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DESCRIPTION

[0001] This invention relates to a spirit level and, more particularly, to a spirit level configured to determine the inclination of a surface, in substantially mutually perpendicular directions.

[0002] Spirit levels of various configurations having the capability to determine the inclination of a surface along multiple degrees of freedom are known. For example EP1630522 describes a spirit level comprising an H-shaped frame formed of two mutually parallel arms connected by a perpendicular cross member. The lower surfaces of the arms and cross member are substantially flat and configured to be placed on the surface to be examine. The upper, opposing surfaces of the arm(s) and cross member are provided with respective bulbs, each comprising a glass tube that contains a liquid in which an air bubble floats, and mounted within a recess in the respective arm/ cross-member. The bulb on the arm(s) and cross member are mutually perpendicularly oriented, such that they determine whether the surface is level (or plumb) in two mutually perpendicular directions.

[0003] However, a significant problem associated with the above-described arrangement is that its size, weight and shape can make it unwieldy to handle and very inconvenient to store for transport.

[0004] Other background art includes:

FR 2 538 539 A1 which relates to a plane level; and

GB 2 470 239 A which relates to a radiator fixing tool.

[0005] Aspects of the present invention seek to address at least some of the above-mentioned issues and, in accordance with a first aspect of the present invention, there is provided a spirit level, comprising a generally central elongate bar, and two pairs of arm members pivotally coupled at respective ends of said bar for movement between a first, extended, generally H-shaped configuration in which said arm members extend from said end of said bar at an angle thereto, and a second folded configuration, in which a side-wall of each of said arm members is substantially parallel to and located against or adjacent to a side edge of said central bar, wherein at least one bulb containing a bubble is provided in or on said central bar and oriented substantially parallel to its longitudinal axis, and at least one bulb containing a bubble is provided in or on an arm member and oriented substantially parallel to its longitudinal axis wherein each arm member comprises a distal end and a proximal end and is pivotally coupled at its respective proximal end to an end of said central bar so as to be pivotal toward and away from a respective one of the opposing longitudinal side edges of said central bar.

[0006] In one exemplary embodiment of the present invention, there may be provided a spirit level wherein one or more of said arm members may comprise a respective extension

member, mounted for movement relative thereto between a first, retracted position and a second, extended position wherein it forms an extension to the length of said respective arm member.

[0007] The above-mentioned extension member may be slidably mounted on a respective arm member such that longitudinal sliding movement relative thereto, between said first and second positions, is possible.

[0008] The extension member may comprise an elongate longitudinal slot by which said extension member may be mounted on a protrusion provided on said respective arm member, wherein said sliding movement may be effected, in use, by sliding a side edge of said slot longitudinally over said protrusion.

[0009] Additionally, in one exemplary embodiment of the present invention, there may be a spirit level, wherein each arm member may be mounted at a respective end of said central bar by means of a hinge member.

[0010] The hinge member may be substantially cuboidal with a semi-cylindrical portion, wherein said semi-cylindrical portion may comprise a hole through the depth of the hinge for the accommodation of a fastener.

[0011] According to one exemplary embodiment of the invention the arm members may be coupled to the respective end of said central bar such that they may lie substantially flush against said central bar when in said second configuration, and substantially perpendicular relative to the longitudinal axis of the central bar, when in said first configuration.

[0012] Optionally, the invention may comprise a releasable holding means for releasably holding said arm members in said second configuration.

[0013] In one exemplary embodiment the releasable holding means may comprise a first magnetic portion provided on a side edge of said central bar and a second magnetic portion provided on an arm member, on said side edge located against or adjacent to said side edge of said central bar, when in said second configuration.

[0014] Each arm member comprises a distal end and a proximal end and may be pivotally coupled at its respective proximal end to an end of said central bar so it may be pivotal toward and away from a respective one of the opposing longitudinal side edges of said central bar.

[0015] The invention may, in one exemplary embodiment, be such that the proximal ends of each of a pair of arm members are substantially flush with each other when in a first configuration.

[0016] One exemplary embodiment may provide the proximal ends of one or both of a pair of arm members with a friction surface for enabling said proximal ends to engage with each

other, in a friction fit, when said arm members are in said first configuration.

[0017] Furthermore, the above-mentioned friction surface may further comprise a serrated surface.

[0018] These and other aspects of the present invention will be apparent from the following specific description, and embodiments of the present invention will now be described, by way of examples only, and with reference to the accompanying drawings, in which:

Figure 1 is an isometric schematic diagram showing a spirit level according to an exemplary embodiment of the invention in a first configuration, wherein the arms are substantially perpendicular to the central bar, and the extendable portions are retracted fully;

Figure 2A is a schematic plan view of the spirit level of Figure 1, in the aforementioned configuration;

Figure 2B is a schematic side view of the spirit level of figure 1, in the aforementioned configuration;

Figure 2C is a schematic diagram end view of the spirit level of Figure 1, in the aforementioned configuration;

Figure 3 is an isometric schematic drawing of the spirit level of Figure 1 in a second configuration, wherein the arms are folded in so as to lie parallel to the central bar, and the extendable portions are retracted fully;

Figure 4A is a schematic plan view of the spirit level of Figure 3, in the aforementioned configuration;

Figure 4B is a schematic side view of the spirit level of Figure 3, in the aforementioned configuration;

Figure 4C is a schematic end view of the spirit level of Figure 3, in the aforementioned configuration;

Figure 5 is an isometric schematic diagram of the spirit level of Figure in a third exemplary configuration, wherein the arms are substantially perpendicular to the central bar, and the extendable portions are extended to their maximum capacity;

Figure 6A is a schematic plan view of the spirit level of Figure 5, in the aforementioned configuration;

Figure 6B is a schematic side-view of the spirit level of Figure 5, in the aforementioned configuration;

Figure 6C is a schematic end view of the spirit level of Figure 5, in the aforementioned configuration;

Figure 7 is a schematic diagram showing a close up of the top view of a pair of hinges located at either end of the central bar of a spirit level according to an exemplary embodiment of the present invention, in any of the aforementioned configurations; and

Figure 8 is an isometric schematic diagram of a spirit level according to an exemplary embodiment of the present invention, in a further, optional, configuration.

[0019] Referring to Figure 1, 2B and 6B of the drawings, a spirit level according to an exemplary embodiment of the present invention comprises a central bar 1, which may comprise a top, two sides, two ends and a base. In the example shown in the drawings the top and base are of an equal width which is less than the width of the sides, but the invention is not necessarily intended to be limited to this particular shape. In one exemplary embodiment there may be included within a recess 3 along the length of the central bar, an elongate bulb 2 which may be filled with a liquid and a gas bubble, the recess 3 providing for the user a line of sight to the elongate bulb 2 such that a reading or measurement may be taken. The elongate bulbs 2 may have on them, markings such that a user can determined if the surface on which the device is level (horizontal) or plumb (vertical) according to the location of a bubble therein relative to the markings.

[0020] In one exemplary embodiment of the present invention the central bar may house two such elongate bulbs 2 in recesses 3, one to be viewed from above and one to be viewed from the side. Each bulb 2 contains liquid and a bubble such that when viewed, a user can determine which way is down. The bulb 2 on the side of the central bar 1 may be able to give an indication of the vertical incline of the surface, while the bulb 2 on the top of the central bar 1 may give a reading of the horizontal flatness along the direction defined by the length of the bar.

[0021] Referring to Figures 1 and 2A, at each end of the central bar 1, there is provided a respective pair of arm members 6 attached to the central bar 1 by means of hinges 5. Each hinge 5 may be positioned such that it extends out of the side of the arm 6 facing the central bar 1, such that when the arm members 6 are in a first configuration, the ends of each arm member are able to lie flush against each other and extend substantially perpendicular to the central bar 1 such that, in the first configuration illustrated, each pair of arm members 6 defined a single perpendicular arm across a respective end of the central bar 1 and, together, the central bar 1 and the two pairs of arm members 6 define a generally H-shaped structure.

[0022] Referring to Figure 1 and 2C, each arm member 6 is provided with an extension member 9 of generally U-shaped cross-section, which is slidably mounted over the lower edge of a respective arm member 6. Each extension member 9 includes a protrusion 8, which may be generally T-shaped, which is mounted within an elongate recess of slot 9A in the side wall of the extension member 9

[0023] The protrusion 8, in this exemplary embodiment, is generally T-shaped, oriented with

the narrow end attached to the arm 6, and constructed such that the 'bar' of the 'T' is wider than the width of the slot such that the extension member 9 may not slip off.

[0024] In the aforementioned first configuration, the extension member 9 is fully retracted and its entire length rests against the arm member 6. However, in a second configuration (as shown in Figure 5 of the drawings) the extension member 9 can be slidably and longitudinally extended beyond the distal end of the respective arm member 6 (as the edges of the slot 9A slide over the protrusion 8) to effectively extend the length.

[0025] Referring to Figure 3, the spirit level is illustrated in a second configuration, in which the arm members 6 have been folded in to meet the central bar 1. Referring to Figure 1, there may be provided along the length of the side of the central bar 1, at least two magnets 4, positioned such that they line up with corresponding magnets 7 on the inner side of the arm members 6. If an arm member 6 is pushed in toward the central bar 1 and the magnets 4 in order to move it into a second configuration, the corresponding magnets 7 on the respective arm member 6 will interact such that the arm member 6 is effectively pulled in toward the central bar 1, until an opposing (manual) force pulls the arm member 6 out again. This has the effect of locking the arm members 6 into the second configuration, without providing too much resistance that a user will not be able to pull them out again. Thus, the arm members 6 cannot swing out and cause damage, and the risk of damage thereto is consequently reduced.

[0026] Referring to Figure 5, 6A and 6C, the spirit level is illustrated in a second configuration, in which the extension members 9 are fully extended. When in this configuration, the extension members 9 have the effect of providing further stability to the device by increasing the "resting" surface area. Since in this configuration the invention is covering a larger area of the surface needing to be measured, it can provide a more general reading of the entire surface.

[0027] In one exemplary embodiment, referring to Figures 1, 3 or 5 of the drawings, the invention may comprise at least six elongate bulbs 2, the first of which may be located within a recess 3 on the top surface of the central bar 1 as described above and oriented such that the elongate bulb 2 lies parallel to the longitudinal axis of the central bar 1. A second elongate bulb 2 may be located substantially centrally along the length and width of the central bar and oriented such that it lies perpendicular to the longitudinal axis of the central bar 1, furthermore there may be recesses on both sides of the central bar such that the second bulb 2 may be viewed from either side. As described above, the user may use the device to make a determination of the level (horizontal) or plumb (vertical) of the surface on which the device is resting in two directions, namely, vertically and laterally.

[0028] Still referring to Figures 1, 3 or 5, the other four elongate bulbs 2 may be located in recesses 3 situated near the distal end of each arm member 6, i.e. the end furthest from the hinges 5. These elongate bulbs 2 may be oriented such that they lie parallel with the longitudinal axis of the respective arm member 6. In said first or third configuration, as shown in figures 1 and 5 respectively, these elongate bulbs are such that they are perpendicular to both the bulbs located within the central bar. This enables a user to make a determination of

inclination in three perpendicular directions, one vertical and two horizontal.

[0029] Referring to Figure 3, 4A, 4B and 4C of the drawings, in a second configuration the arm members 6 of the invention and the extension members 9 of the spirit level are retracted and folded in fully, thereby making it easier to pack away into, for example, a tool box or a car. In one exemplary embodiment there may be provided a protective case for the invention, helping to protect the invention from impacts or scratches and, therefore, extending its lifetime.

[0030] Referring only to Figure 3, there is provided a serrated surface 10 on the end of each arm member 6 (closest to the hinge 5). The serrated surfaces 10 at adjacent ends of the arm members 6 correspond such that when the spirit level is in a first or second configuration, they interlock, thereby providing a substantial amount of friction and ensuring that the two adjacent arm members 6 do not move relative to each other. This is advantageous in that it enables a more accurate determination of inclination of a surface to be made.

[0031] The hinges themselves may be of a shape which provides support to the structure in certain configurations. Referring to Figure 7 there is shown a close up of the hinges 5 as viewed from above. They may comprise a cuboidal main body, with a semi-cylindrical portion made up from the alternating knuckles, which has a hole through the geometric centre of the semi-cylinder which may accommodate a screw, pin or other fastening piece. These semi-cylindrical portions are the pivot points of the hinges 5 and are oriented such that they face the end of the central bar 1. In between the end of the central bar 1 and the hinges 5 there may be a stopper 11 made from a hard material, such as a rigid plastic, which follows the same shape of the cylindrical shaped portion of both adjacent hinges, and is flat in between. This acts as a barrier for the arm members 6, providing extra resistance such that the arms 6 may not fold out any further than the stopper 11 allows. This ensures the arm members 6 are substantially parallel to each other and substantially perpendicular to the central bar 1 at maximum extension.

[0032] When the arm members 6 are in a configuration as portrayed in Figure 7, there may be a gap between the two adjacent sides of the hinges 5. This gap may extend part way down the length of each hinge 5 and all the way down its depth. This allows the inner corners of the hinges 5 to be able to move past each other without collision, collisions may result in damage to the invention or inability to move the invention between two different configurations. The arm member 6 has a width of substantially enough such that when the arms are in a second configuration (as shown is Figure 3), the arm lies flush against the central bar 1, and the hinge 5 lies flush against the end of the central bar. Distances marked with an 'x' are equal.

[0033] Optionally, and referring to Figure 8 of the drawings the arm members 6 of the spirit level may be folded out at other angles to the central bar, e.g. 45 degrees, thereby defining further configurations to suit the needs of the user. They may also be folded out at different angles to each other, providing the user with many options and increasing the number of different situations in which it can be effectively and conveniently used.

[0034] From the description laid out above it will be apparent to someone skilled in that art that variations and adaptations can be made to the described embodiments without departing from the scope of the invention as defined in the appended claims.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP1630522A [0002]
- FR2538539A1 [0004]
- GB2470239A [0004]

PATENTKRAV

1. Et vaterpas omfattende en generelt midterplaceret langstrakt stang (1) og to par
armelementer (6), hvor hvert par er drejeligt koblet til hver sin ende af nævnte stang (1) til
bevægelse mellem en første, udfoldet, generelt H-formet konfiguration, i hvilken nævnte
5 armelementer (6) strækker sig ud fra nævnte ende af nævnte stang i en vinkel i forhold til
denne, og en anden foldet konfiguration, i hvilken en sidevæg af hvert af nævnte armelementer
(6) i det væsentligste er parallel med og placeret op ad eller ved siden af en sidekant af nævnte
midterstang (1), hvori mindst ét rør (2) indeholdende en boble er anbragt i eller på nævnte
midterstang (1) og orienteret i det væsentligste parallelt med dens længdeakse, og mindst ét rør
10 (2) indeholdende en boble er anbragt i eller på et af nævnte armelementer (6) og orienteret i det
væsentligste parallelt med længdeaksen af det tilsvarende armelement, hvori hvert armelement
(6) omfatter en distal ende og en proximal ende og er drejeligt koblet ved sin respektive
proximale ende til en ende af nævnte midterstang (1), så de kan drejes hen imod og bort fra de
tilsvarende overfor liggende langsgående sidekanter af nævnte midterstang (1).

15

2. Et vaterpas i overensstemmelse med Krav 1, hvori et eller flere af nævnte armelementer (6)
omfatter et tilsvarende forlængelseselement (9), monteret til bevægelse i forhold dertil mellem
en første, optrukket, stilling og en anden, udfoldet, stilling, hvori den udgør en forlængelse af
længden af nævnte pågældende armelement (6).

20

3. Et vaterpas i overensstemmelse med Krav 2, hvori nævnte forlængelseselement (9) er
forskydeligt monteret på et tilsvarende armelement (6) til langsgående forskydningsbevægelse i
forhold dertil, mellem nævnte første og anden stilling.

25 4. Et vaterpas i overensstemmelse med Krav 3, hvori nævnte forlængelseselement (9) omfatter
en langstrakt langsgående slids (9A), ved hjælp af hvilken nævnte forlængelseselement (9) er
monteret på et fremspring (8) anbragt på nævnte respektive armelement (6), hvori nævnte
forskydningsbevægelse udføres ved brug ved at forskyde en sidekant af nævnte slids (9A)
langsgående over nævnte fremspring (8).

30

5. Et vaterpas i overensstemmelse med et hvilket som helst af de foregående krav, hvori hvert armelement (6) er monteret på en tilsvarende ende af nævnte midterstang (1) ved hjælp af et hængselselement (5).

5 6. Et vaterpas i overensstemmelse med Krav 5, hvori nævnte hængselselement (5) i det væsentligste er terningformet med en halvcylindrisk del, hvor nævnte halvcylindriske del omfatter et hul igennem hængslets (5) dybde til optagelse af et fastgørelsesmiddel.

10 7. Et vaterpas i overensstemmelse med et hvilket som helst af de foregående krav, hvori nævnte armelementer (6) er koblet til den pågældende ende af nævnte midterstang (1) således, at de i det væsentligste ligger plant imod nævnte midterstang (1), når de er i nævnte anden konfiguration, og i det væsentligste vinkelret i forhold til den langsgående akse af midterstangen (1), når de er i nævnte første konfiguration.

15 8. Et vaterpas i overensstemmelse med et hvilket som helst af de foregående krav omfattende et udløsbart fastholdelsesmiddel til udløsbart at kunne holde nævnte armelementer (6) i nævnte anden konfiguration.

20 9. Et vaterpas i overensstemmelse med Krav 8, hvori nævnte udløsbare fastholdelsesmiddel omfatter en første magnetisk del (4) anbragt på en sidekant af nævnte midterstang (1) og en anden magnetisk del (7) anbragt på et armelement (6) på nævnte sidekant anbragt imod eller ved siden af nævnte sidekant af nævnte midterstang (1), når den er i nævnte anden konfiguration.

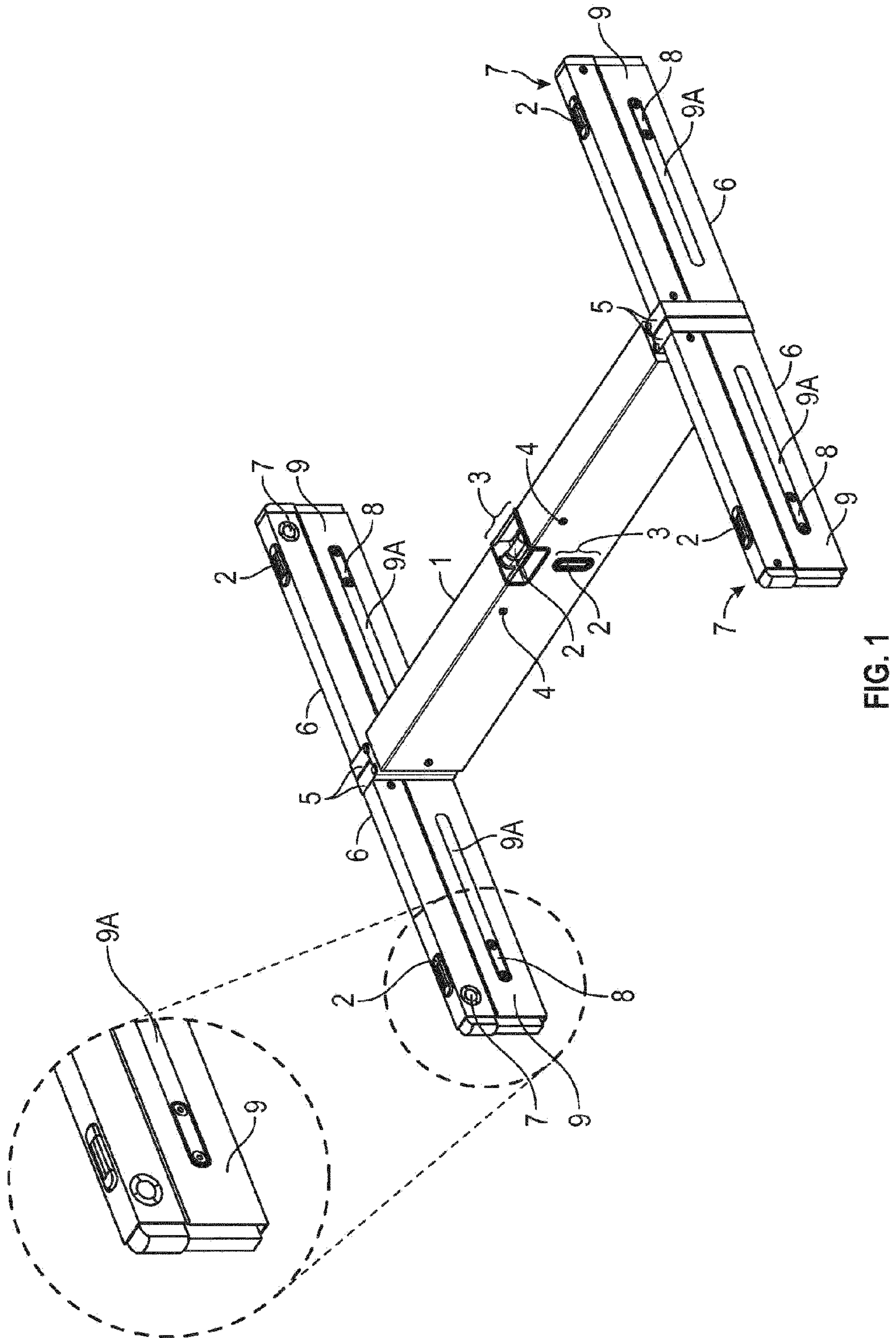
25 10. Et vaterpas i overensstemmelse med et hvilket som helst af de foregående krav, hvori i nævnte første konfiguration de proximale ender af hvert af et par af armelementer (6) i det væsentligste ligger i plan med hinanden.

11. Et vaterpas i overensstemmelse med Krav 10, hvori nævnte proximale ender af det ene eller begge par armelementer (6) er anbragt med en friktionsoverflade (10), som gør det muligt for de nævnte proximale ender at gribe ind i hinanden i et friktionsindgreb, når nævnte armelementer (6) er i nævnte første konfiguration.

5

12. Et vaterpas i overensstemmelse med Krav 11, hvori nævnte friktionsoverflade (10) omfatter en savtakket overflade (10).

DRAWINGS



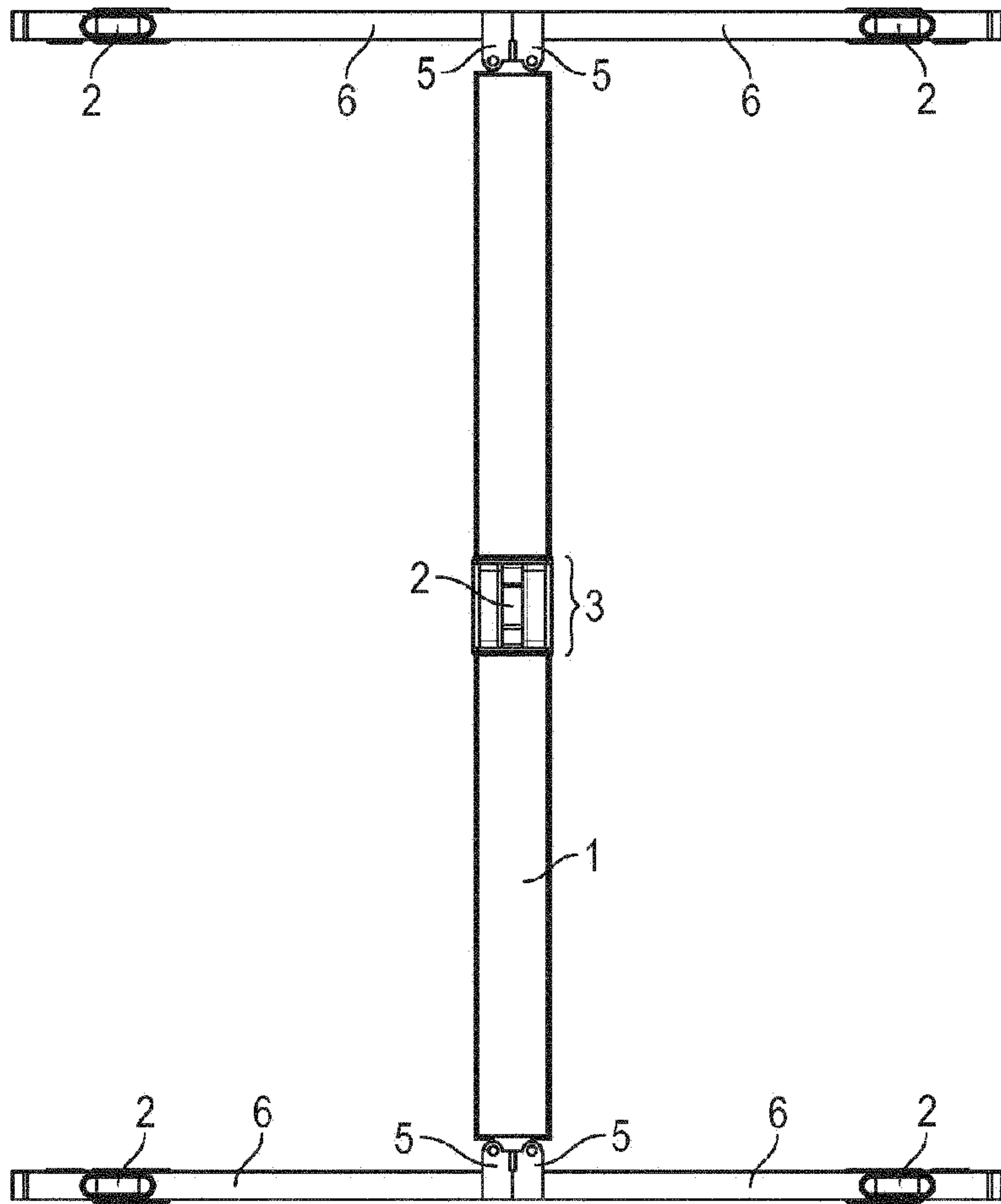


FIG. 2A

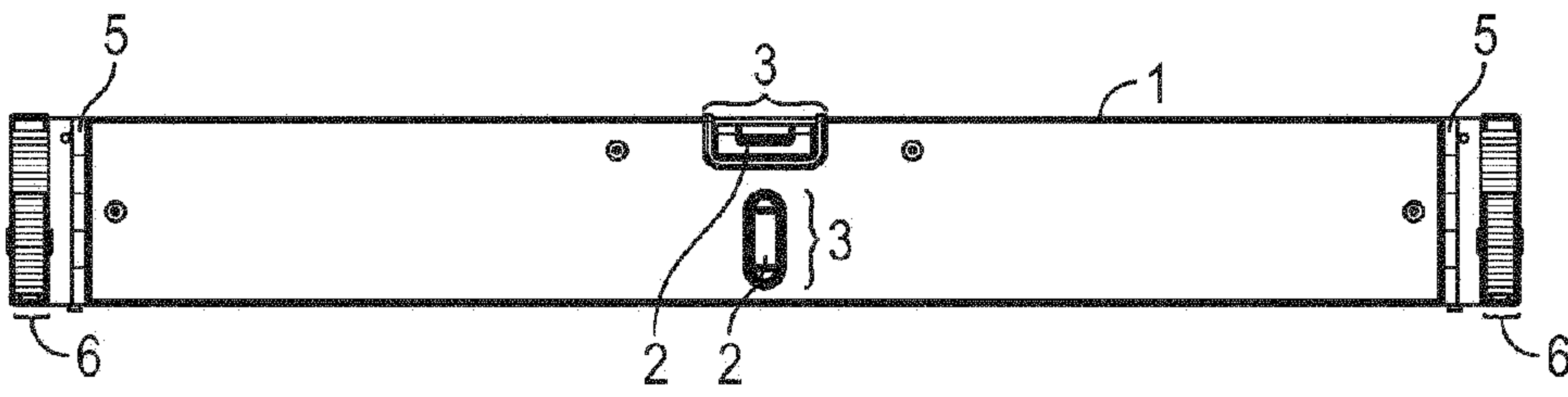


FIG. 2B

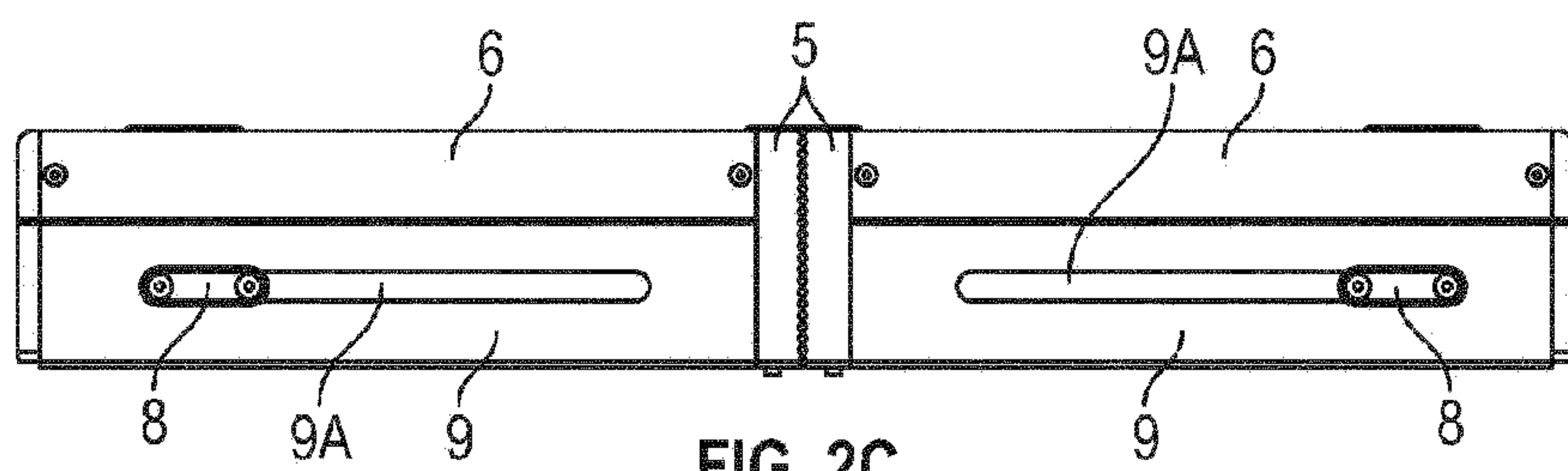


FIG. 2C

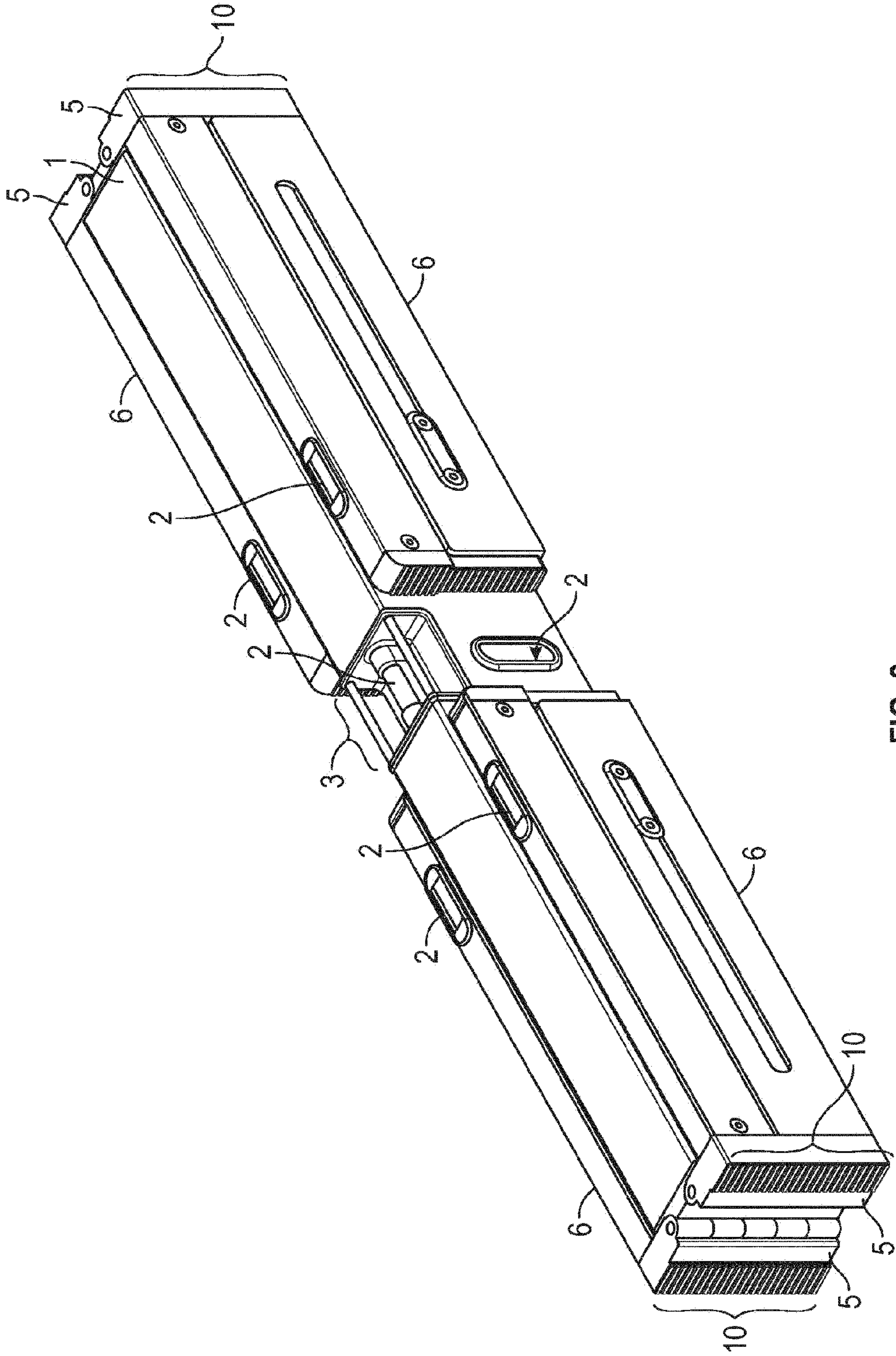


FIG. 3

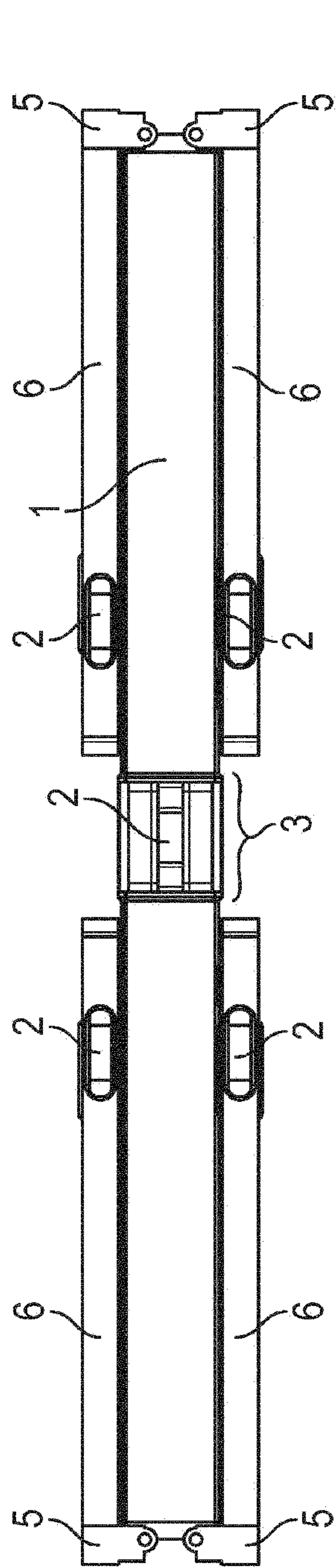


FIG. 4A

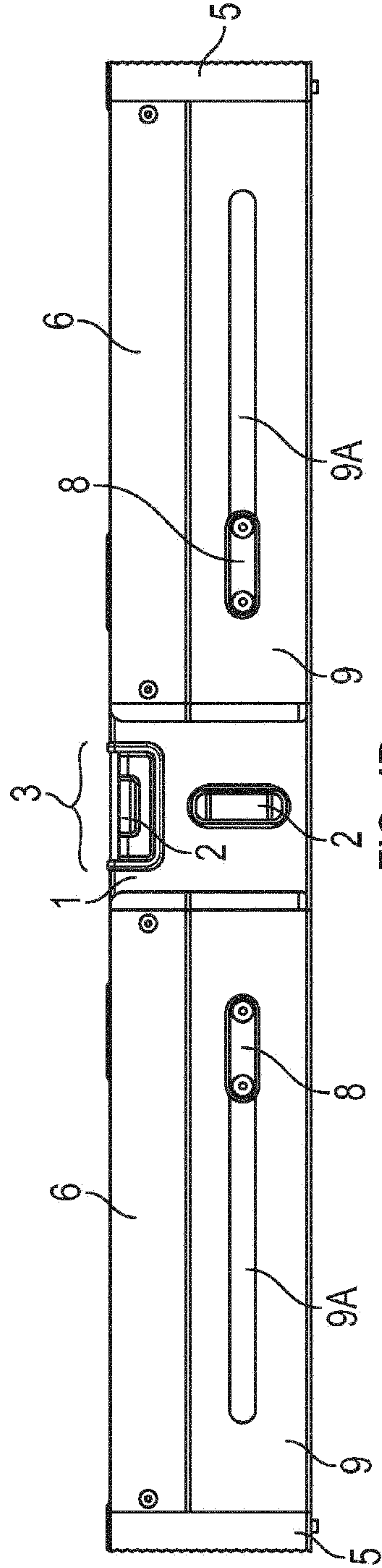


FIG. 4B

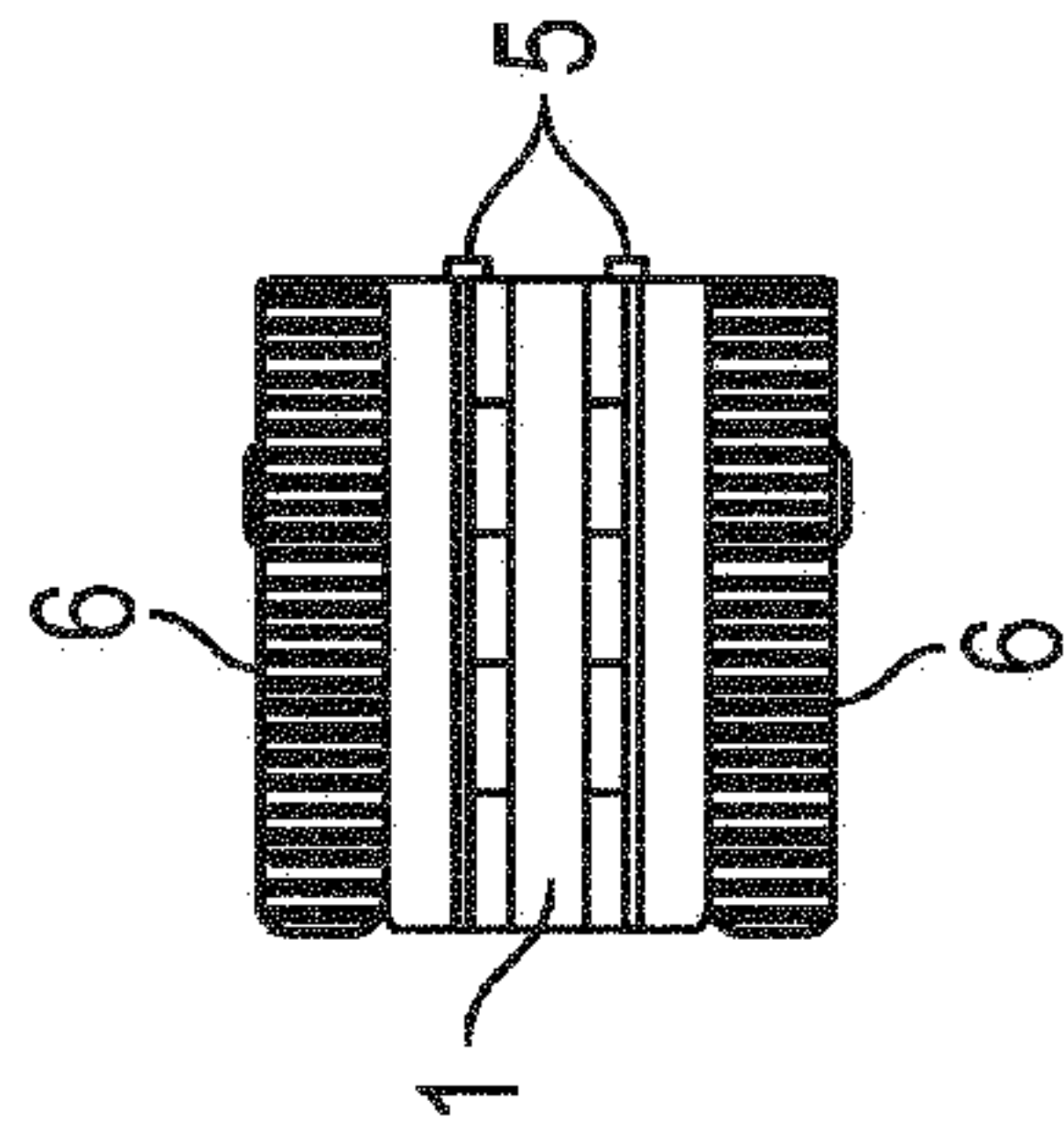
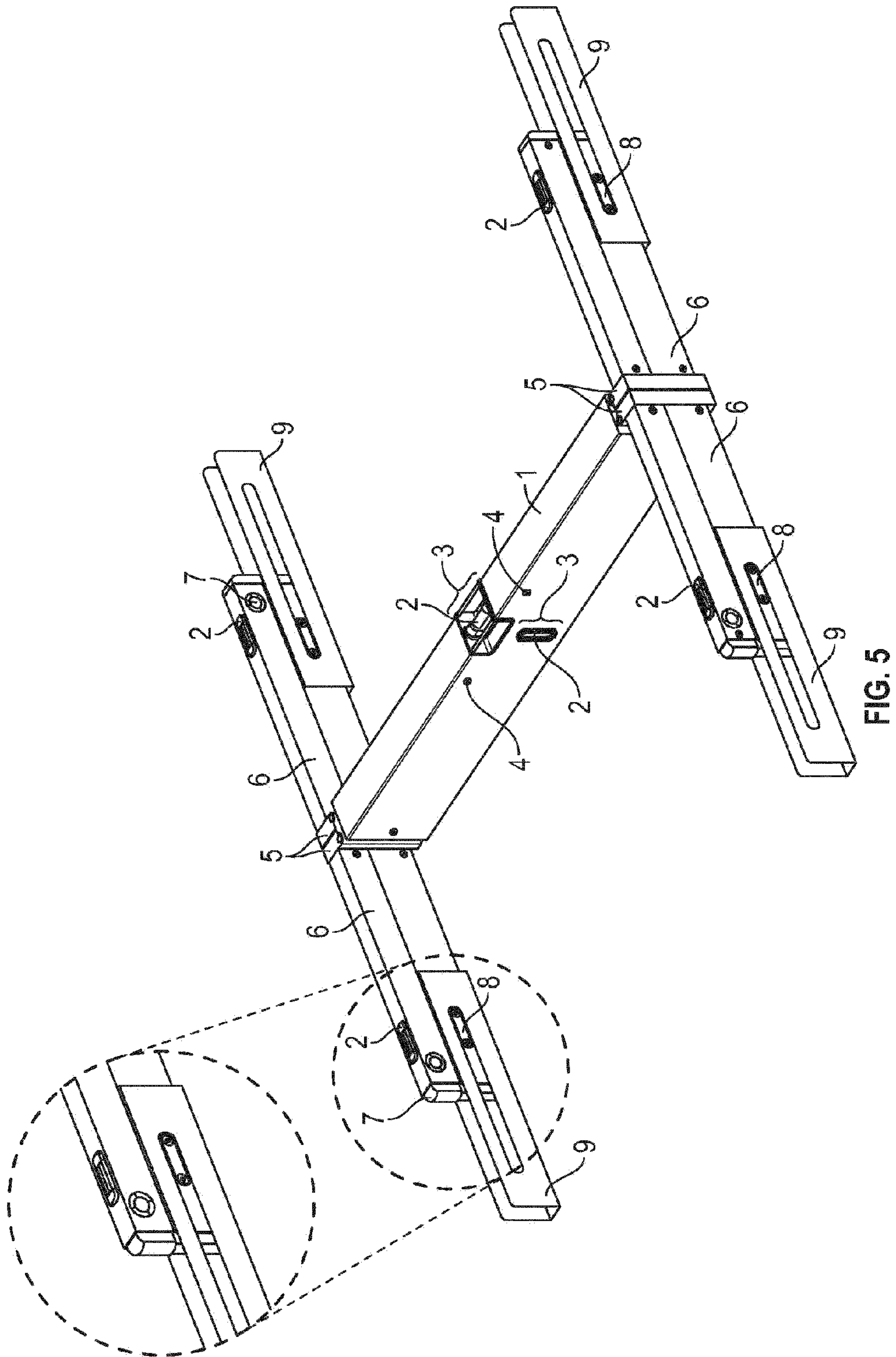


FIG. 4C



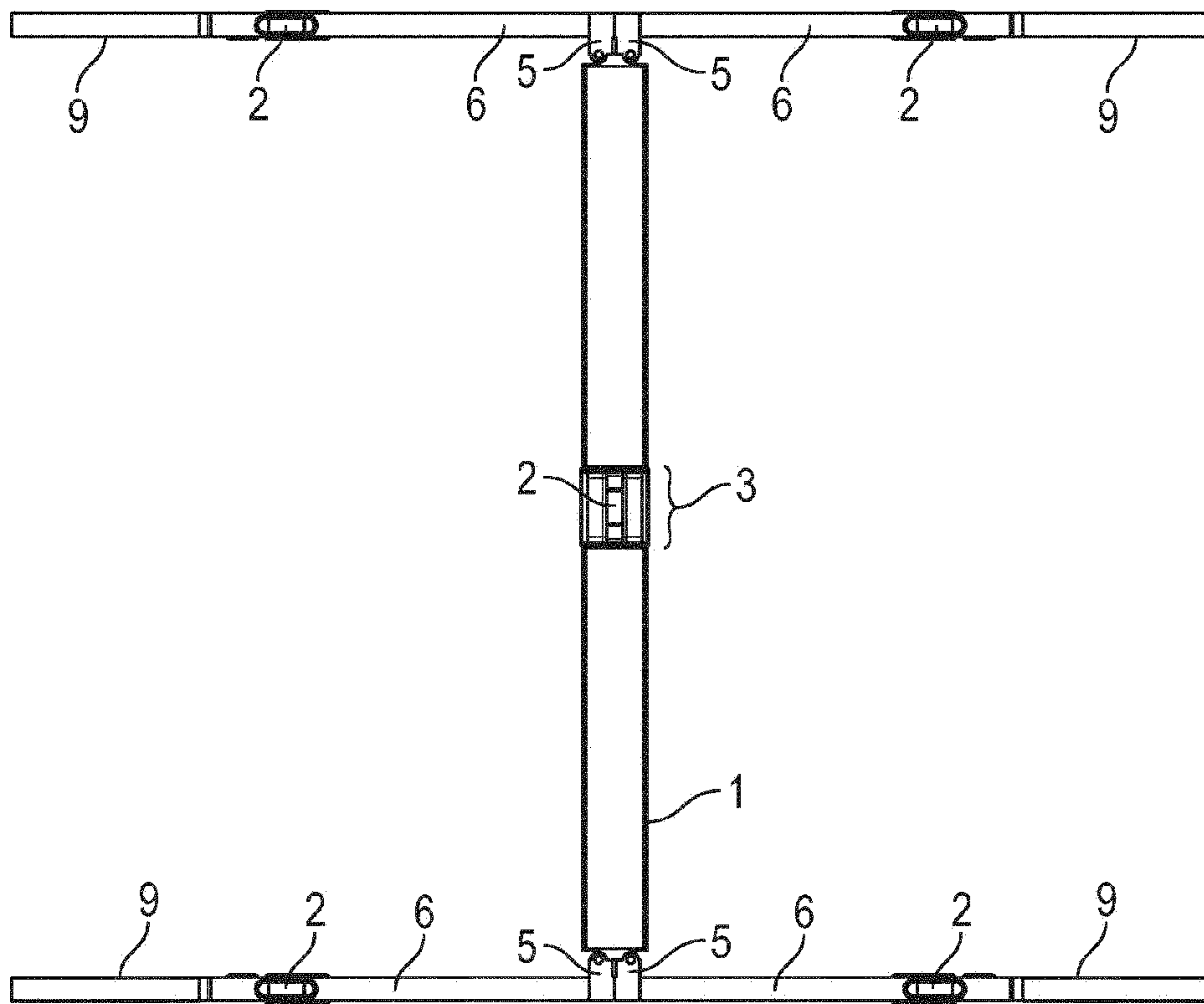


FIG. 6A

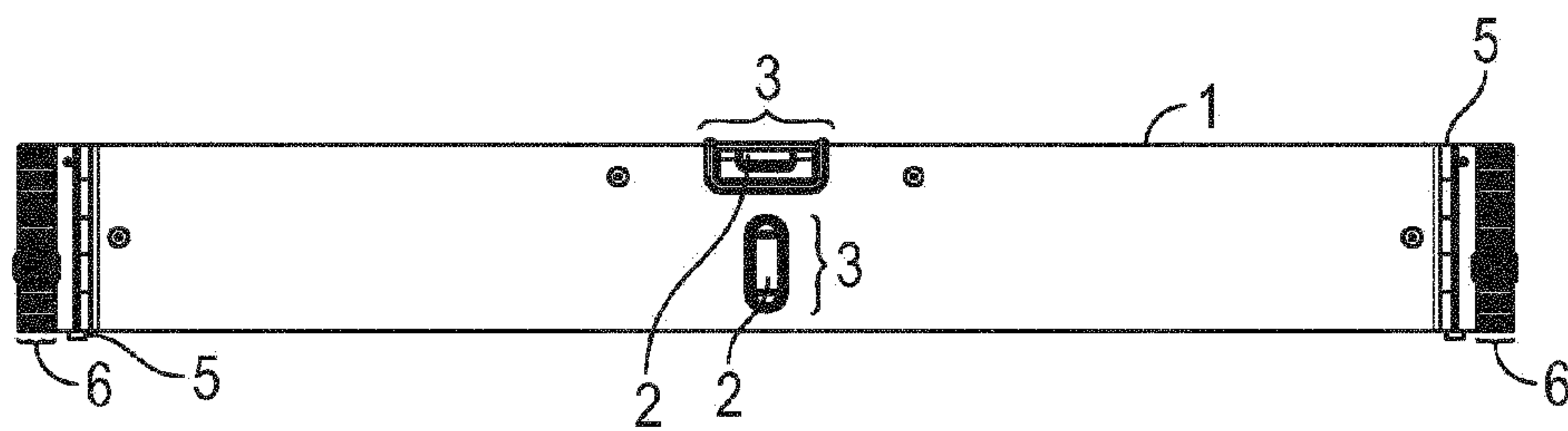


FIG. 6B

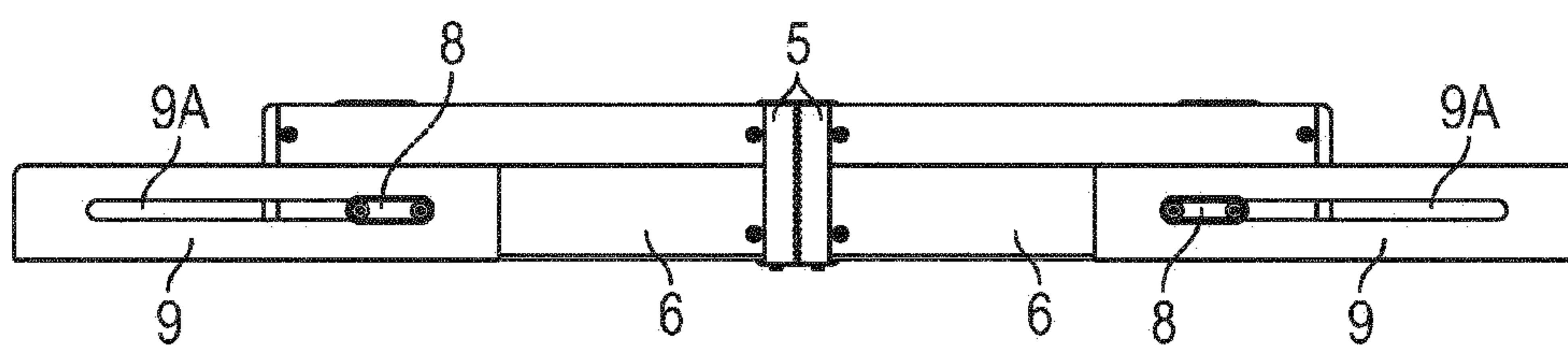


FIG. 6C

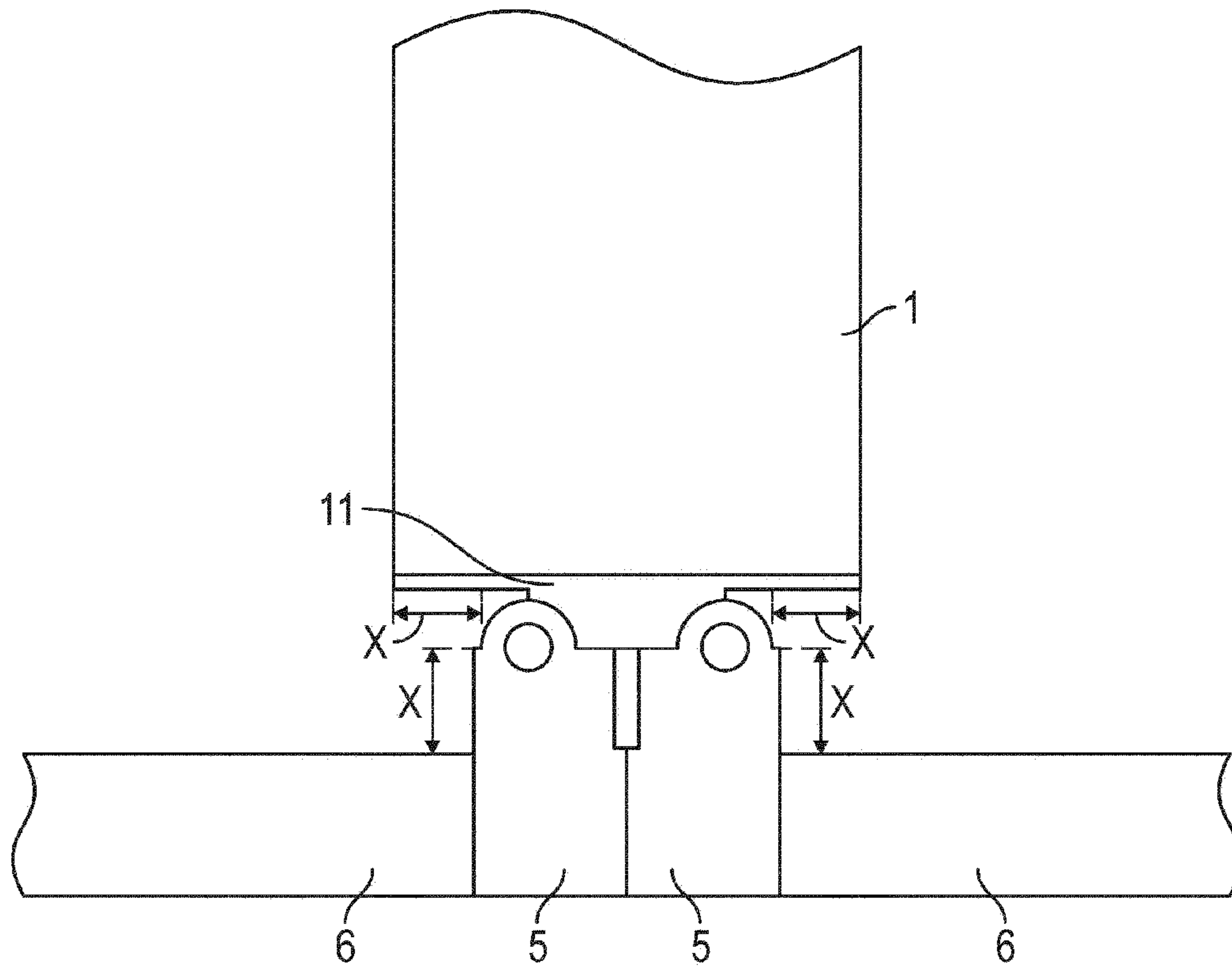


FIG. 7

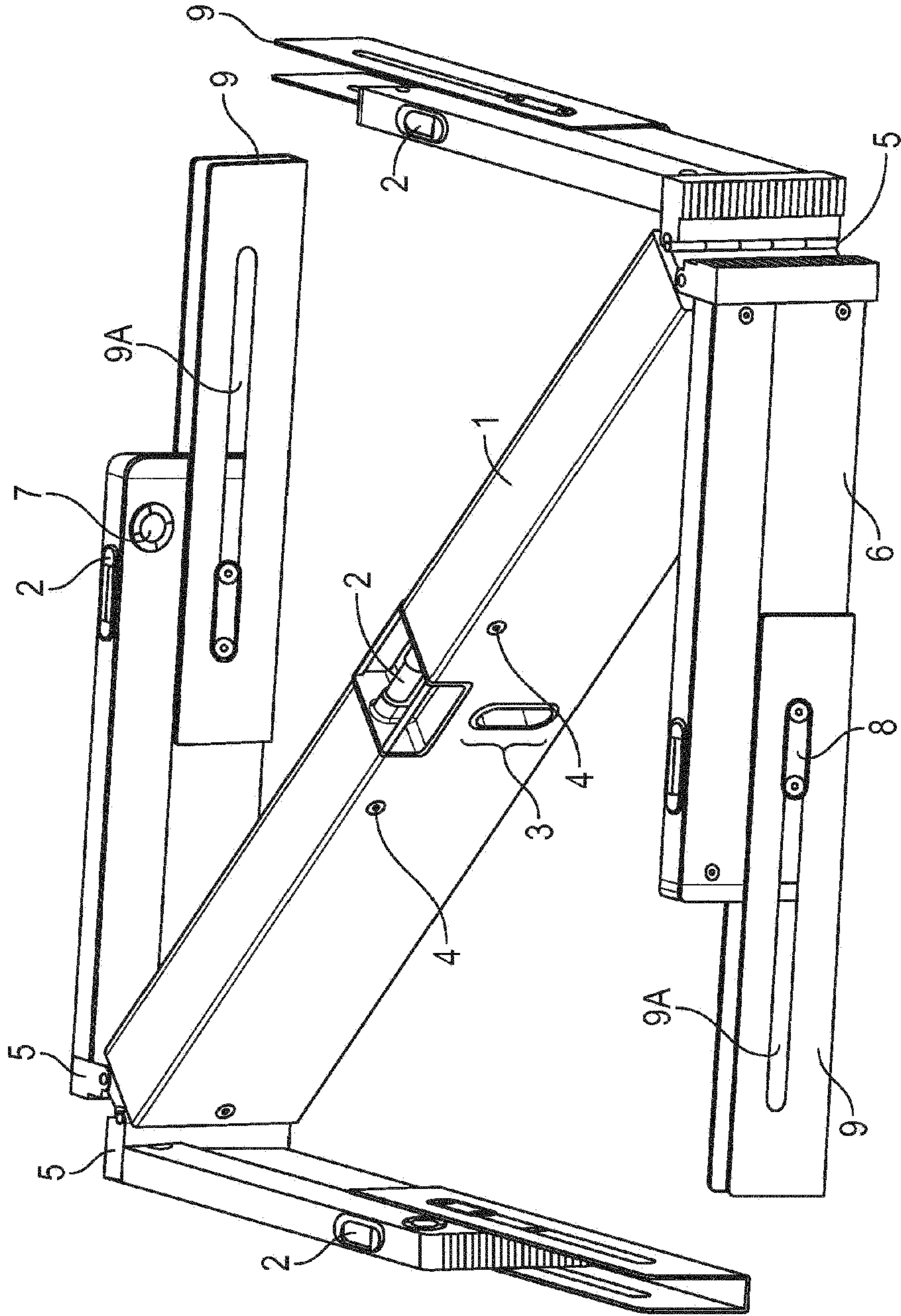


FIG. 8