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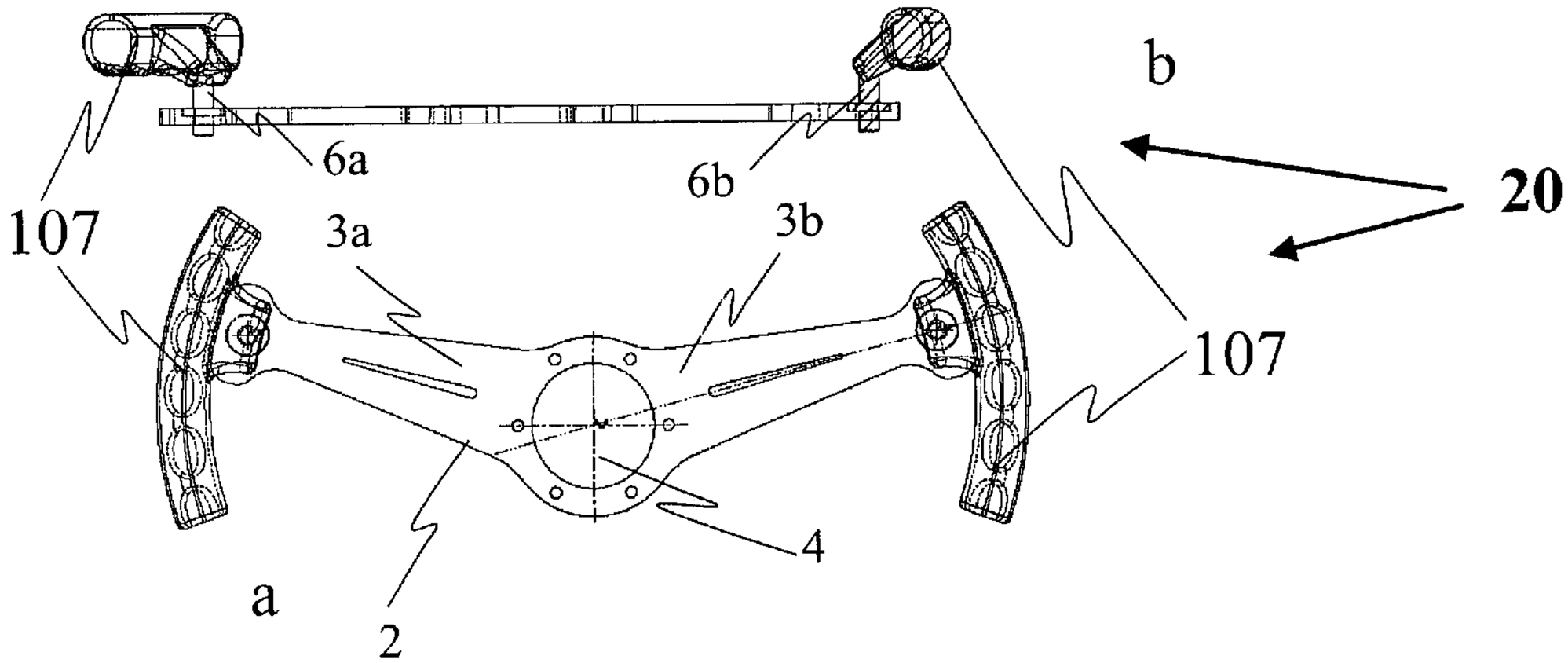

(57) Abrégé/Abstract:
The invention discloses a steering device (1, 20, 30, 40, 50) comprising a support structure (2) having a central hole (4) and at least two handgrips (7, 107, 207, 307), at least one of these being mobile, placed in distal positions compared to the central hole (4) and tied to the support structure (2) by means of pivots (6). The mobile handgrip (7, 107, 207, 307) is rotatable around an axis substantially orthogonal to the plane of the support structure (2), so as to manually apply thereto a rotating motion around the axis of the column.

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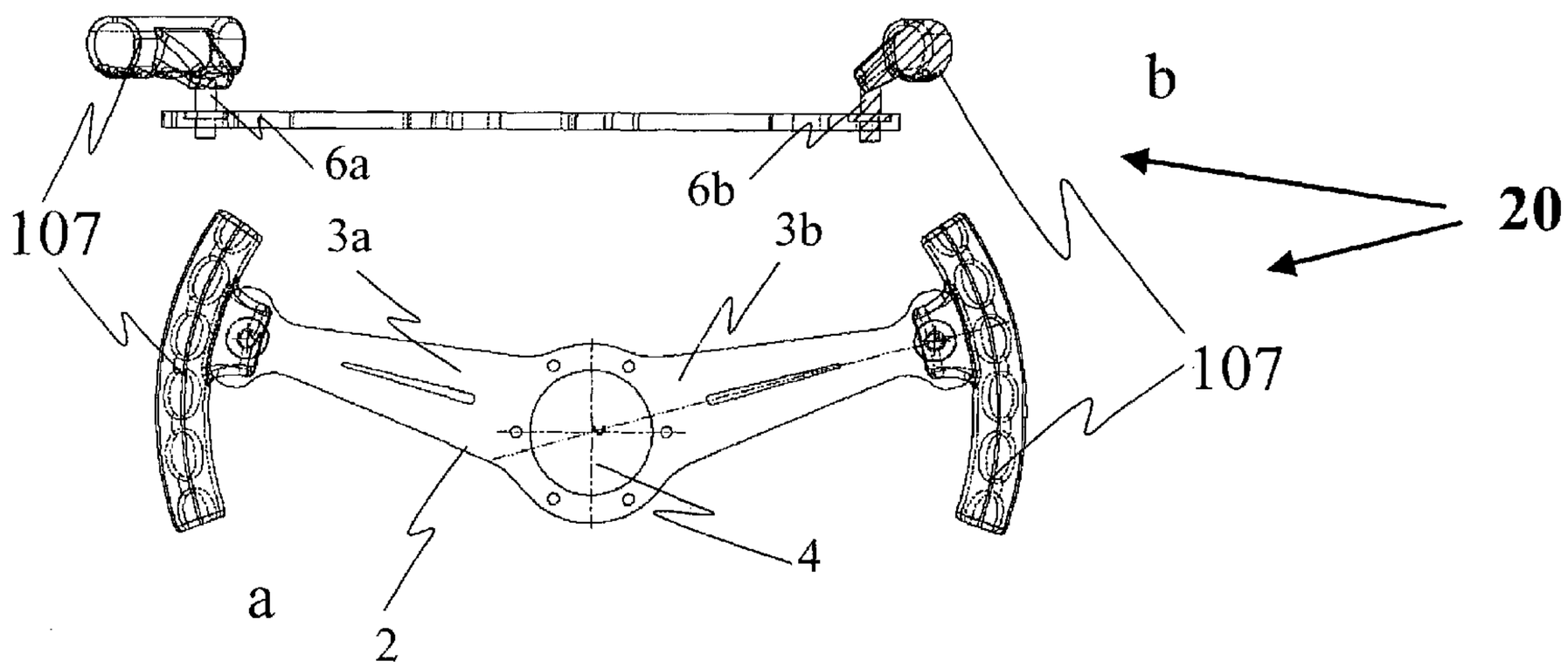
(54) **Title:** STEERING DEVICE



(57) **Abstract:** The invention discloses a steering device (1, 20, 30, 40, 50) comprising a support structure (2) having a central hole (4) and at least two handgrips (7, 107, 207, 307), at least one of these being mobile, placed in distal positions compared to the central hole (4) and tied to the support structure (2) by means of pivots (6). The mobile handgrip (7, 107, 207, 307) is rotatable around an axis substantially orthogonal to the plane of the support structure (2), so as to manually apply thereto a rotating motion around the axis of the column.

A1 WO 2007/043072

Title STEERING DEVICE

DESCRIPTION

The invention discloses a steering device particularly usable, but not exclusively, for motor vehicles and the following description has been made referring to this field of application only with the purpose to make the description easier.

However, the device is usable also for trolley vehicles, farm machinery, public works vehicles, motor boats, amphibious vehicles, and the like or for any vehicle allowing a movement even if not rectilinear.

As it is well known, starting from the first motor vehicles, the steering control has always been transmitted from a steering device, usually known as a "steering wheel" fixed on a central hub and connected, by means of a steering column, to steering mechanisms controlling the directioning position of the front wheels.

Over the years, the steering wheels have been modified and improved in design, ergonomics, adjustment etc.

Nowadays steering wheels exist which are adjustable in height and inclination, made of different materials, stronger and, at the same time, of lighter weight, steering wheels that are able to absorb shocks, thanks to modification to the steering column, or more simply, equipped with instantaneously inflatable cushions (called airbags) to protect the driver in case of collision.

The shape of the steering wheels has changed, in some cases, as for example in "Formula One", in which steering wheels of semicircular shaped and extractable from the driver have been used, to satisfy more restrictive space needs, during the driving and upon getting in and out of the vehicle.

The way in which the steering is controlled has not changed.

The steering control is applied by the driver of the vehicle to the steering wheel; safety rules and highway code require the driver to hold the steering wheel with both hands, while driving, in order to have a better control of the vehicle.

However, in particular driving conditions, for example in reverse motion, or in U-turn, it is uncomfortable to keep both hands onto the steering wheel; during reverse motion, the position of the driver is unnatural in comparison with the normal driving position, the driver being partially or totally turned backwards, thereby he tends to detach one hand from the steering wheel.

Moreover in case of elbow bends, sudden swerving, steering corrections, etc. it is also difficult to timely steer, the steering wheel having an intrinsic resistance against the rotation.

This last inconvenience is more evident under driving conditions already naturally extreme like in rallies, road races, track races or the like.

The need of avoiding frequently detaching the hands from the steering wheel, in event of bends, U-turns and reverse motion, causes the driver to accompany hands on the steering wheel, the rotation of the steering wheel as far as possible, leading to a torsion of the arms in the direction of the steering. This fact results in a continuous stress on the muscles of the arms increasing in time and in proportion to non rectilinear paths.

In JP 11 342849 A to Honda Motor Co Ltd the ARH, opposite to the direction of rotation, suffers for the same continuous stress during a rotation of the steering wheel.

Moreover, the aforementioned stresses are a not negligible problem for drivers unskilled or poorly inclined to the driving.

Under extreme driving conditions, as rallies, road races, or track races, the crosswire acceleration acting during bends amplifies even more the stresses acting on the arms and on the shoulders making it necessary a high physical effort to drive the vehicle.

The purpose of the present invention is to provide a steering device having structural and functional features to overcome the above described drawbacks.

A particular purpose of the present invention is thus to guarantee greater driving safety, to reduce the effort needed for the steering control and to reduce the stress on the arms and the shoulders during the steering.

These purposes are achieved by means a steering device comprising a support structure fixed on a steering column by means of a central hub and rotatable with the steering column to operate control mechanisms for the direction of the front wheels, characterised by comprising at least two handgrips, at least one of which being mobile, connected to the support structure, said at least one mobile handgrip being rotatable around an axis substantially orthogonal to the lying and rotating plane of the support structure so as to manually impart a rotating motion, around the steering column axis, to said support structure.

According to a preferred embodiment of the invention, the device comprises two mobile handgrips, fastened to said support structure in symmetrical positions with

respect to the mid-plane of the support structure, said handgrips being shaped for the normal grip by the two hands of the driver.

In one aspect, the present invention provides a steering device comprising: a support structure comprising a central hole for fixing said support structure onto a steering column, wherein said support structure is rotatable together with the steering column to operate steering mechanisms; two rotatable handgrips connected to said support structure and placed at distal positions with respect to the central hole, each of the two rotatable handgrips comprising: a pivot attached to the support structure and freely rotatable, in a range from 0° to 360°, around an axis substantially orthogonal to a lying and rotating plane of said support structure, a twist grip member configured essentially in a shape of a cylinder and for being gripped by a hand of a driver and to thereby impart a rotation motion around an axis of the steering column to the support structure, the twist grip member comprising a first end and a second end, wherein said first end is rotatably associated to the pivot and said second end is a free end which linearly extends along an axis of the cylinder in a plane parallel to the lying and rotating plane of said support structure, wherein said support structure further comprises a number of peripheral holes arranged around said central hole.

In a further aspect, the present invention provides a steering device comprising a support structure comprising a central hole for fixing said support structure onto a steering column, wherein said support structure is rotatable together with the steering column to operate steering mechanisms; two rotatable handgrips connected to said support structure and placed at distal positions with respect to the central hole, each of the two rotatable handgrips freely rotatable, in a range from 0° to 360°, around an axis substantially orthogonal to a lying and rotating plane of said support structure, each of the two rotatable handgrips comprising a first handgrip end segment, a second handgrip end segment which is a free end, and a third handgrip segment, the first handgrip end segment and the second handgrip end segment lying in respective end segment planes which are spaced apart and parallel to the lying and rotating plane of said support structure, the third handgrip segment being connected between the first handgrip end segment and the second handgrip end segment, the third handgrip end segment extending in a direction parallel to the pivot axis, the second handgrip end segment having an essentially cantilever cylindrical shape and being configured to be

gripped by a hand of a driver and to thereby manually impart a rotation motion around an axis of the steering column to the support structure, wherein said support structure further comprises a number of peripheral holes arranged around said central hole.

The features and the advantages of the invention will be clear from the following description of an example of realization given in a indicative and non limitative way referring to the attached drawings.

- Figure 1 a is a plan view from above of a basic embodiment of a steering device according to the present invention, in a first operating position.
- Figures 1b and 1c are side views of the device of Figure 1a, seen according to arrows, and Figure 1d is a partial perspective view of the device of Figure 1a.
- Figure 2a is a plan view from above of the basic embodiment of steering device according to the present invention, in a second operating position.
- Figures 2b and 2c are side views of the device of Figure 2a, seen according to arrows, and Figure 1d is a partial perspective view of the device of Figure 2a.
- Figure 3 a is a plan view from above of the second embodiment of a steering device, according to the present invention, in a first operating position and Figure 3b is a side view of the device of Figure 3a, seen according to the arrow.
- Figure 4a is a plan view from above of the second embodiment of steering device according to the present invention, in a second operating position and Figure 4b is a side view of the device of Figure 4a, seen according to the arrow.
- Figure 5a is a plan view from above of a third embodiment of a steering device according to the present invention, in a first operating position.
- Figures 5b and 5c are side views of the device of Figure 5a, seen according to arrows, and Figure 5d is a partial perspective view of the device of Figure 5a.
- Figure 6a is a plan view from above of the third embodiment of steering device according to the present invention, in a second operating position.
- Figures 6b and 6c are side views of the device of Figure 6a, seen according to arrows, and Figure 6d is a partial perspective view of the device of Figure 6a.
- Figure 7a is a plan view from above of a fourth embodiment of a steering device according to the present invention.
- Figures 7b and 7c are side views of the device of the figure 7a, seen according to arrows, and Figure 7d is a partial perspective view of the device of Figure 7a.

- Figure 8a is a plan view from above of a fifth embodiment of a steering device according to the present invention.
- Figures 8b and 8c are side views of the device of Figure 8a, seen according to arrows, and Figure 8d is a partial perspective view of the device of Figure 8a.
- Figure 9 is a plan view from above of a spoke usable with a steering device of the preceeding figures.

In all the figures of the following description, and briefly described above, a steering device can be in a position that we define as "central", namely that allows the motion of the vehicle in a rectilinear direction, or in a position that we will define as "rotated", namely reached through a steering control.

Referring to the embodiment shown in Figures 1 (a, b, c and d), the steering device comprises a support structure 2 integrally built by two spokes 3a and 3b with a central hole 4 and a number of peripheral holes 4a arrange around the central hole 4, for the fastening on a steering column (not shown in the figure); all is shown in detail in Figures 1a, 1c and 1d.

The central hole 4 fits the steering column, permitting the fixing of the support structure 2 to the steering column itself; the latter is responsible of the transmission of the rotation of the steering device 1 to mechanisms controlling the change of the motion direction of the vehicle, by operating on directional members, such as wheels, tracks, rudders or the like.

Two pivots 6a, 6b are fastened at the ends of the spokes 3a, 3b, in distal positions with respect to the central hole 4, each pivot being rotatable around an axis perpendicular to the plane of the related spoke.

A handgrip 7a, 7b is secured at the free end of each pivot, it being substantially shaped as a twist grip, lying on a plane substantially perpendicular to the axis of the respective pivot 6a, 6b and consequently substantially parallel to the plane of the support structure 2.

Advantageously, according to the invention, the support structure 2 and the twist grips 7 are mechanically connected by means of the pivots 6a, 6b, but are not tied to each other in their respective rotations, being able to rotate on two parallel planes respectively around the steering column and the axes of the pivots 6a, 6b, and being fixed to the support structure in symmetrical positions with respect to the mid-plane A-A.

That means that while the support structure 2 is rotated by a certain angle around

the axis of the steering column, the twist grips 7, although following the rotation of the support structure 2 around the column, are also themselves rotatable around the axes of the pivots 6a, 6b, by an angle different from the angle of the rotation of the support structure 2 around the axis of the steering column, as well therewith. Moreover, the two twist grips 7, being not tied in their respective rotations around the axes of the pivots 6a, 6b, can also be rotated by angles of amplitude different from each other.

In traditional steering wheels, if the support structure 2 rotates by an angle α around the steering column, the torsion angle of the arms used for the steering control has amplitude of the same angle α; as the arms reach the limit of their torsion capacity, they get asynchronously detached from the steering wheel to take the initial position again and complete the steering control action.

Advantageously, according to the invention, upon the steering device 1 is rotated by an angle α around the steering column, the torsion angle of the arms used for the steering control is near zero. The twist grips 7 can be rotated in an opposite direction with respect to the rotation of the support structure 2, thus balancing the torsion of the arms around the column, i.e. since the rotation of the support structure and the torsion of the arms are equal and opposite, the resultant force is zero.

Since the resultant of the rotations given to the structure 2 and to the handgrips 7 represents the work done by the arms and the shoulders for the control of the steering device 1, it is clear that the stresses applied to arms and shoulders shall be minimum or near to zero.

The steering control is mainly applied by means of the forearms, carrying out a work of negligible entity. Consequently, the steering is more convenient and also quicker both in everyday driving and in the particular case of driving under non conventional conditions, such as rallies, road races, track races or the like, where the steering readyness is a critical factor and the advantage of the use of the steering device according to the invention is even more evident.

As an alternative to the two mobile handgrips 7a, 7b, one can be non rotatably fixed to the support structure 2 while the handgrip symmetrical with respect to the median axis A-A, can be left freely rotatable.

Furthermore, the present invention allows the extraction of the twist grips 7 from the support structure 2, when the vehicle is stopped, to prevent an unauthorised use of the vehicle.

The support structure 2 may comprise more than one spokes; as an alternative, it can also be designed without the spokes 3, for example shaped as a disk extending from the central hole 4 for the fastening to the steering column.

In particular, the spokes 3 can be of the type shown in figure 9; in this case the angle between them is adjustable, because the spokes fit the hub or the steering column, by means of seats 120, in a position determined beforehand and not variable during the driving. The angle or the number of spokes complies with the particular safety and comfort requirements for the driver.

In view of the above, it is clear that for every vehicle that uses the steering device according to the present invention there are set better driving conditions. The safety is considerably increased; it is no longer necessary to detach the hands from the steering wheel during the steering, even during bends with short radius as those occurring, for example, in U-turns; arms and shoulders are no longer heavily stressed; the driving is more relaxed and the steering quicker; the possibility of removing the handgrips guarantees a reasonable safety against theft.

In the group of Figures 3a, 3b, 4a and 4b a second embodiment of the present invention is shown in two different operating positions in which, in order to identify parts equal or similar to those in the group of Figures 1a - 1d, the same reference numbers already used will be used again, and to indicate modified parts, reference numbers increased by 100 will be used.

In this embodiment, handgrips consist of two crown segments of a normal steering wheel, possibly having imprints for the abutment of the fingers. The steering device 20 can thus be grasped in a more comfortable way in comparison with the basic embodiment.

In the group of Figures 5a - 5d and 6a – 6d a third embodiment of the present invention is shown in two different operating positions, in which in order to, to identify parts equal or similar to those in the group of Figures 1a - 1d, the same reference numbers already used will be used, and to indicate modified parts, reference numbers increased by 200 will be used.

In this embodiment, handgrips are made of two reversed "cow horns" 207 possibly having imprints for the abutment of the fingers.

In particular, in the Figures 5a, 5b, the pivot 6a, 6b is preferably fixed in an adjustable position within a slot 210 of it's the corresponding spoke 3a, 3b; as an alternative, the slot can be formed on the handgrip 207; this permits the placing of the handgrips following the shape of one of the two slots and considering the particular needs of the driver.

The said slots can be present also in the other embodiments of the present invention.

In the group of Figures 7a - 7d a fourth embodiment of the present invention is shown, in which to identify parts equal or similar to those in the group of Figures 1a - 1d, the same reference numbers already used will be used, and to indicate modified parts, reference numbers increased by 300 will be used.

In Figures 7a –7d a steering device 40 is shown, in different views, in a central position with handgrips 307 of the reversed "cow horns" type; in this embodiment, the steering device 40 has two crown segments, the first one 11 upwardly and the second on 12 downwardly.

The two segments are fixed to the hub by means of respective spokes 13 and 14 and rotate therewith owing to a steering control applied to the steering device 40.

In this embodiment, the driver can take advantage of the shape of a traditional steering wheel for abutting his hands during long rectilinear ways.

As it can be easily understood from the figures, the rotation of the handgrips is neither hindered nor conditioned by the two crown segments 11 and 12; thus, their presence has an aesthetic effect helpful to make the new steering wheel looking more conventional and less unconventional.

Obviously, in the solutions of Figures 7a –7d, the handgrips can be made with the shapes of the previous embodiments, in particular that of figure 5, thus maintaining the shape of the traditional steering wheel.

In the group of Figures 8a - 8d a fifth embodiment of the present invention is shown, in which to identify part equal or similar to those in the group of Figures 7a - 7d, the same reference numbers already used will be used and to indicate modified parts, reference numbers increased by 100 will be used.

In Figures 8a –8d a steering device 50 is shown, in different views, in a central position with handgrips 307of the reversed "cow horns" type; in this embodiment, the steering device 50 is provided with a lower segment of crown 112.

The segment is fixed to the hub by means of a spoke 114 and rotates therewith upon a steering control is applied to the steering device 50.

A very important feature of the present invention is that, as shown in Figures 8a-8d, it is possible to omit, at least partially or also totally, the crown of the traditional steering wheel, thus preventing to place the airbag for the driver not necessary on the steering wheel, but also on the dashboard in front of the driving position, namely using the same arrangement that, for example, is provided for the passenger.

Such a positioning of the airbag leads to the insertion, also after the purchase of a vehicle, of the steering device that is easy adaptable, by merely modifying or changing the hub assembled in the current production.

Furthermore, the visibility of the instrument system can be notably improved, to the advantage of the driving safety and comfort.

Finally, it also becomes easier to place on the steering wheel those commands that now are placed along the crown of the steering wheel (For example the gearbox control, the audio device control, etc.).

Obviously, the configuration of the steering device can be flat or of cup-shaped type, or of any other known type.

We claim:

1. A steering device comprising:

- a support structure comprising a central hole for fixing said support structure onto a steering column, wherein said support structure is rotatable together with the steering column to operate steering mechanisms;
- two rotatable handgrips connected to said support structure and placed at distal positions with respect to the central hole, each of the two rotatable handgrips comprising:

a pivot attached to the support structure and freely rotatable, in a range from 0° to 360°, around its axis substantially orthogonal to a lying and rotating plane of said support structure,

a twist grip member configured in a shape of a cylinder and for being gripped by a hand of a driver and to thereby impart a rotation motion around an axis of the steering column to the support structure, the twist grip member comprising a first end and a second end, wherein said first end is rotatably associated to the pivot and said second end is a free end which linearly extends along an axis of the cylinder in a plane parallel to the lying and rotating plane of said support structure,

wherein said support structure further comprises a number of peripheral holes arranged around said central hole.

2. The steering device according to claim 1, wherein said support structure comprises two spokes, each of said two spokes having a shape reducing its width toward its end, and wherein said two rotatable handgrips are rotatably associated to said support structure by means of pivots fixed to respective spokes of said support structure, and wherein each of said pivots is rotatable around their respective pivot axis.

3. The steering device according to claim 2, wherein said two spokes are angularly adjustable on said support structure.

4. The steering device according to claim 2, wherein said two rotatable handgrips are placed on said spokes in a distal position in comparison with the central hole.

5. The steering device according to claim 2, wherein each of said two spokes has a shape enlarged at its end, wherein each enlarged end comprises a slot, wherein pivots are fixed in an adjustable position within said slots so that said two rotatable handgrips can be arranged at least at a first angular position and at a second angular position.

6. The steering device, according to claim 5, in which said two rotatable handgrips are removably connected to said support structure.

7. The steering device according to claim 6, wherein said two rotatable handgrips are fixed to said support structure in symmetrical positions with respect to a mid-plane of said support structure, said two rotatable handgrips being shaped for the normal grip by the two hands of a driver.

8. The steering device according to claim 1, wherein a gap is provided between said first end and said second free end.

9. The steering device according to claim 1, wherein the pivot also has an cylindrical shape and the pivot spaces the parallel plane of the twist grip away from the support structure.

10. A steering device comprising

- a support structure comprising a central hole for fixing said support structure onto a steering column, wherein said support structure is rotatable together with the steering column to operate steering mechanisms;
- two rotatable handgrips connected to said support structure and placed at distal positions with respect to the central hole, each of the two rotatable handgrips freely rotatable, in a range from 0° to 360°, around its axis substantially orthogonal to a lying and rotating plane of said support structure, each of the two rotatable handgrips comprising a first handgrip end segment, a second handgrip end segment which is a free end, and a third handgrip segment, the first handgrip end segment and the second handgrip end segment lying in respective end segment planes which are spaced apart and parallel to the lying and rotating plane of said support structure, the third handgrip segment being connected between the first handgrip end segment and the second handgrip

end segment, the third handgrip end segment extending in a direction parallel to the pivot axis, the second handgrip end segment having an cantilever cylindrical shape and being configured to be gripped by a hand of a driver and to thereby manually impart a rotation motion around an axis of the steering column to the support structure,

wherein said support structure further comprises a number of peripheral holes arranged around said central hole.

11. The steering device according to claim 10, wherein said support structure comprises two spokes, each of them having a shape reducing its width toward the end and wherein said two rotatable handgrips are rotatably associated to said support structure by means of pivots fixed to respective spokes of said support structure, and wherein each of said pivots is rotatable around a respective pivot axis.

12. The steering device according to claim 10, wherein said two spokes are angularly adjustable on said support structure.

13. The steering device according to claim 10, wherein said two rotatable handgrips are placed on said spokes in a distal position in comparison with the central hole.

14. The steering device according to claim 10, wherein each of said two spokes has a shape enlarged at its end, wherein each enlarged end comprises a slot, wherein pivots are fixed in an adjustable position within said slots so that said two rotatable handgrips can be arranged at least at a first angular position and at a second angular position.

15. The steering device, according to claim 14, wherein said two rotatable handgrips are removably connected to said support structure.

16. The steering device according to claim 15, wherein said two rotatable handgrips are fixed to said support structure in symmetrical positions with respect to a mid-plane of said support structure, said two rotatable handgrips being shaped for the normal grip by the two hands of a driver.

17. The steering device according to claim 1, wherein said peripheral holes are six peripheral holes which are equally angularly arranged around said central hole.

18. The steering device according to claim 1, wherein said support structure is a planar support structure laying on said laying and rotating plane.

19. The steering device according to claim 2, wherein each of said spokes comprises an axis and wherein the axis of the two spokes intersect at a center of said central hole and form an angle which is different from 180°.

20. The steering device according to claim 10, wherein said peripheral holes are six peripheral holes which are equally angularly arranged around said central hole.

21. The steering device according to claim 10, wherein said support structure is a planar support structure laying on said laying and rotating plane.

22. The steering device according to claim 10, wherein each of said spokes comprises an axis and wherein the axis of the two spokes intersect at a center of said central hole and form an angle which is different from 180°.

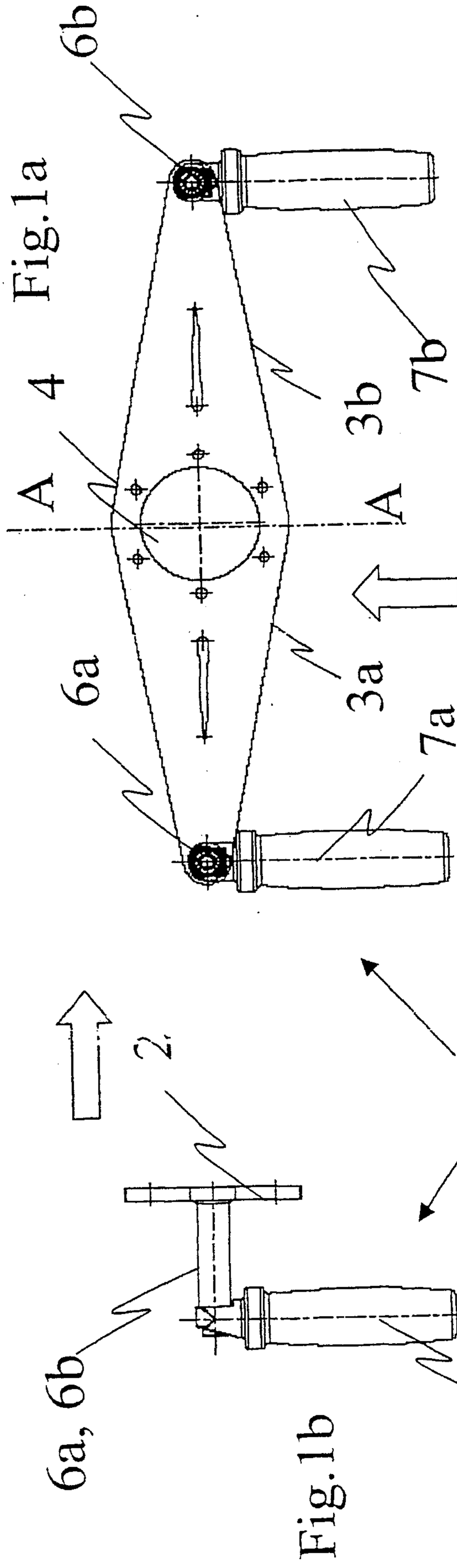


Fig.1a

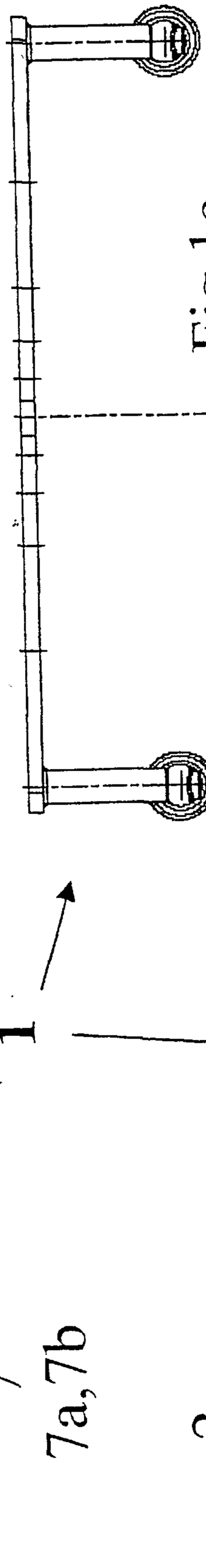


Fig.1c

Fig.1b

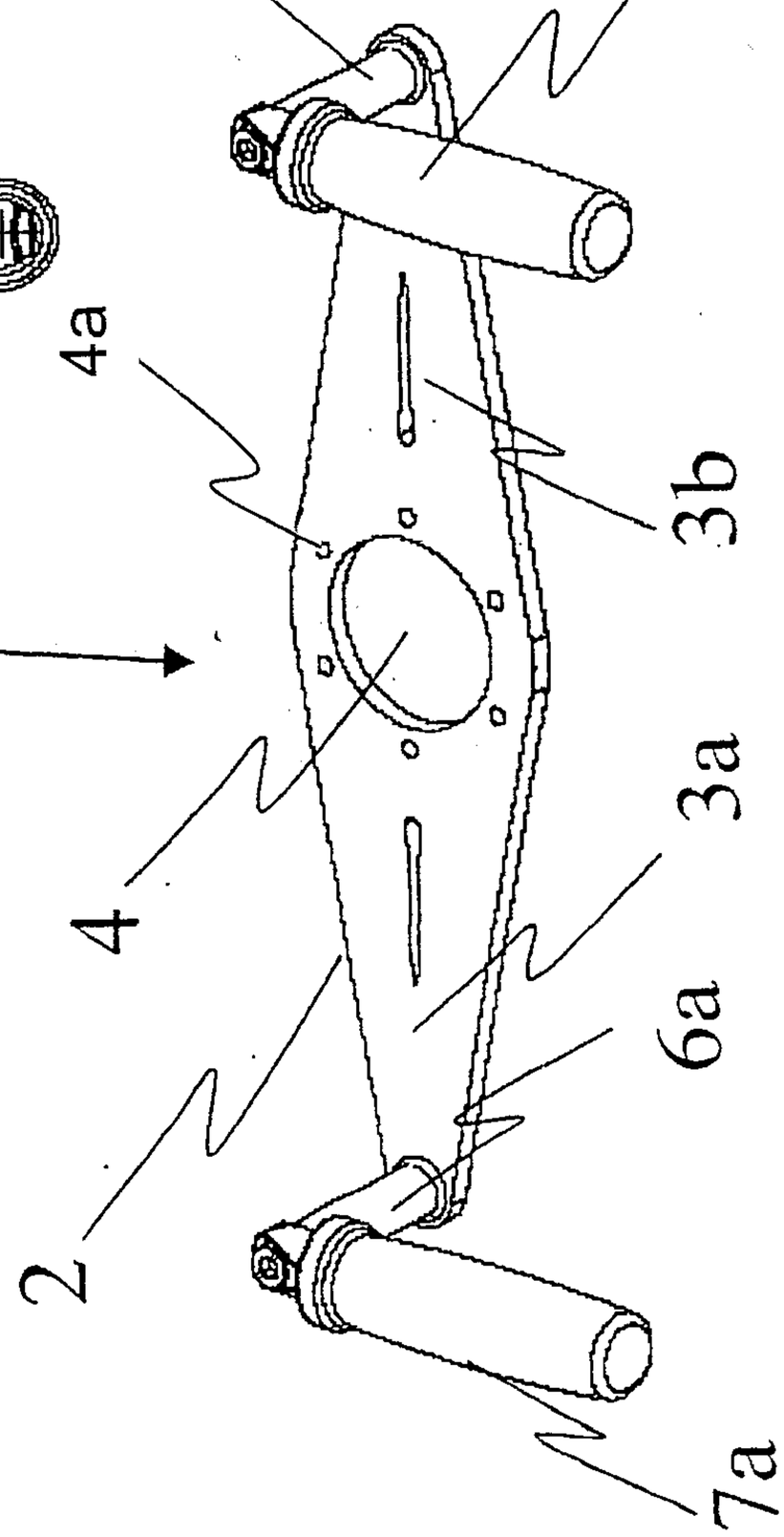


Fig.1d

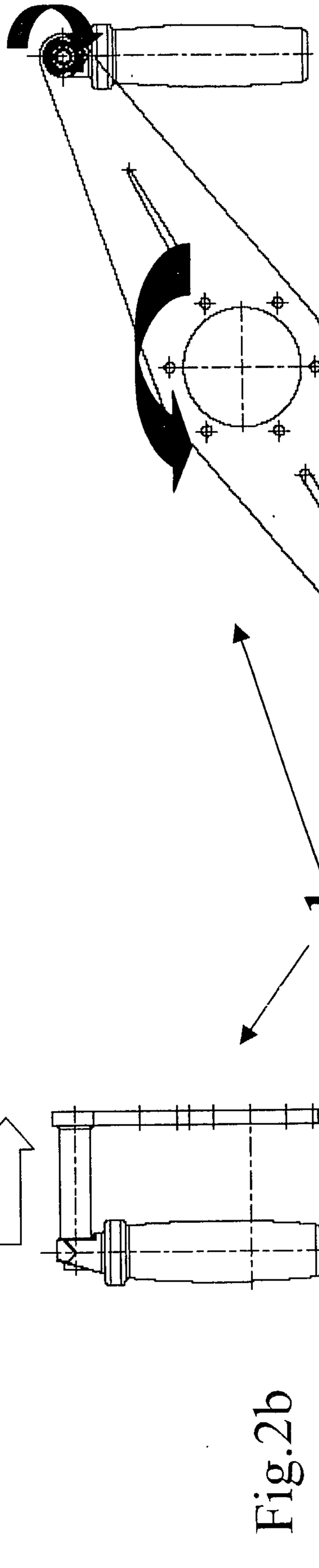


Fig.2a

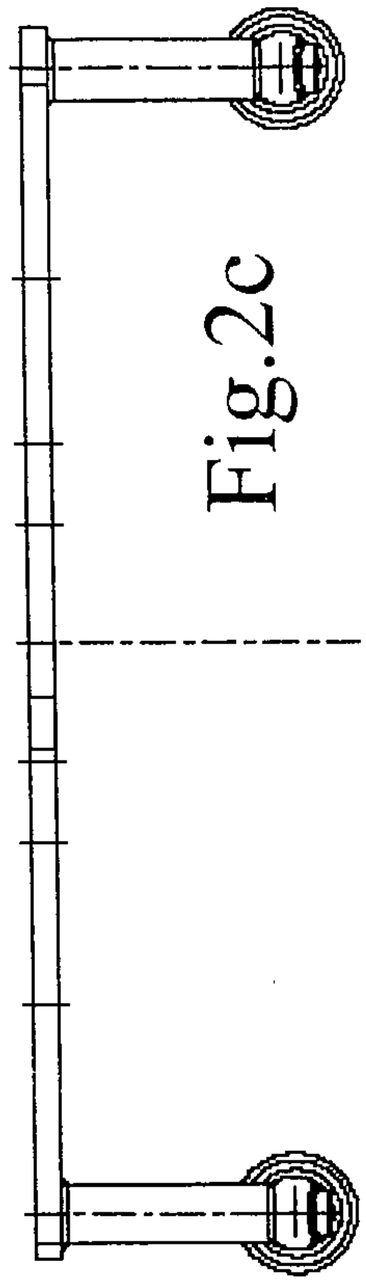


Fig.2c

Fig.2b

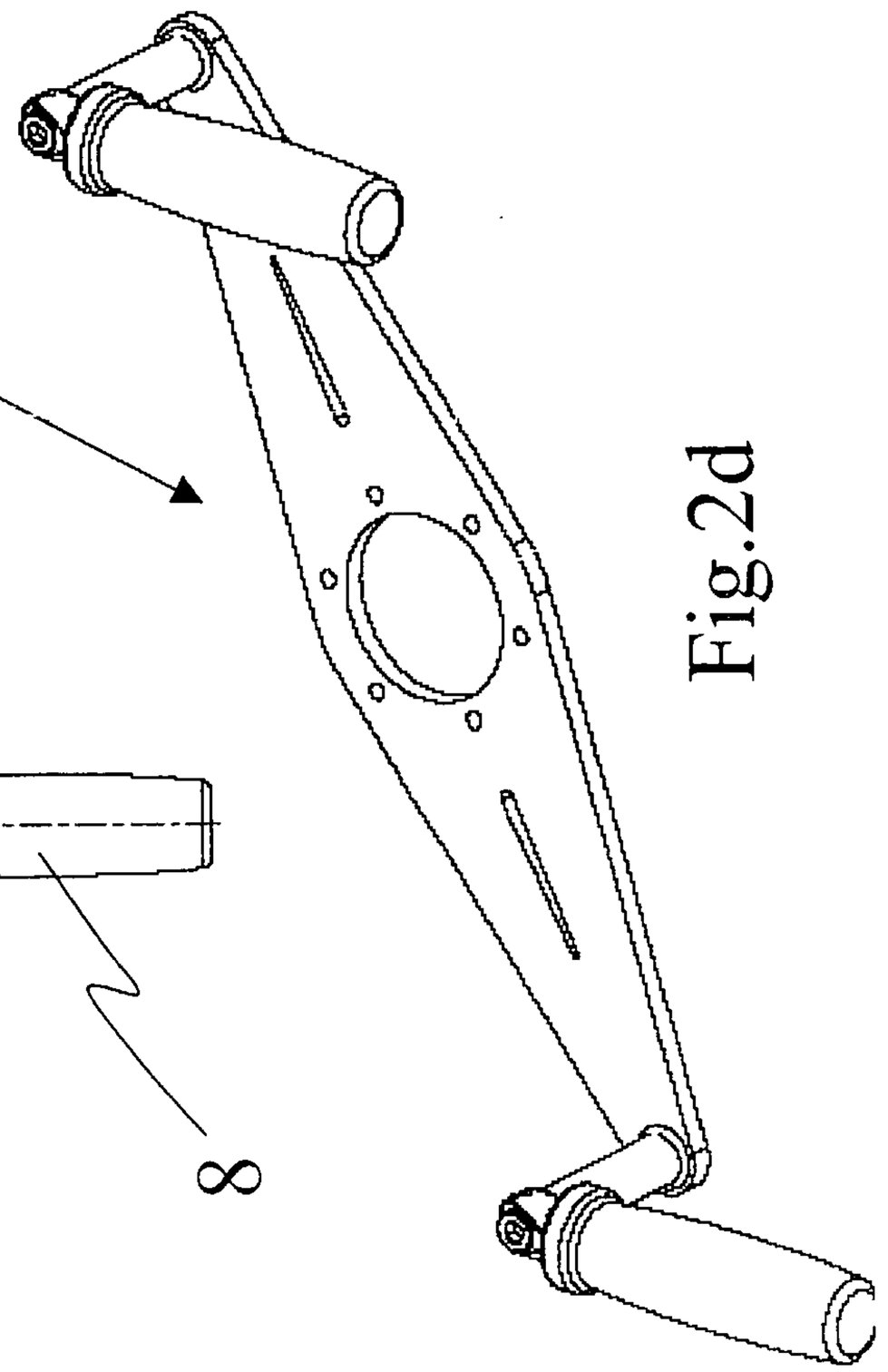


Fig.2d

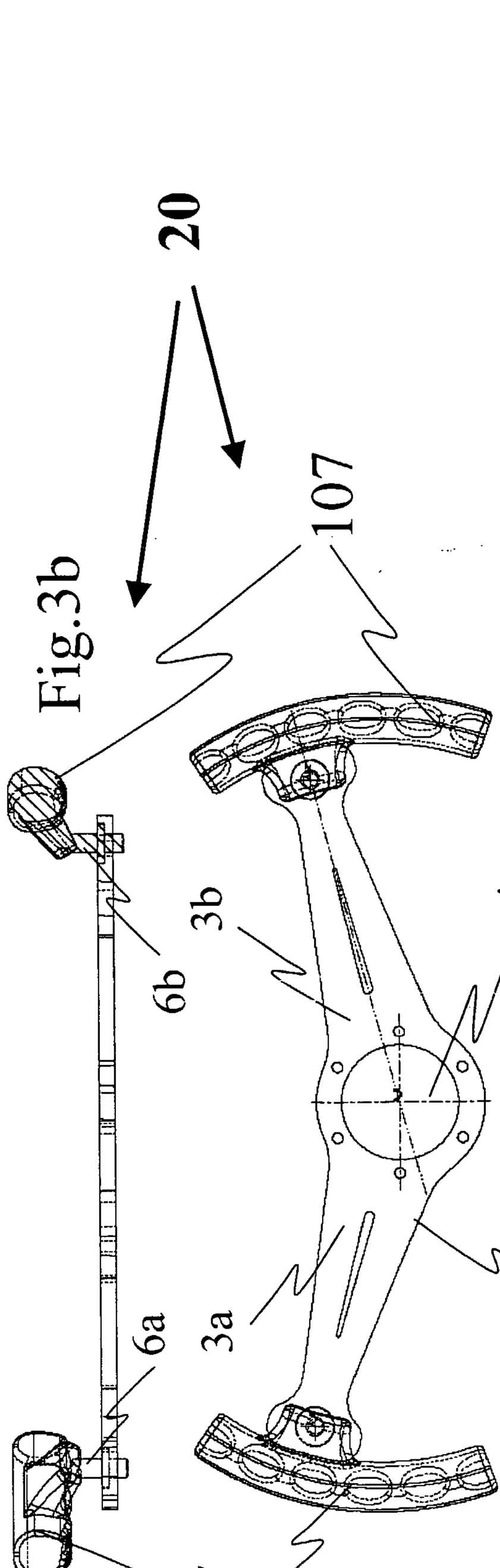


Fig.3a

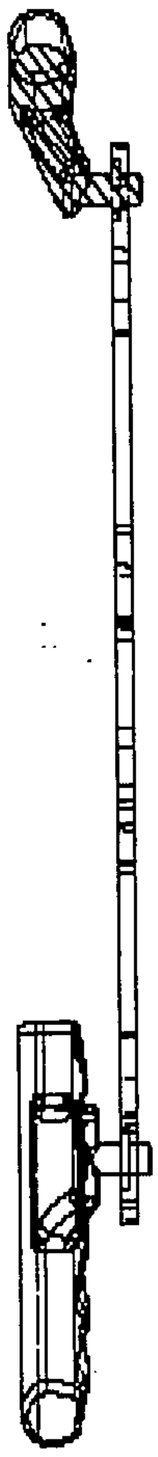


Fig.3b

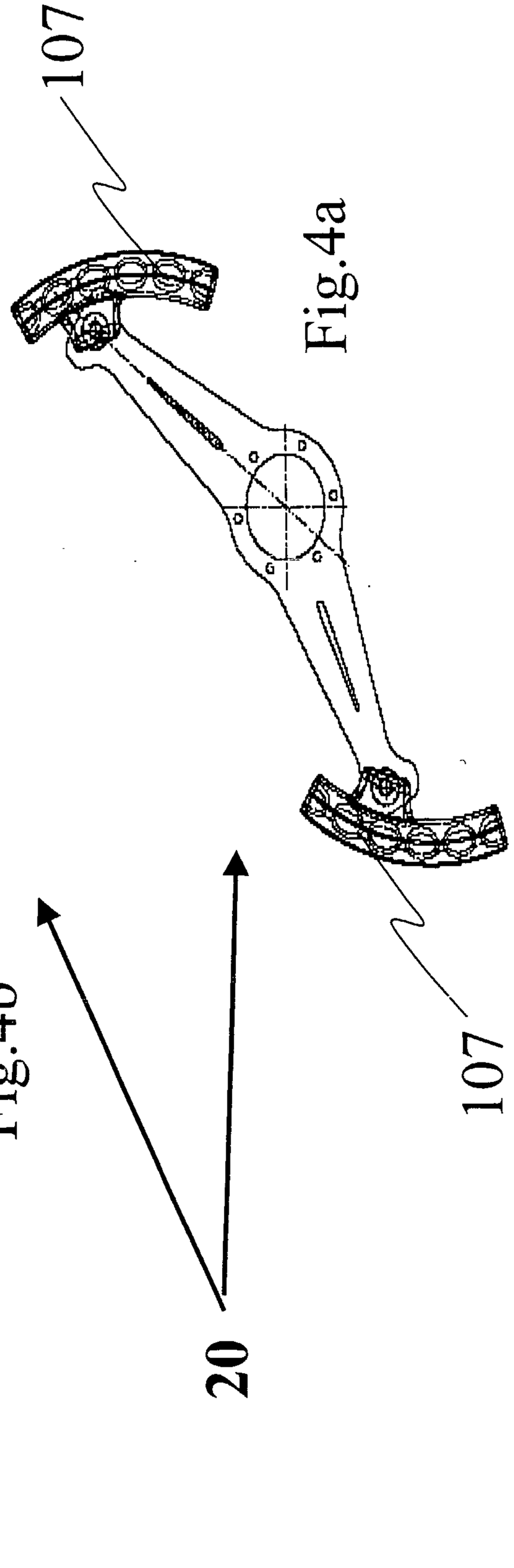


Fig.4a

Fig.4b

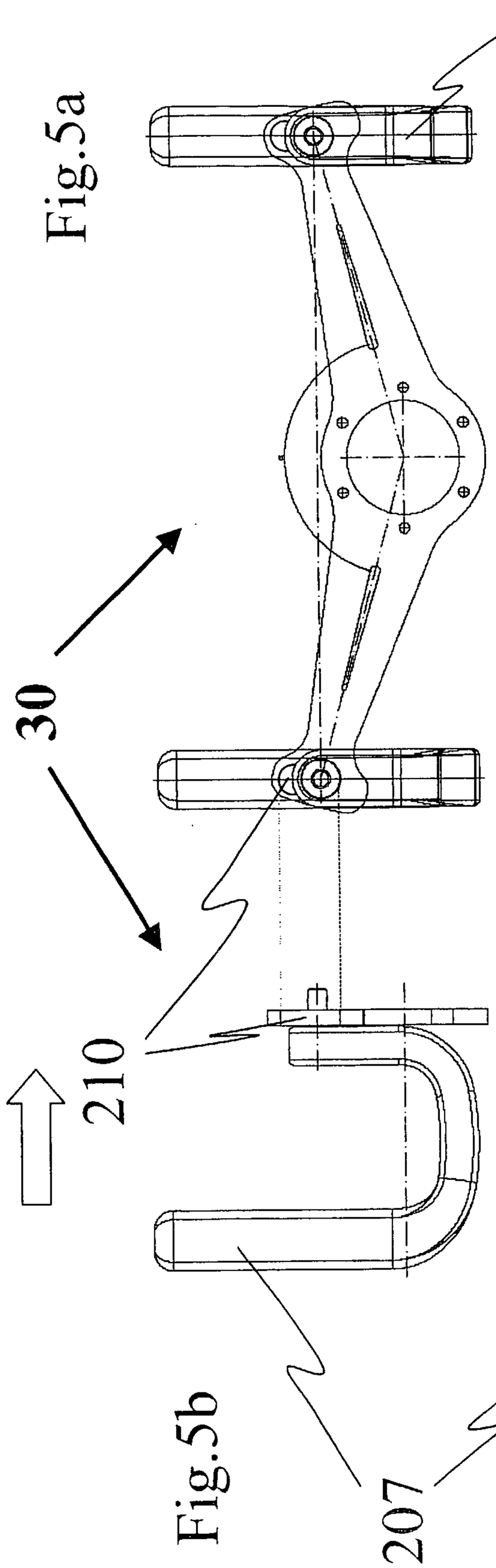


Fig.5a

Fig.5b

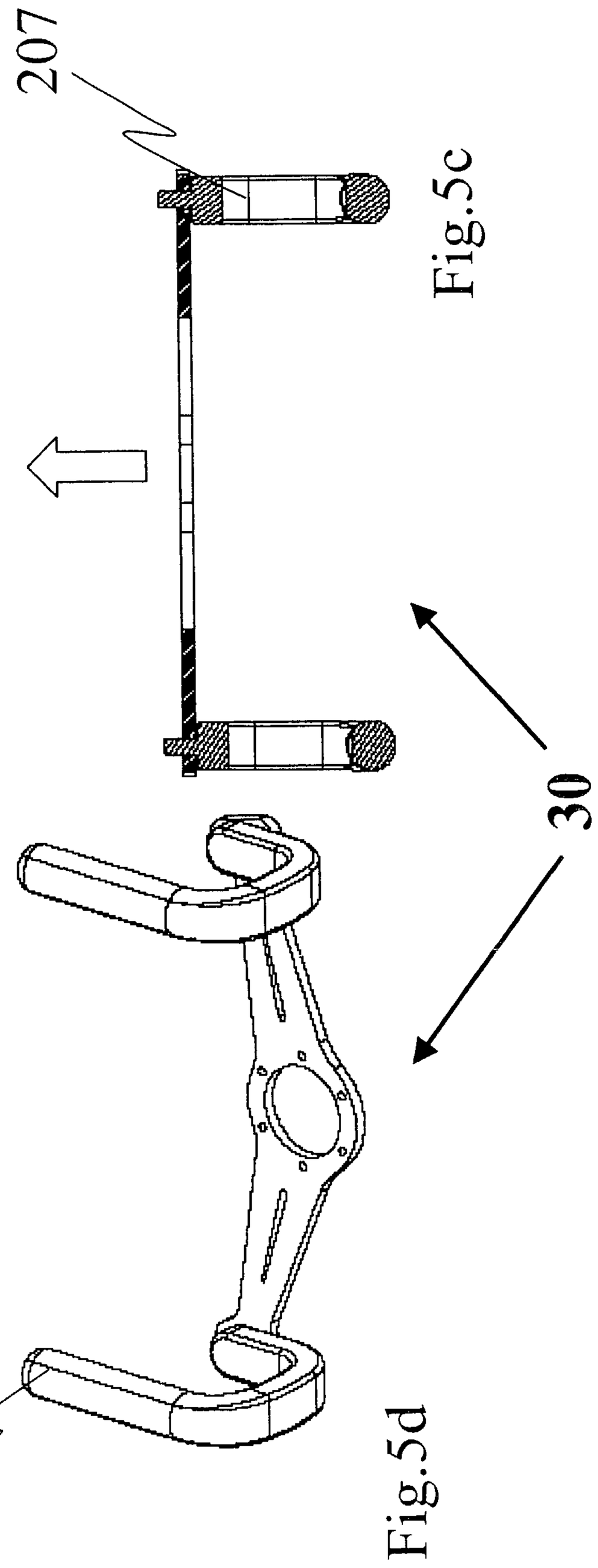


Fig.5c

Fig.5d

Fig.6a
207
Fig.6c
30
30
Fig.6b
207
Fig.6d

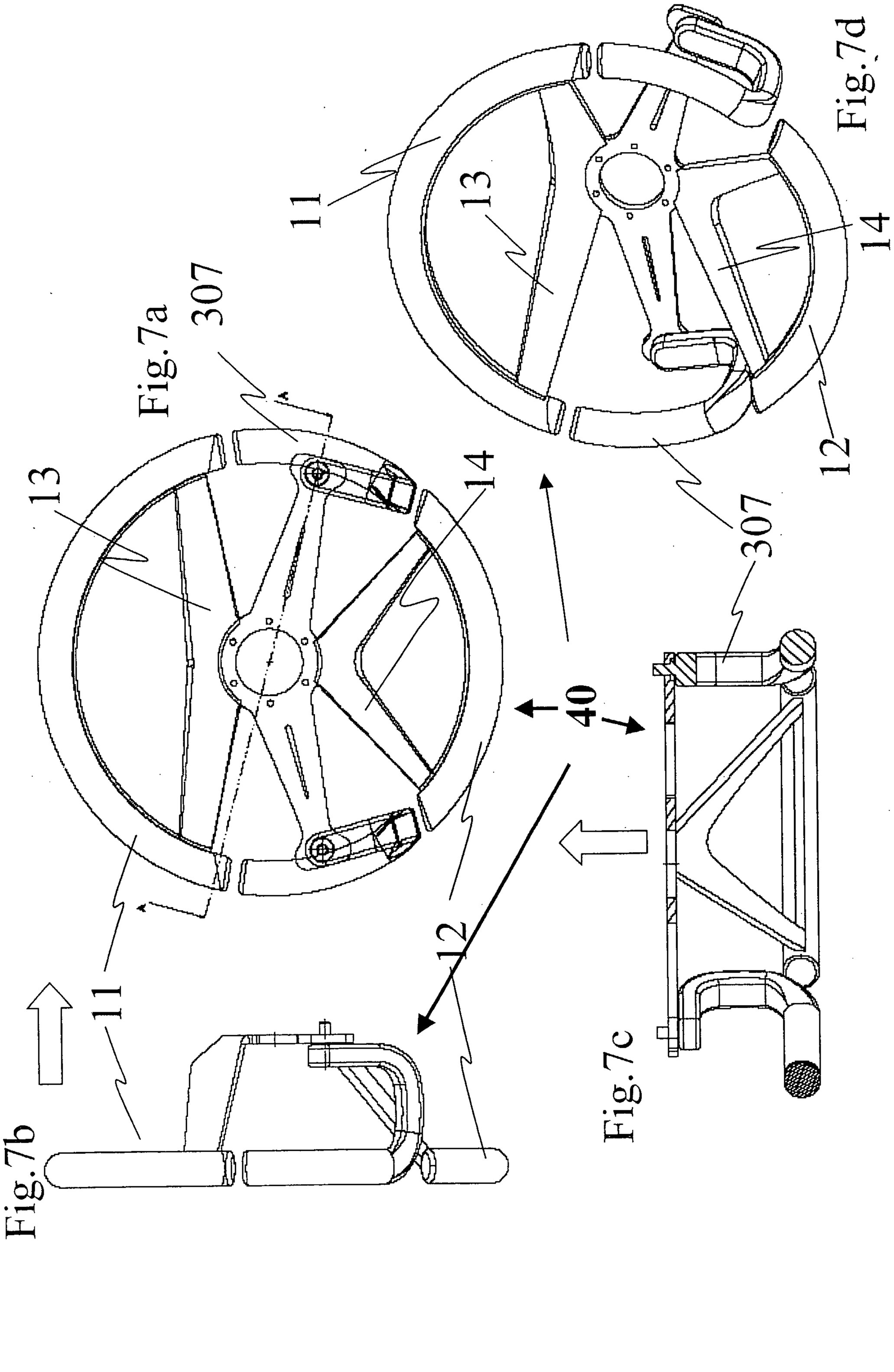


Fig.7a

Fig.7b

Fig.7c

Fig.7d

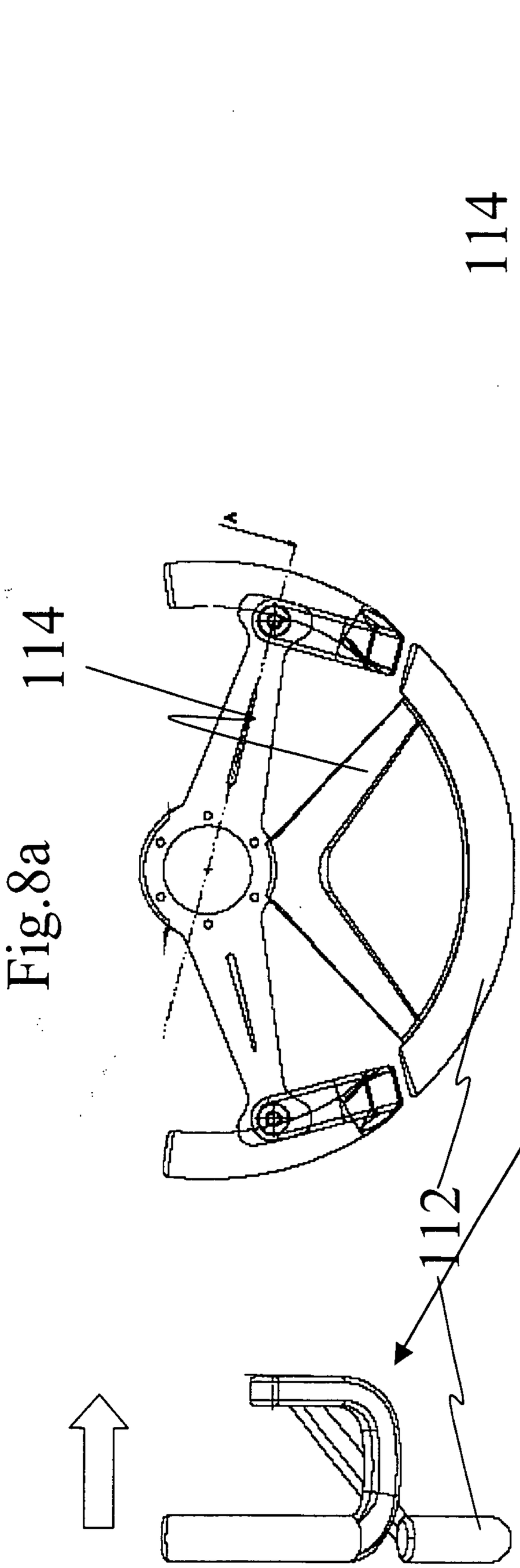


Fig.8a

Fig.8b

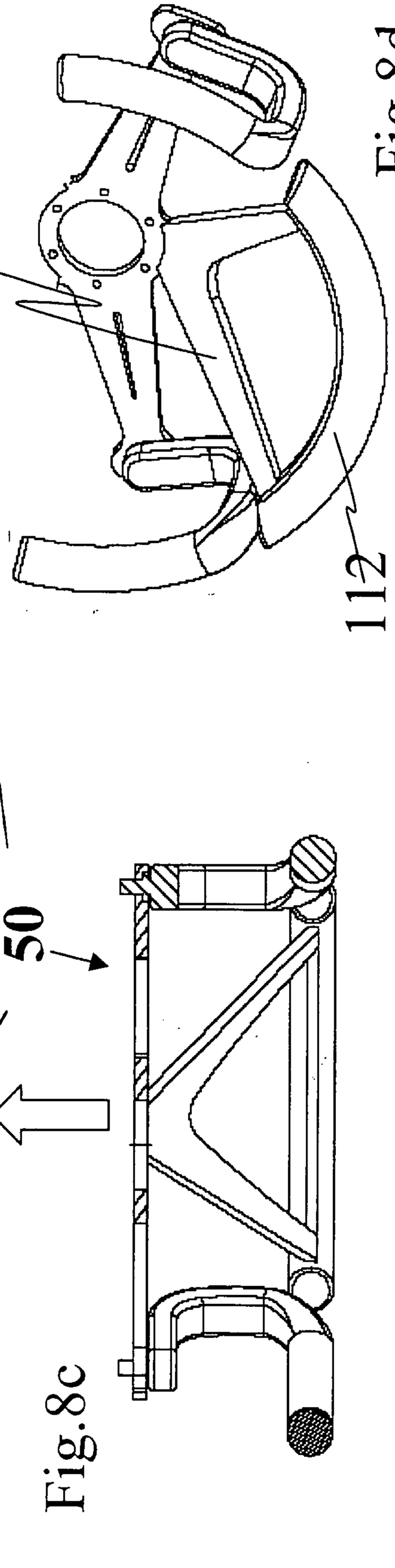


Fig.8d

Fig.8c

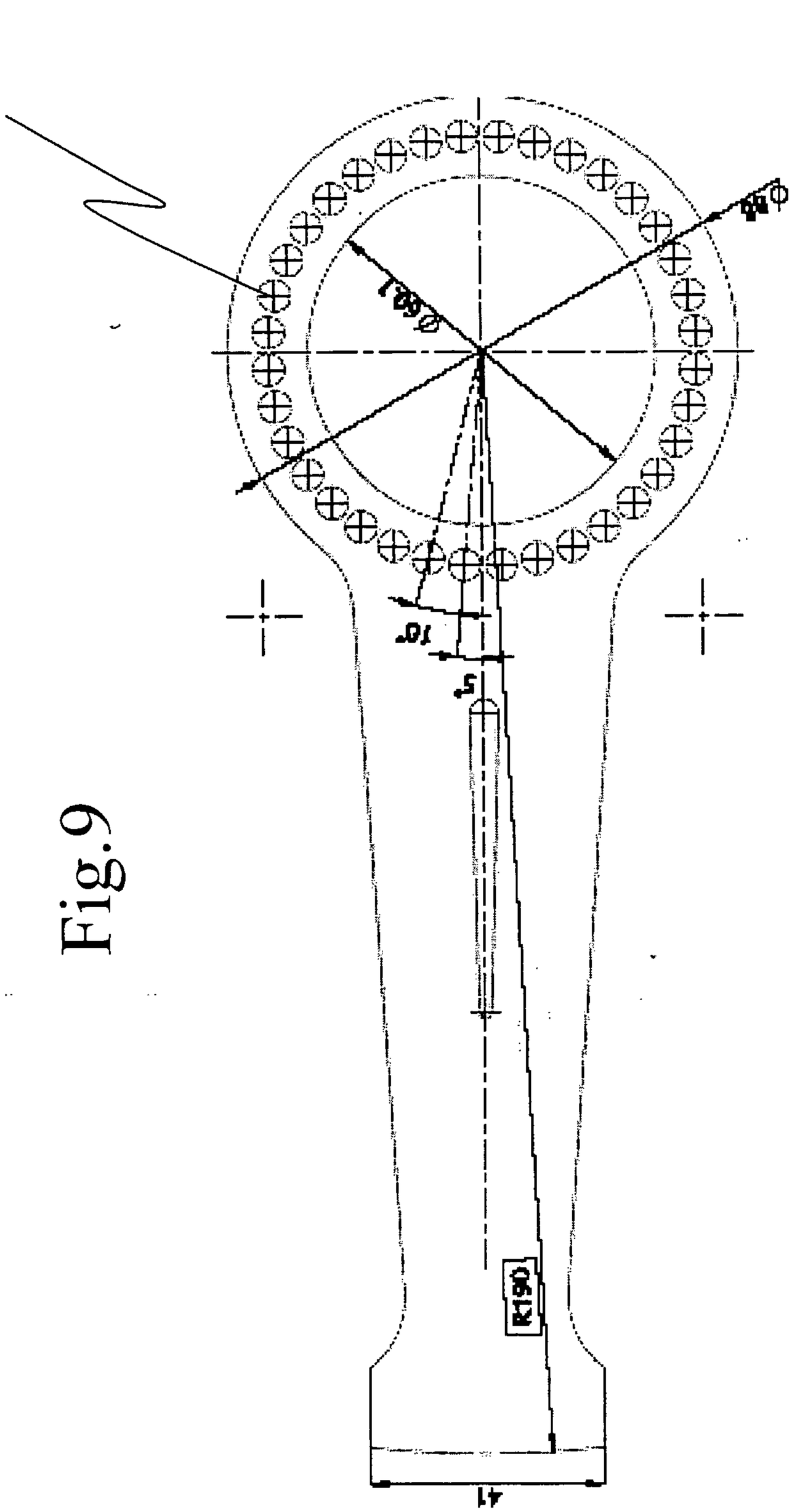
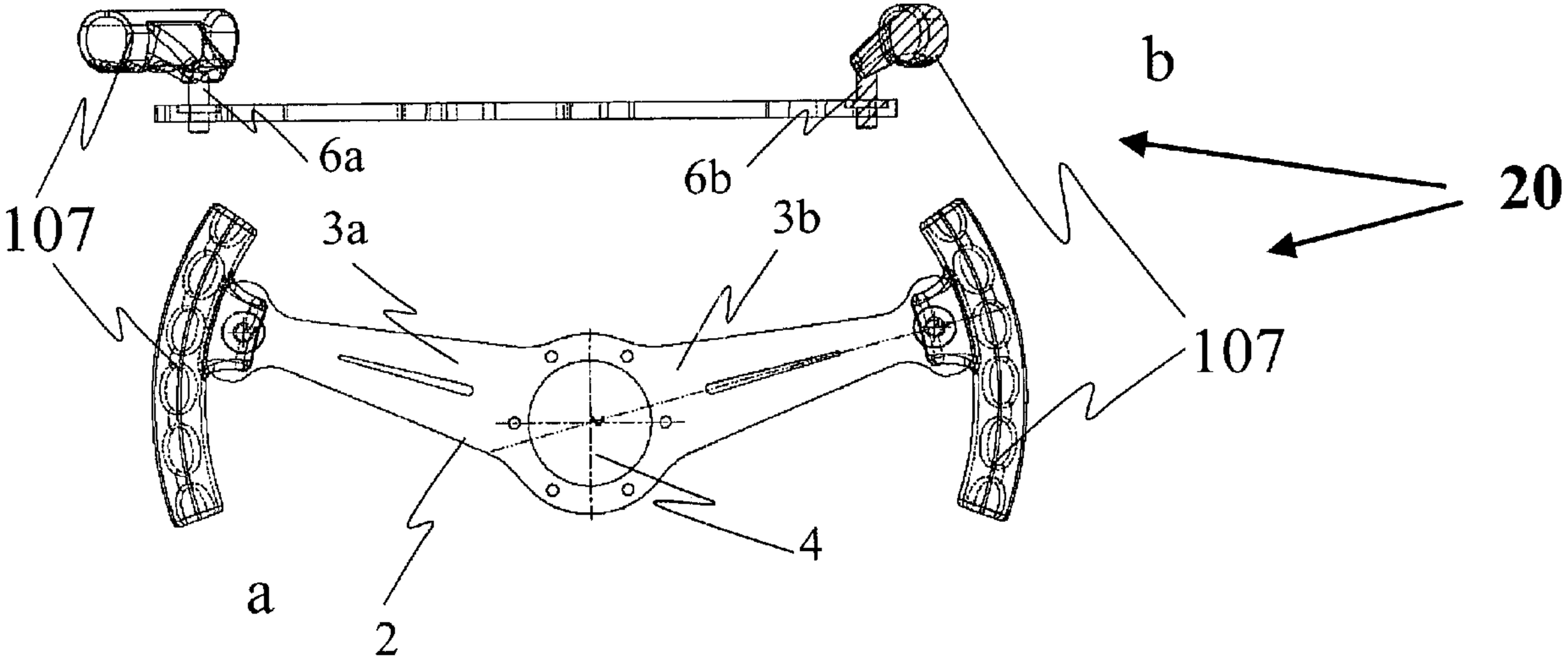


Fig.9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6a
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3a
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