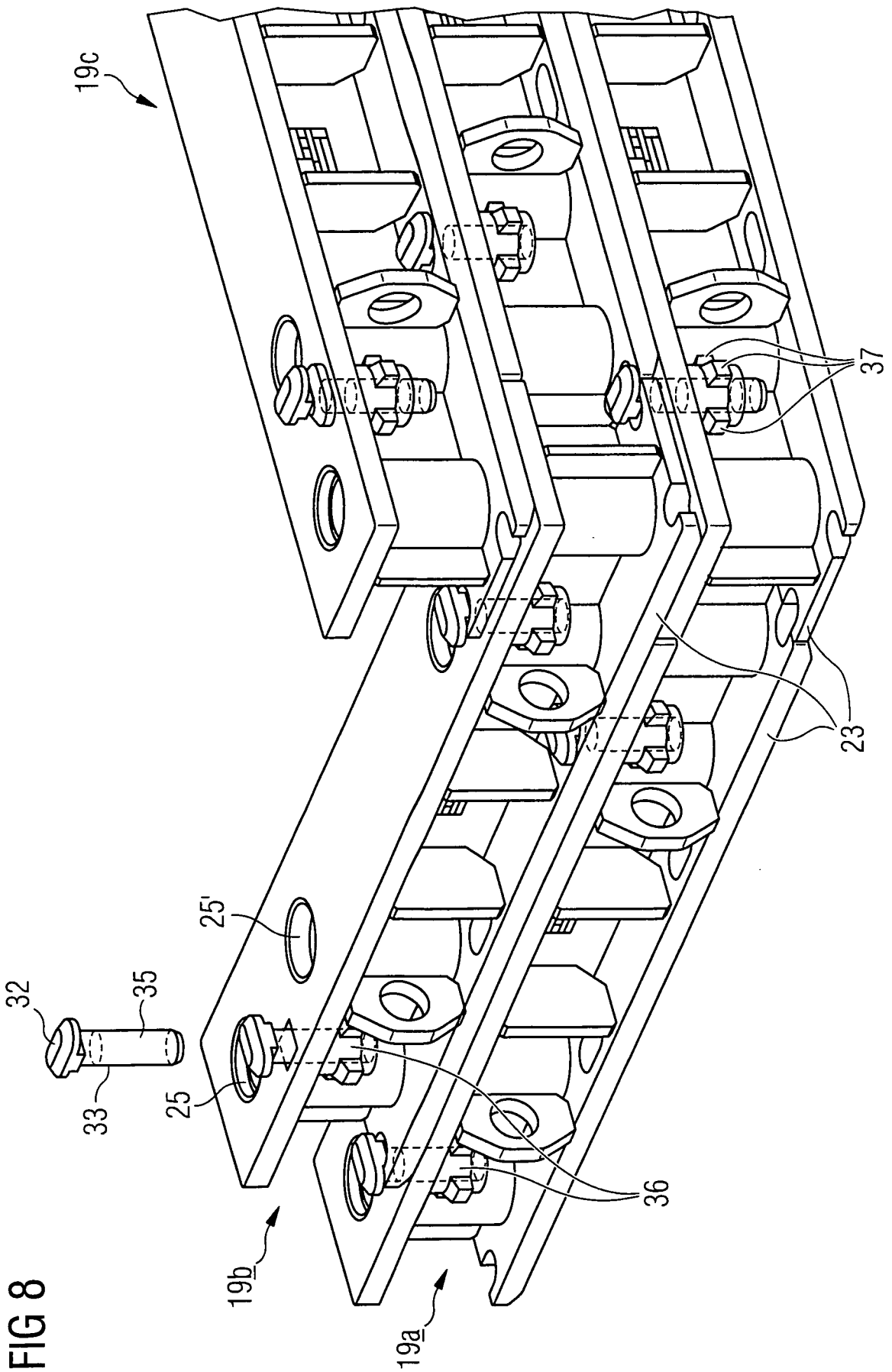

FIG 8