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(54) Titre : SCOOTER PLIABLE MOTORISE
(54) Title: MOTORIZED FOLDABLE SCOOTER

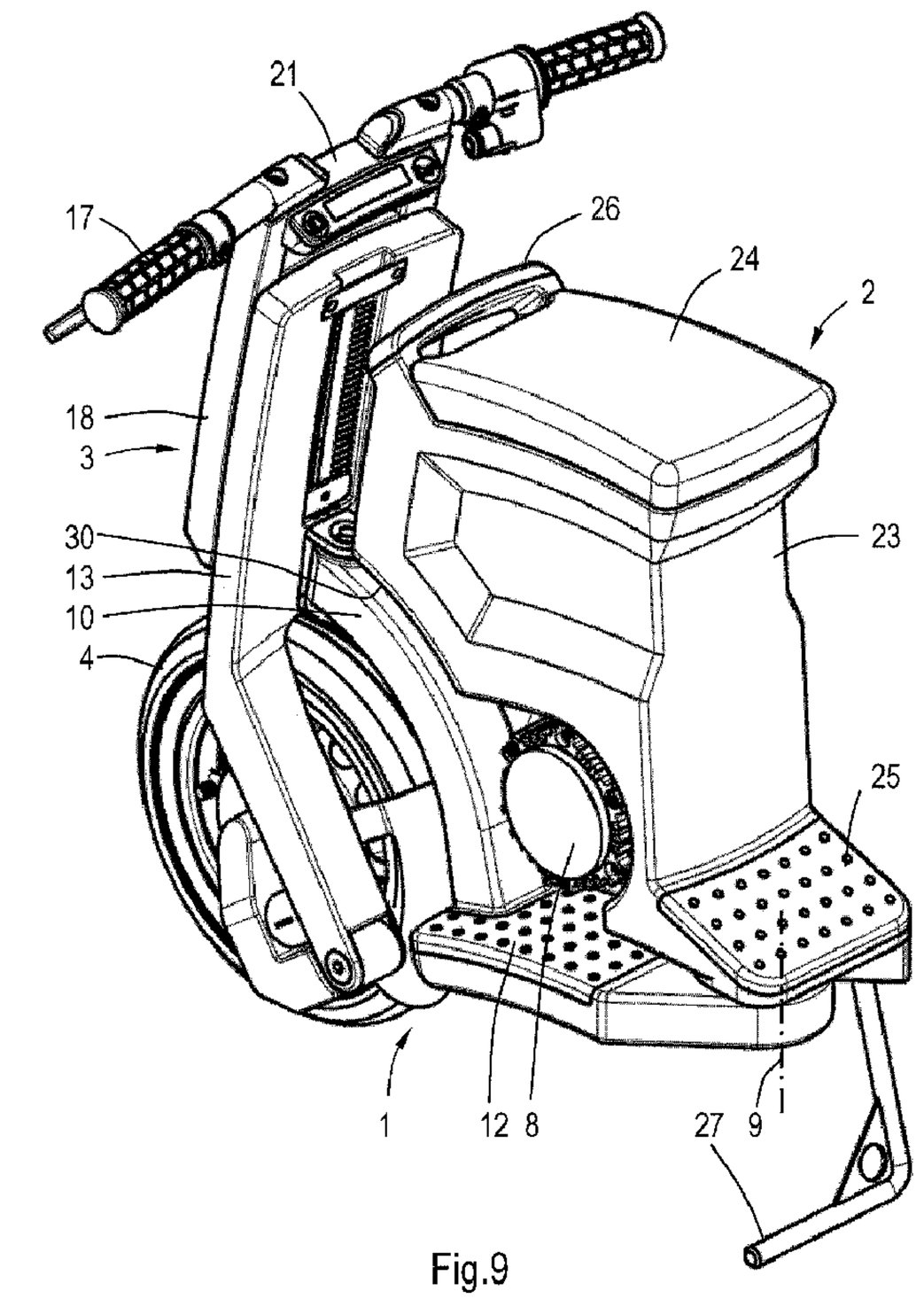

Fig.9

(57) Abrégé/Abstract:
A motorized foldable scooter has a frame (1, 2), at least a front (4) and rear wheel (5) connected to the frame, a seat (24) supported by the frame, a steerrng arrangement (3) for the front wheel, and an electric motor (8), driving the rear wheel through a

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(57) Abrégé(suite)/Abstract(continued):
transmission (6). The frame has at least front (1) and rear frame parts (2) movably connected through a substantially vertical rotary axis (9) to move the frame parts between an extended position of use and a collapsed resting position. The steering arrangement and the scat, and/or the front and rear frame parts are shaped such with respect to each other and the rotary axis that they at least partly nest in lateral direction of the scooter when the frame parts are m the collapsed resting position.

ABSTRACT

A motorized foldable scooter has a frame (1, 2), at least a front (4) and rear wheel (5) connected to the frame, a seat (24) supported by the frame, a steering arrangement (3) for the front wheel, and an electric motor (8), driving the rear wheel through a transmission (6). The frame has at least front (1) and rear frame parts (2) movably connected through a substantially vertical rotary axis (9) to move the frame parts between an extended position of use and a collapsed resting position. The steering arrangement and the seat, and/or the front and rear frame parts are shaped such with respect to each other and the rotary axis that they at least partly nest in lateral direction of the scooter when the frame parts are in the collapsed resting position.

Motorized foldable scooter

The present invention relates to a motorized foldable scooter having a frame, at least a front and rear wheel connected to the frame, a seat supported by the frame, a steering arrangement for the front wheel, and a motor, preferably an electric motor, driving the rear wheel through a transmission, the frame having at least front and rear frame parts movably connected to a substantially vertical rotary axis to move the frame parts between an extended position of use and a collapsed resting position.

Nowadays, rush hour traffic becomes a greater problem every year, especially on the roads. Therefore the public transport is promoted to decrease the problems on the roads. The disadvantage of public transport is that it is not a door-to-door transport which is considered by many people to be most convenient. Therefore, mixed transport is promoted, wherein part of the distance is covered by individual means of transport and the main distance is travelled by public transport, for example by train. The foldable bike is a means of transport which enables mixed transport in a convenient manner if the distance from the starting point or the final destination to a train station is relatively small. For larger distances, the bicycle trip is either too tiring or takes up too much time in the total travel. Motorized bicycles are a step forward but good foldable motorized bicycles are not available yet.

On the other hand, motorized scooters are a popular means of transport, especially with the youth and it would be favourable if a motorized scooter could be developed which is foldable in a compact way so as to be easily stowed during public transport or at the final destination.

It is an object of the present invention to provide a motorized foldable scooter which can be collapsed in a compact manner.

For this purpose the scooter according to the invention is characterized in that the steering arrangement and the seat, and/or the front and rear frame parts are shaped such with respect to each other and the rotary axis that they at least

partly nest in lateral direction of the scooter when the frame parts are in the collapsed resting position.

Due to this nesting, the main disadvantage of a scooter with respect to a bicycle, that is its width, is neutralized. If the nesting is done in an effective way, the total width of the folded scooter is only slightly larger than the width of the scooter in its position of use. This makes the scooter very compact in its collapsed position, not only by halving the length of the scooter but also by keeping the width of the scooter within acceptable limits.

Favourable manners of facilitating the collapsing or enabling the compact nesting of the bicycle in the collapsed position are defined in claim 2.

The embodiment of claim 3 allows the use of the scooter as a seat when it is in its collapsed position. This is very favourable if the user has to wait, for example for his public transport, such as the train. The user has then already collapsed the scooter to enter the train, but in this position he/she may use it as a seat during the waiting time. The shape of the seat enables a comfortable seating position, which cannot be obtained by a bicycle saddle.

The feature of claim 4 facilitates collapsing because the front frame part and the steering arrangement including the front wheel act as a unit, so that only two rigid parts have to be folded and no attention has to be paid to the position of the steering arrangement during collapsing. It is favourable if the steering arrangement can be locked by a downward movement of the handle bars because this combines two functions in one action: the reducing of the size of the scooter in vertical direction and the locking of the steering arrangement.

The features of claim 5 enable the user to roll the collapsed scooter on the ground, which is of course much more comfortable than carrying the relatively heavy scooter. If the transmission of the driven rear wheel does not have a free wheel clutch that allows for free forward and reverse rotation of the rear wheel when the motor is not engaged, the alternative feature of claim 5 still enables the rolling of the scooter in an inclined position. Then, in the forwardly inclined position only the front wheel, which is slightly projecting beyond or below

the rear wheel, is touching the ground and of course this front wheel is freely running. The grip between the handle bars enables the user to bring and hold the scooter in this forwardly inclined position.

In case the axis of the wheels are aligned in the collapsed position of the wheel, claim 6 provides a very favourable way of locking the frame parts in the collapsed position by locking the wheel axles with respect to each other. This locking through the axles, instead of through the wheels, makes it possible to use exactly the same wheels for the front and rear wheel, which simplifies production and reduces the number of stock parts.

The feature of claim 7 allows the use of a very high transmission ratio without having to use a very large sprocket wheel or the like on the rear wheel. This reduces the total weight as above a certain transmission ratio the total weight of the three transmission wheels and two endless transmission elements will be lower than that of two transmission wheels and a single endless transmission element.

The feature of claim 8 enables the wheels to be positioned very close to each other in the collapsed position, while the mudguards can still be effective during use of the scooter in wet conditions.

The object of the embodiment according to claim 9 is to provide a safe position for the actuating member for actuating the lock of the rotary axis. This positioning prevents accidental actuation of the actuating member, while it is an easy position to actuate the lock when the scooter is collapsed, because it allows firm gripping of the rear frame part by hand and actuating the actuating member by the same hand. The other hand can be used to grip the front frame part.

This position of the actuating member is of course especially intended for use on a scooter for one person only. Otherwise, the passenger will use the handgrip behind the seat when the scooter is used, with the risk of actuating the actuating member.

The embodiment of claim 10 provides a shielding of the exposed hot parts of the engine, thereby preventing contact be-

tween the user and the hot parts during collapsing or when the scooter is in the collapsed position.

Further features and advantages of the invention will appear from the following description with reference to the drawings showing an embodiment of the scooter according to the invention by way of example.

Fig. 1 is a perspective view of an embodiment of the motorized foldable scooter according to the invention, as seen from the left rear side.

Fig. 2 is a perspective view of the scooter of fig. 1 as seen from the front right side.

Figs. 3, 4 and 5 are side, plan and front views, respectively, of the scooter of fig. 1.

Fig. 6 is a view corresponding to that of fig. 1, but showing the scooter with the handle bars in a downwardly displaced position.

Figs. 7 and 8 are views corresponding to those of figs. 1 and 2, but showing the scooter during collapsing.

Fig. 9 is a view corresponding to that of fig. 1, but showing the scooter in the collapsed position in which it can be used as a seat.

Fig. 10 is a view corresponding to that of fig. 1, but showing the scooter in the fully collapsed position.

Figs. 11, 12, 13 and 14 are side, plan, front and rear views respectively, of the scooter of fig. 1, but in the fully collapsed position.

The drawings show an embodiment of a foldable scooter, which is driven by an electric motor, although it is conceivable that the scooter is driven by a different type of motor, for example an internal combustion engine or other type of motor.

The main parts of the scooter comprise a front frame part 1 and a rear frame part 2. The front frame part 1 supports a steering arrangement 3 carrying a front wheel 4 and the rear frame part 2 supporting a rear wheel suspension 5 and transmission 6, both connected to a rear wheel 7, while the transmission 6 is driven by an electric motor 8 attached to the rear frame part 2. The front frame part 1 and the rear frame part 2 are connected permanently through a substantially vertical rotary axis 9, Preferably a pin or the like and during use the front

and rear frame parts 1, 2 are additionally coupled through a lock (not shown) locking the frame parts 1 and 2 in an aligned position.

The front frame part 1 includes a front frame beam 10 substantially following the curvature of the front wheel 4 and being provided on its front and with a steering head 11 and being attached to a platform-like foot rest 12 on its rear lower end.

The steering arrangement 3 includes a front fork 13 having only one leg 14 carrying the front wheel suspension 15. This front wheel suspension 15 includes spring and damper means 16.

The steering arrangement 3 further comprises handle bars 17 which are connected to the handle bar support 18. The handle bars 17 are connected to the handle bar support 18 through a substantially vertical pivoting axis 19 and having a locking arrangement 20 to either lock the handle bars 17 in a desired position or allow the handle bars to be rotated around their own pivoting axis 19 to swivel from a position of use as shown in fig. 1 to a collapsed position as shown in fig. 10. Of course it would also be conceivable to use the pivoting axis 19 to allow adjustment of the handle bars 17 to the needs of a user to obtain a comfortable position during use. The handle bar support 18 is provided on its upper end between the handle bars 17 with a hand grip 21 which can be used for carrying or rolling the scooter in the collapsed position as will be explained later on.

The handle bar support 18 is connected to the front fork 13 through an height adjustment mechanism 22 or other adjustable connection to allow for a height adjustment of the handle bar support 18 with respect to the front fork 13. This mechanism may for example include a toothed rack and ratchet, but other arrangements are conceivable. This height adjustment mechanism 22 may not only be used for moving the handle bar support 18 between a use position and collapsed position, but also for adjusting the height of the handle bars 17 to the needs of the user for a comfortable position during use. A stop may be used for determining the use position.

The up and down movement of the handle bar support 18 may also be used to actuate a locking mechanism for the steering arrangement 3. The locking of the steering arrangement 3 in a central position facilitates the collapsing of the frame parts 1 and 2, because the front frame part 1 and the steering arrangement 3 will then act as a rigid unit. The locking arrangement may for example include a projecting part on the front frame beam 10 and a part on the lower side of the handle bar support 18 coming into engagement with the projecting part in the lower position of the handle bar support 18.

It is clear from the drawings that the handle bar support 18 and the upper portion of the front fork 13 are plate shaped and have a small dimension in the longitudinal direction of the scooter. This can be used for nesting the front and rear frame parts 1 and 2 in the collapsed position of the scooter.

The rear frame part 2 has a box shaped housing or carries a housing having a box shape. This housing 23 carries on top a cushioned seat 24 which is substantially rectangular and has a convenient width and length to provide a comfortable seat. At the front of the housing 23 near the lower end thereof is a rear extension 25 of the foot rest 12, which foot rest extension 25 is positioned above the rotary axis 9.

Behind the seat 24 the housing 23 is provided with a hand grip 26 concealing an actuating member for the lock which locks the front and rear frame part 1, 2 near the rotary axis 9. The lock may be actuated in an electro-mechanical way, so that the actuating member behind the hand grip 26 may be a push button, although a fully mechanical actuation is also conceivable. On its lower side the rear frame part 2 carries a stand 27 providing a stable support for the scooter both in the position of use and in the collapsed position. The stand 27 is attached to the rear frame part 2 at a position just behind the rotary axis 9.

The housing 23 partly encloses the electric motor 8 and fully encloses the batteries for powering the electric motor 8. Preferably the batteries are such or are provided with such equipment that the batteries can be charged by connecting them to the mains supply so that it is easy to charge the batteries at home or at the final destination.

The rear wheel suspension 5 includes a one-sided rear fork (not shown) which is positioned on the same side as the front wheel suspension 15, that is on the side facing away from the folding direction. This means that the front and rear wheel suspensions 5, 15 will not hinder a compact collapse of the frame parts 1, 2. This compact collapsing of the frame parts is also not hindered by a front wheel mudguard 28 and a rear wheel mudguard 29 which are attached to the front and rear wheel suspensions 15, 5 on one side too, while they both cover the front and rear wheel in a portion at the rear half of the respective wheel so that in the collapsed position of the scooter they are in a different circumferential portion of the wheels 4, 7 enabling a close relative position of the front and rear wheels.

The transmission 6 for the rear wheel 7 preferably includes one or more transmission elements transmitting the rotation of an output shaft of the electric motor 26 to the axle of the rear wheel 7. In order to allow for a large transmission ratio without unduly enlarging the transmission wheel, for example sprocket wheel, on the rear wheel 7, the invention proposes to provide a two step transmission, that is to have a first endless transmission element between the motor transmission wheel and an intermediate transmission wheel, and a second transmission element between a second intermediate transmission wheel and a rear transmission wheel. The transmission ratio of each endless transmission element should be larger than one.

In order to allow for the nesting of the front and rear frame parts 1, 2, and in this case for the steering arrangement 3 and the box-shaped housing 23, the box-shaped housing 23 is shaped such as to allow the front frame beam 10 to be positioned between the housing 23 and the rear wheel 7. For this purpose the housing has a recess 30 accommodating the front frame beam 10 in the collapsed position of the scooter. The rear side of the flat front fork 13 is positioned at a distance from the vertical rotary axis 9 which is slightly larger than the distance between the rotary axis 9 and the rear side of the housing 23, so that in the collapsed condition the front fork 13 fits just behind the housing 23 of the rear frame part 2 (see for example fig. 10).

The collapsing of the scooter from the position of use to the collapsed position will be discussed with reference to fig. 6 - 14.

In fig. 6 the handle bar support 18 is moved downwardly with respect to the front fork 13 to collapse the scooter in vertical direction. During this downward movement through the height adjustment mechanism 22, the handle bar support 18 has locked the steering arrangement 3 with respect to the front frame part 1, so that the front wheel 4 is locked in its central position in which it is aligned with the rear wheel 7. The scooter is preferably placed on the stand 27, the central gravity of the scooter being positioned behind the stand 27, so that the scooter will rest on the stand 27 and the rear wheel 7. In a next step the lock between the front and rear frame parts 1, 2 is released by means of the actuating element below the rear hand grip 21. While holding this rear hand grip 27 and one of the handle bars 17 or the hand grip 21 the front frame part 1 and the steering arrangement 3 are pivoted as a unit around the vertical rotary axis 9 so as to fold the front and rear frame parts 1, 2.

Figs. 7 and 8 show the front frame part 1 in a 90° position halfway of the complete folding movement.

Fig. 9 shows the scooter in its completely folded position in which the front and rear wheels 4, 7 are positioned parallel and close to each other with their axles aligned. These axles may be provided with a snap lock so as to lock the axles of the front and rear wheels 4, 7 to each other and thereby to lock the front and rear frame parts 1, 2 with respect to each other in the collapsed position. In this position, the scooter may be used as a seat, the flat and large seat 24 providing a comfortable place to sit on, while the scooter is standing on the stand 27 and the front and rear wheels 4, 7 in a stable manner.

As is shown in fig. 9, the platform shaped foot rest 12 is positioned partly below the foot rest extension 25 and the housing 23 of the rear frame part 2. It is also positioned close to the exposed portion of the electric motor 8 and it projects sideways beyond the electric motor 8 thereby providing protection against accidental contact with the hot parts of the

electric motor 8 during handling of the scooter or when somebody is sitting on the seat 24. The front frame beam 10 extends just behind the motor and in the recess 30 between the housing 23 and the rear wheel 7.

In the position according to figs. 10 - 14, the handle bars 17 are pivoted inwardly to extend within the width of the collapsed scooter and fig. 12 shows that the width of the collapsed scooter is approximately 1,5 time the width of the scooter in the position of use (excluding the handle bars), so that the nesting of the front and rear frame parts 1, 2 substantially reduces the size of the scooter in collapsed condition. In this position, the scooter may be gripped by the hand grip 21 between the handle bars 17, in order to incline the collapsed scooter forwardly so as to roll the collapsed scooter on one or two wheels in order to displace it in a comfortable manner.

If the rear wheel transmission 6 is provided with a free wheel clutch that allows for free forward and reverse rotation of the rear wheel when the motor is not engaged it is possible to roll the scooter on two wheels. The centre of gravity of the scooter will be chosen such that in this collapsed position the centre of gravity is substantially between the front and rear wheels 4, 7 in lateral direction. The scooter will then show a stable behaviour when the scooter is rolled on its two wheels.

If the scooter is not provided with such a free wheel clutch in the transmission, rolling of the scooter in the collapsed position can be allowed by ensuring that in the inclined position of the scooter it is resting on the front wheel 4 only. This can be accomplished by allowing the front wheel 4 to project slightly beyond the rear wheel (in forward direction) in the collapsed condition so that the axles of the wheels 4, 7 are out of alignment. The scooter will then be resting on two wheels when the scooter is resting on its stand 27, but in the forwardly inclined position, the scooter will be resting on the projecting front wheel 4 only. Another way of obtaining the situation that the collapsed and forwardly tilted scooter is resting on its front wheel only is by selecting the position of the rotary axis and the spring characteristic of the front and rear wheel suspension 15, 5 properly, so that the front wheel

projects downwardly beyond the rear wheel. The spring characteristics are preferably such that both wheels 4, 7 are resting on the ground when the scooter is loaded in collapsed position, especially when a person uses the collapsed scooter as a seat. This promotes stability of the scooter during this use.

In this embodiment, the centre of gravity should be offset more towards the front wheel 4 in the collapsed position of the scooter. This positioning of the centre of gravity in the collapsed position may cause the centre of gravity to be offset with respect to the centre line of the scooter in the position of use, but this will hardly be a problem, because the user has a much larger weight than the weight of the scooter, so that the user mainly determines the total centre of gravity, and not the scooter itself. In the embodiment shown, the scooter may have a weight between 12 and 20 kilograms.

From the foregoing it will be clear that the invention provides a means of transport which looks like the very popular scooter but allows compact folding of the scooter and thereby making the scooter very useful in a mixed transport of individuals.

The invention is not limited to the embodiment shown in the drawings and described above and may be varied in different manners within the scope of the appended claims. Furthermore, the scooter will comprise parts not described and/or shown in order to meet the respective legal requirements. These requirements may differ from country to country, and include brakes, lighting, licence plates etc.

CLAIMS

1. Motorized foldable scooter having a frame, at least a front and rear wheel connected to the frame, a seat supported by the frame, a steering arrangement for the front wheel, and a motor, preferably an electric motor, driving the rear wheel through a transmission, the frame having at least front and rear frame parts movably connected through a substantially vertical rotary axis to move the frame parts between an extended position of use and a collapsed resting position, **characterized in that** the steering arrangement and the seat, and/or the front and rear frame parts are shaped such with respect to each other and the rotary axis that they at least partly nest in lateral direction of the scooter when the frame parts are in the collapsed resting position.

2. Scooter according to claim 1, wherein the scooter has one or more of the following features: the scooter having a foot rest between the seat and the steering arrangement on the front frame part, the rotary axis being positioned adjacent this foot rest and a portion of the foot rest being below the rear frame part in the collapsed position of the frame parts; the front and rear wheel are suspended to the frame through a suspension which is positioned on one side of the wheel only which is facing away from the folding direction; the wheels being parallel to each other in the collapsed position; the seat being provided on a box-shaped housing containing the motor; the steering arrangement having handle bars arranged on a handle bar support connecting the handle bars to the wheel suspension, said handle bar support being flat in longitudinal direction of the scooter and fitting behind the box-shaped housing in the collapsed position; the rotary axis being positioned outside the longitudinal centre line of the scooter, while the motor and accumulator are positioned such that in the collapsed position the centre of gravity in lateral direction is positioned substantially between the wheels; and the scooter having a stand which is attached to the rear frame part.

3. Scooter according to claim 1 or 2, wherein the seat is substantially flat and rectangular and provides a comfortable seat, also in the collapsed position.

4. Scooter according to any one of the preceding claims, wherein the steering arrangement is provided with a locking device, locking the steering arrangement in a central position to facilitate collapsing, the handle bars of the steering arrangement being preferably adjustable up and down, and the locking arrangement being preferably actuated by an up and down movement of the handle bars.

5. Scooter according to one of the preceding claims, wherein either the transmission of the driven rear wheel has a freewheel clutch that allows for free forward and reverse rotation of the rear wheel when the motor is not engaged, or the front and rear wheels being slightly out of alignment in the collapsed and forwardly tilted position of the scooter such that the axis of the front wheel is spaced a small distance from the axis of the rear wheel and thus the collapsed scooter is resting on the front wheel only, the steering arrangement having a grip between the handle bars in the collapsed position of the scooter.

6. Scooter according to one of the preceding claims, wherein the axes of the wheels are aligned in the collapsed position of the wheels, the wheels having wheel axles including snap locks to lock the wheels and thereby the frame parts in the collapsed position of the scooter.

7. Scooter according to one of the preceding claims, wherein the transmission includes two endless transmission elements, such as belts or chains, which are arranged in series and each connect transmission wheels of different diameters.

8. Scooter according to one of the preceding claims, wherein each wheel is provided with a mudguard, the mudguards being dimensioned and arranged such that they are free from an overlap in circumferential direction when the scooter is in the collapsed position.

9. Scooter according to one of the preceding claims, wherein the rear frame part comprises a hand grip behind the seat, an actuating member for actuating a lock of the rotary axis being arranged below the grip.

10. Scooter according to one of the preceding claims, wherein a portion of the motor to be cooled is exposed

to the side of the scooter and wherein, in the collapsed position of the scooter, the front frame part is positioned adjacent to this motor portion and projects sideways away from the motor portion.

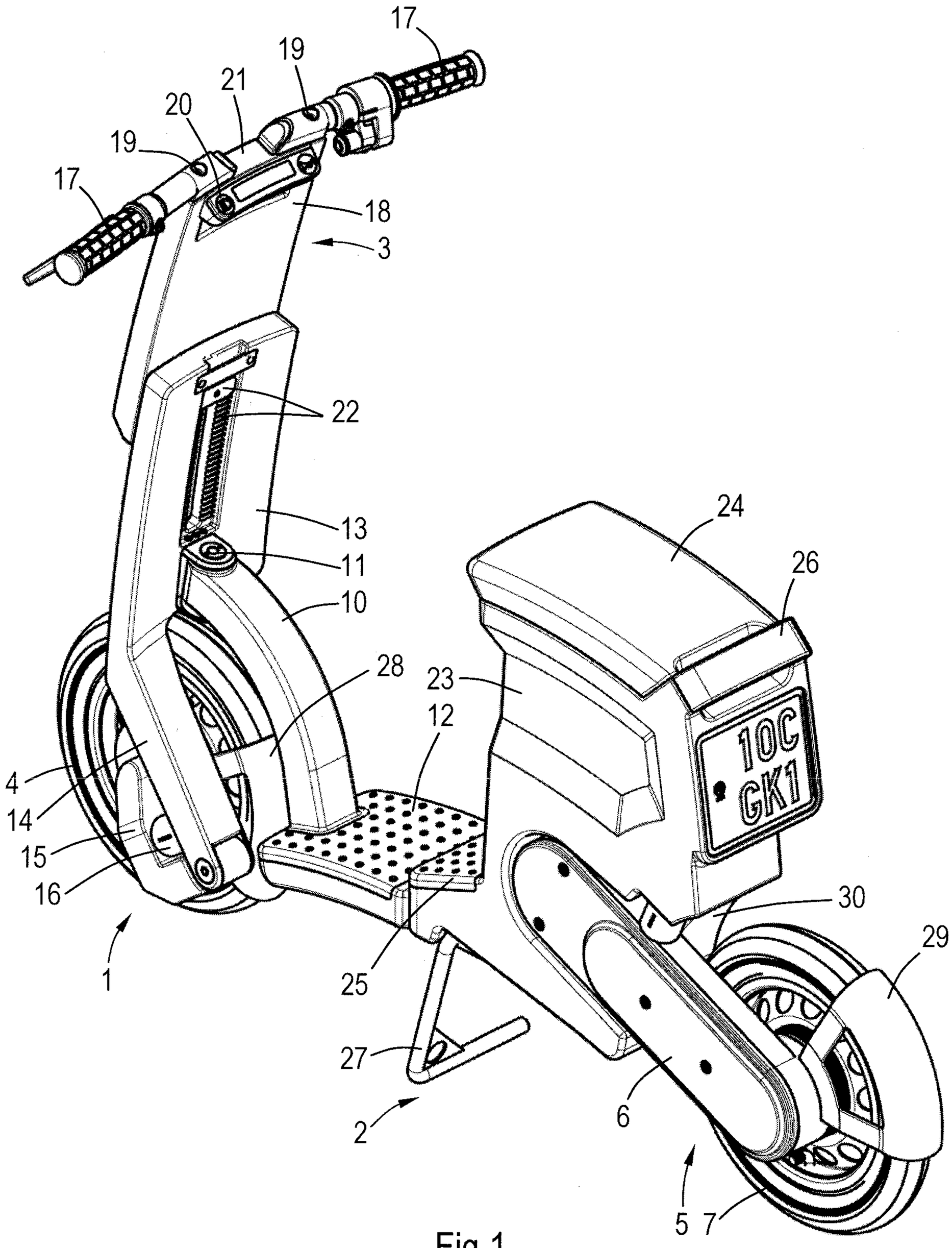
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Fig.1

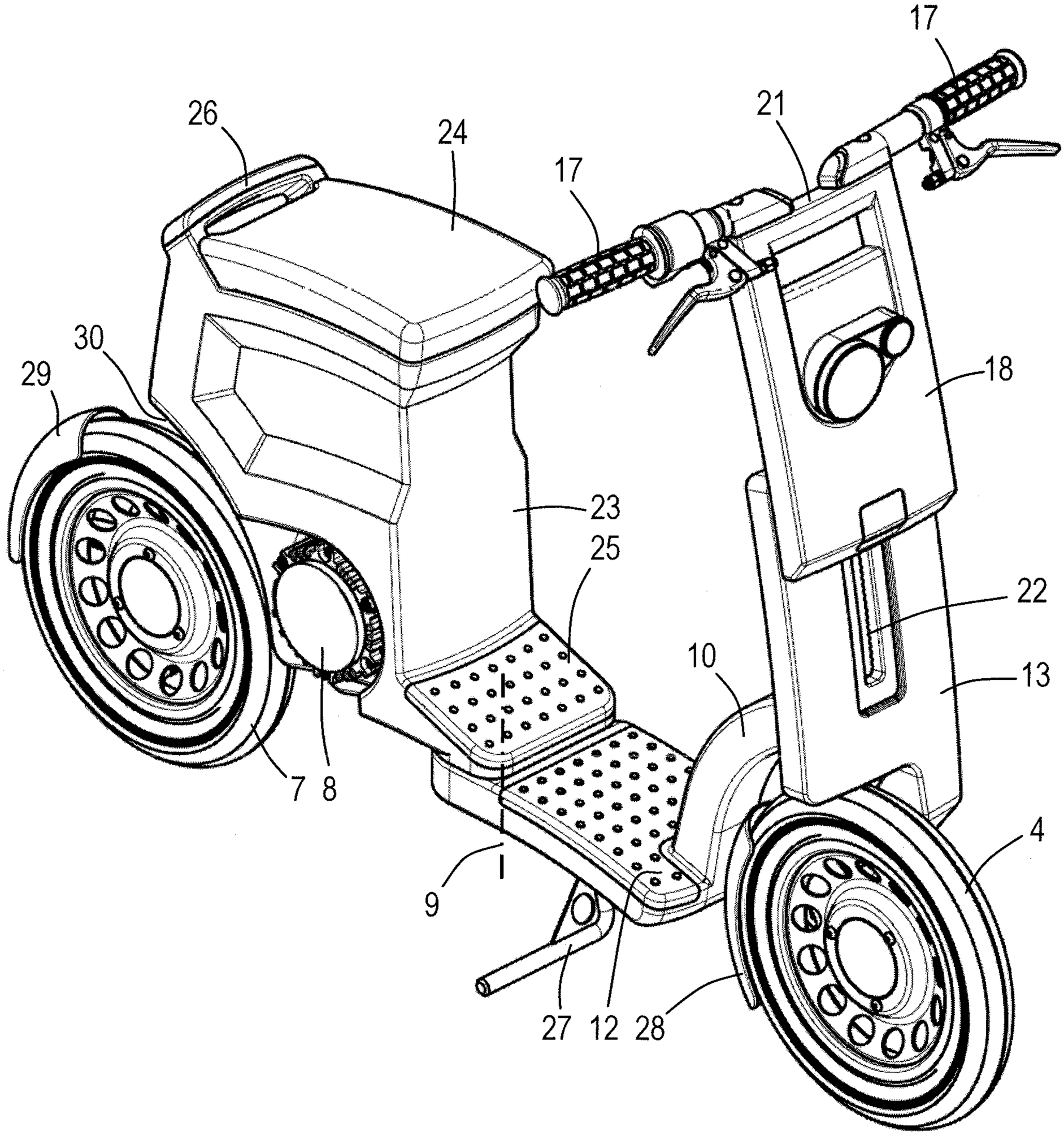

Fig.2

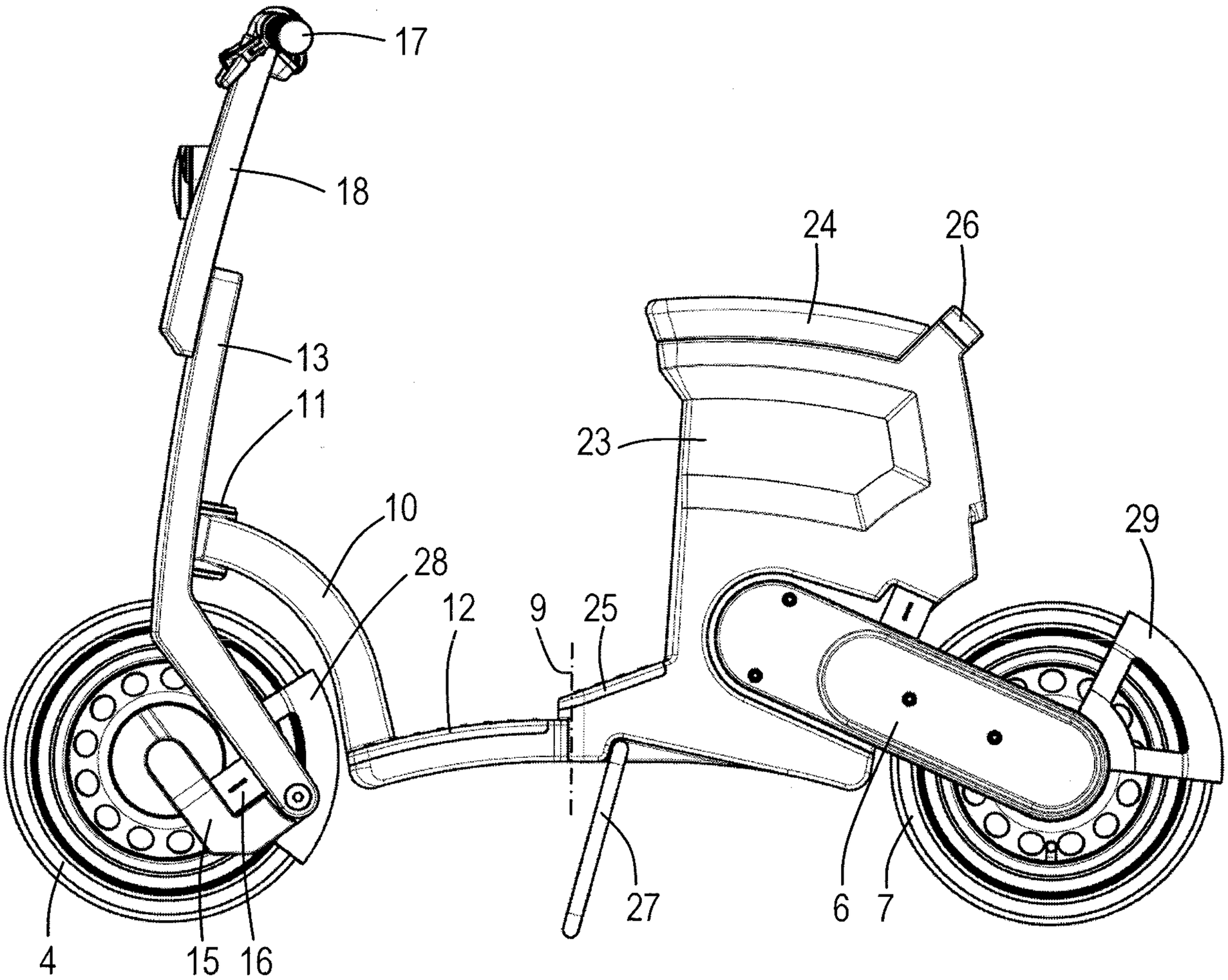

Fig.3

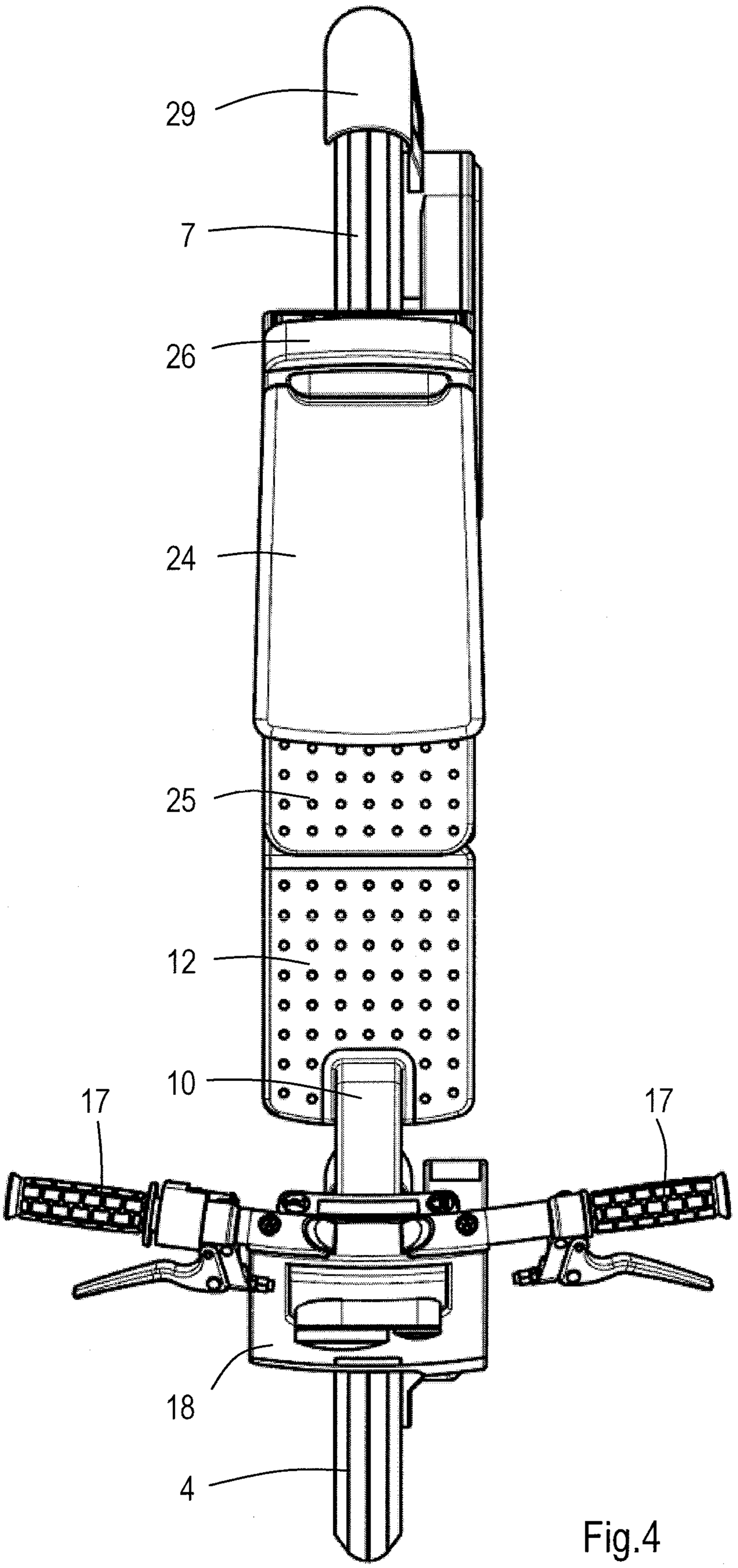

Fig.4

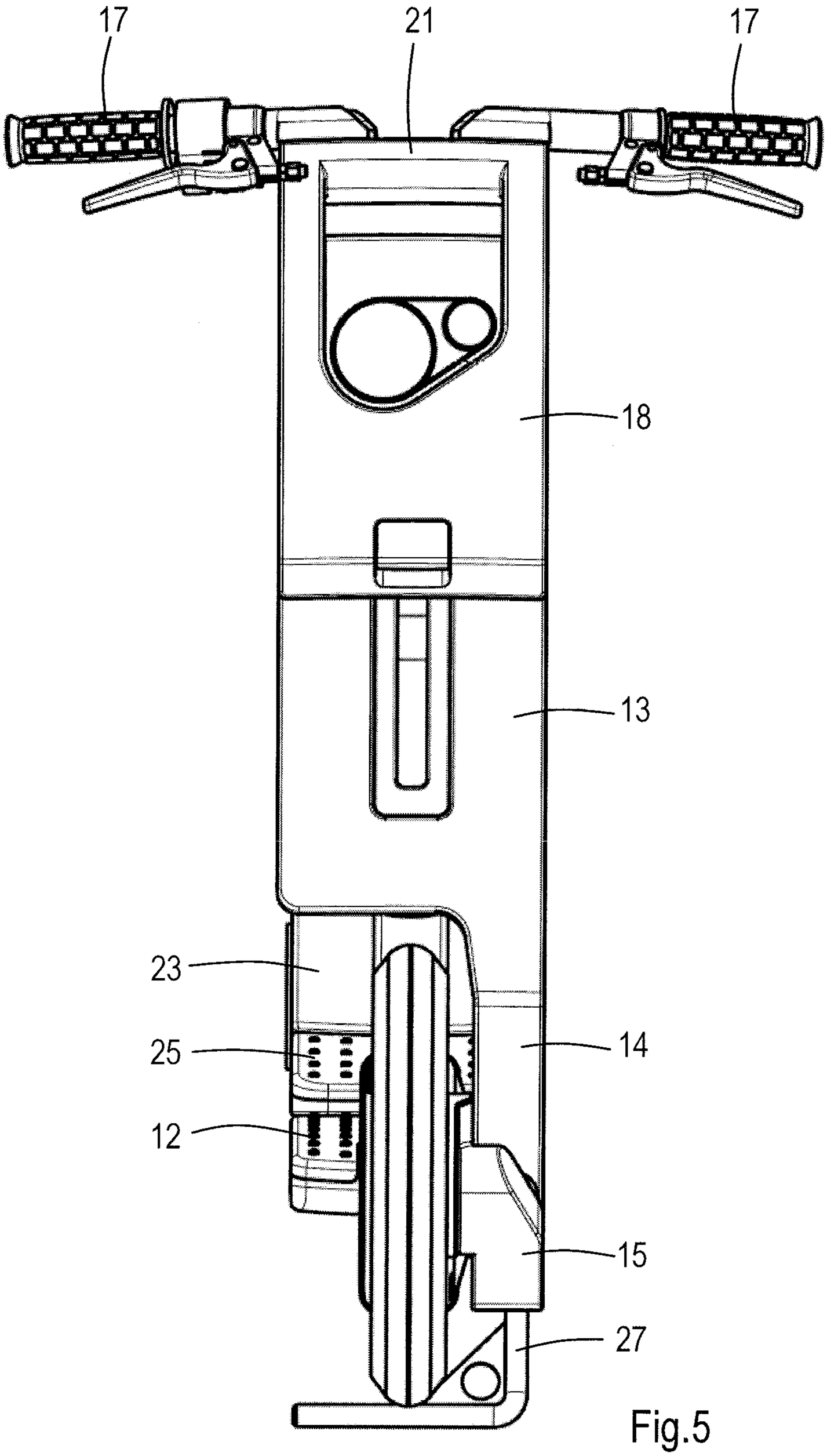

Fig.5

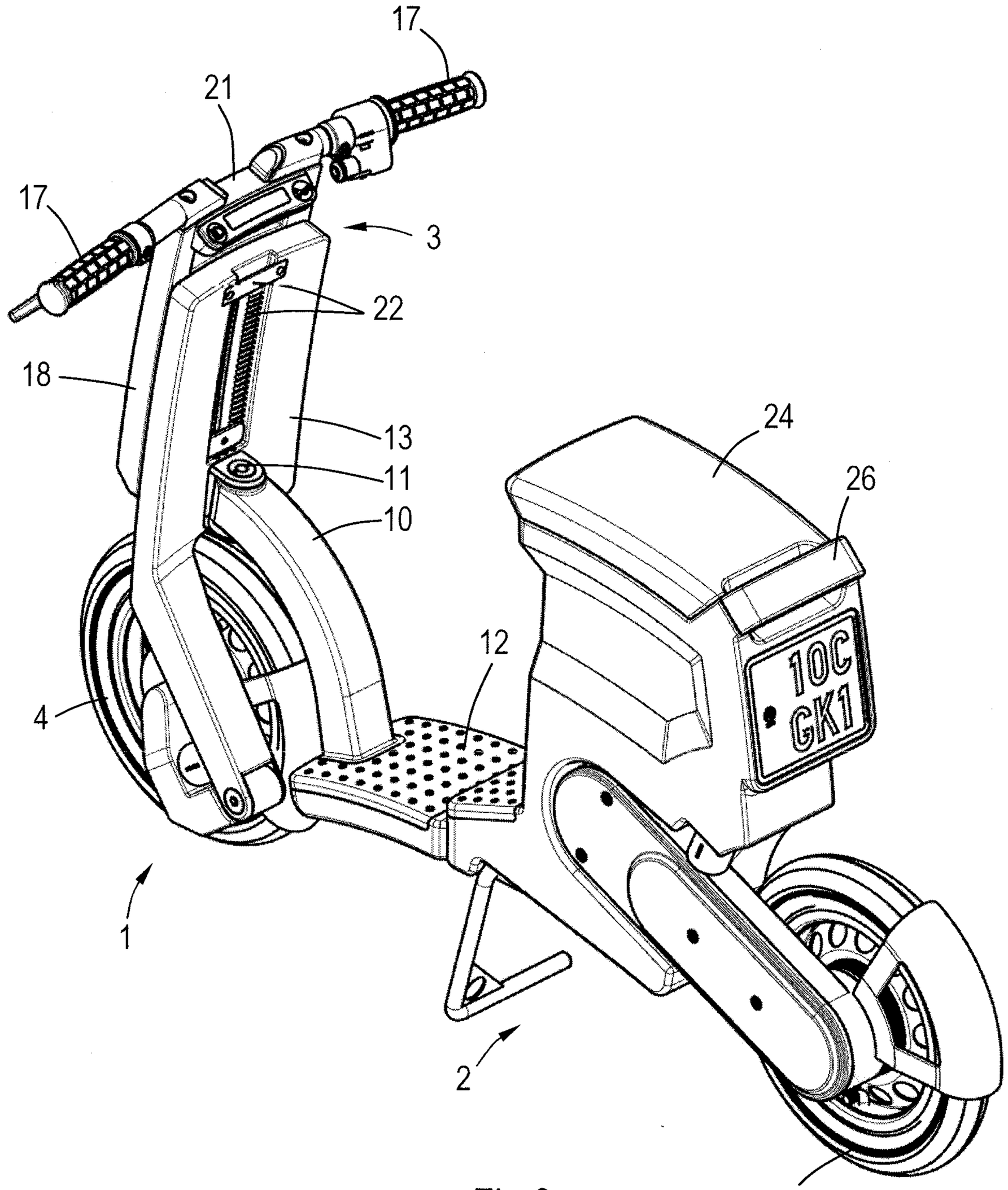

Fig.6

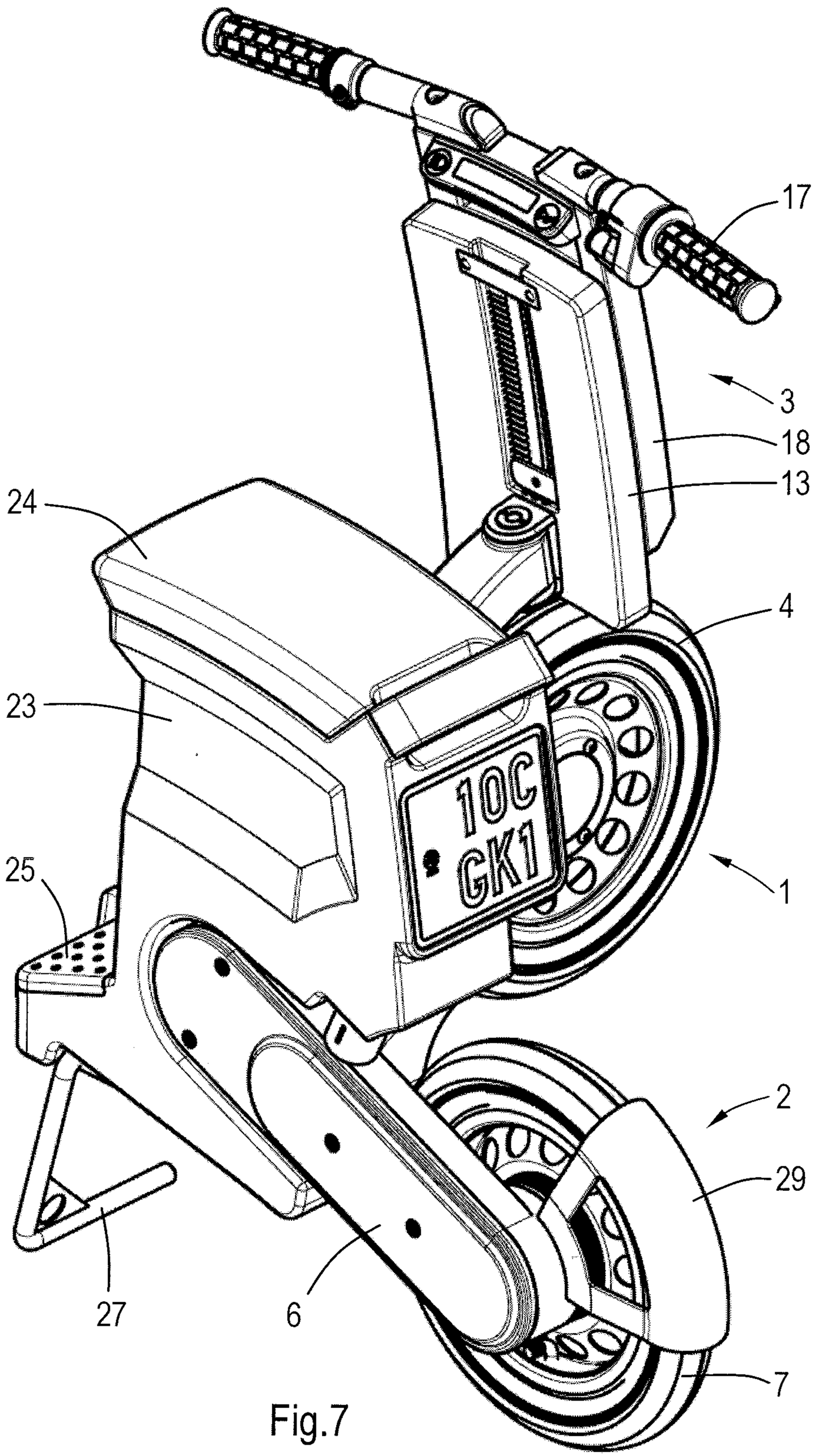

Fig.7

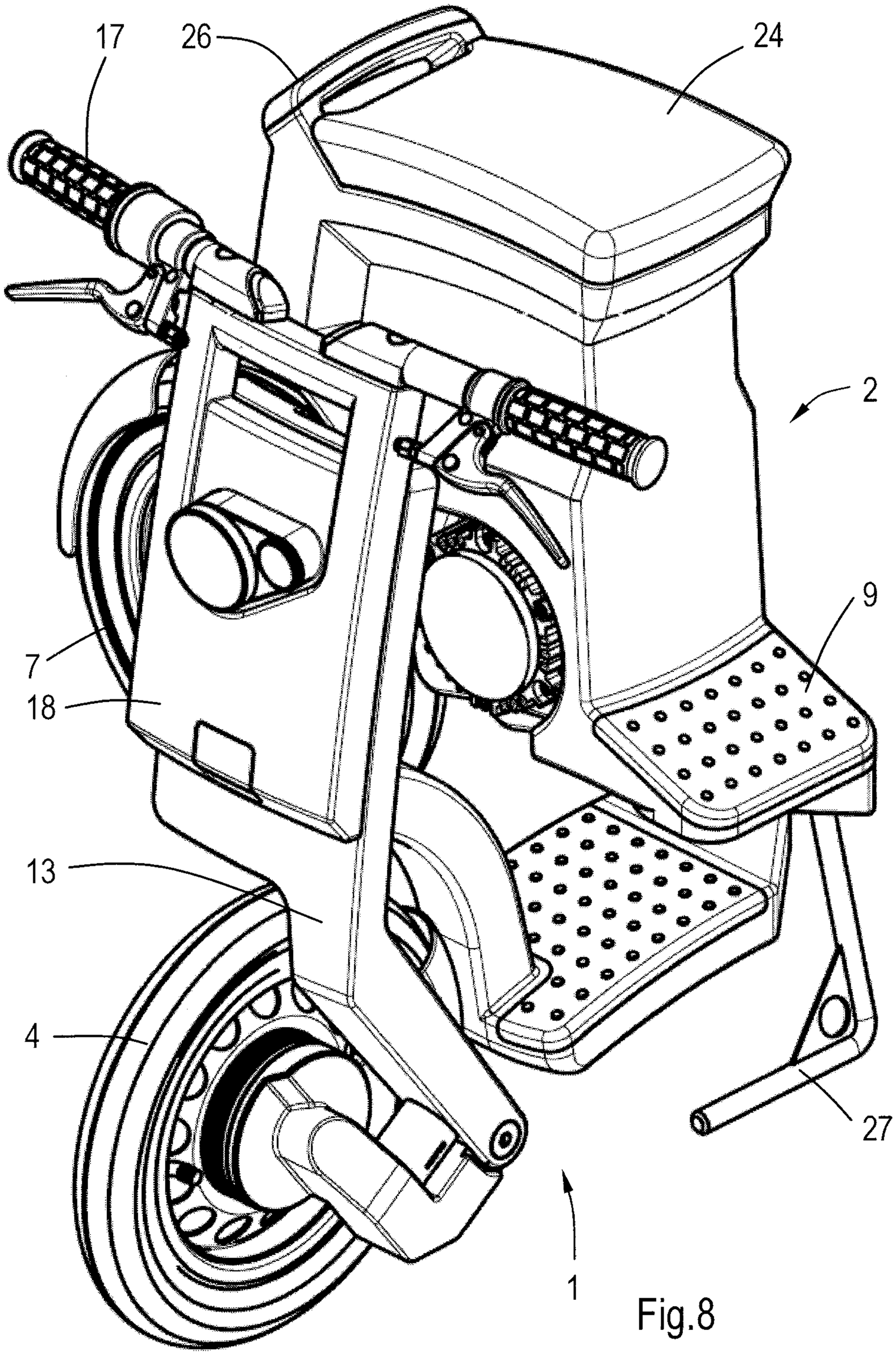

Fig.8

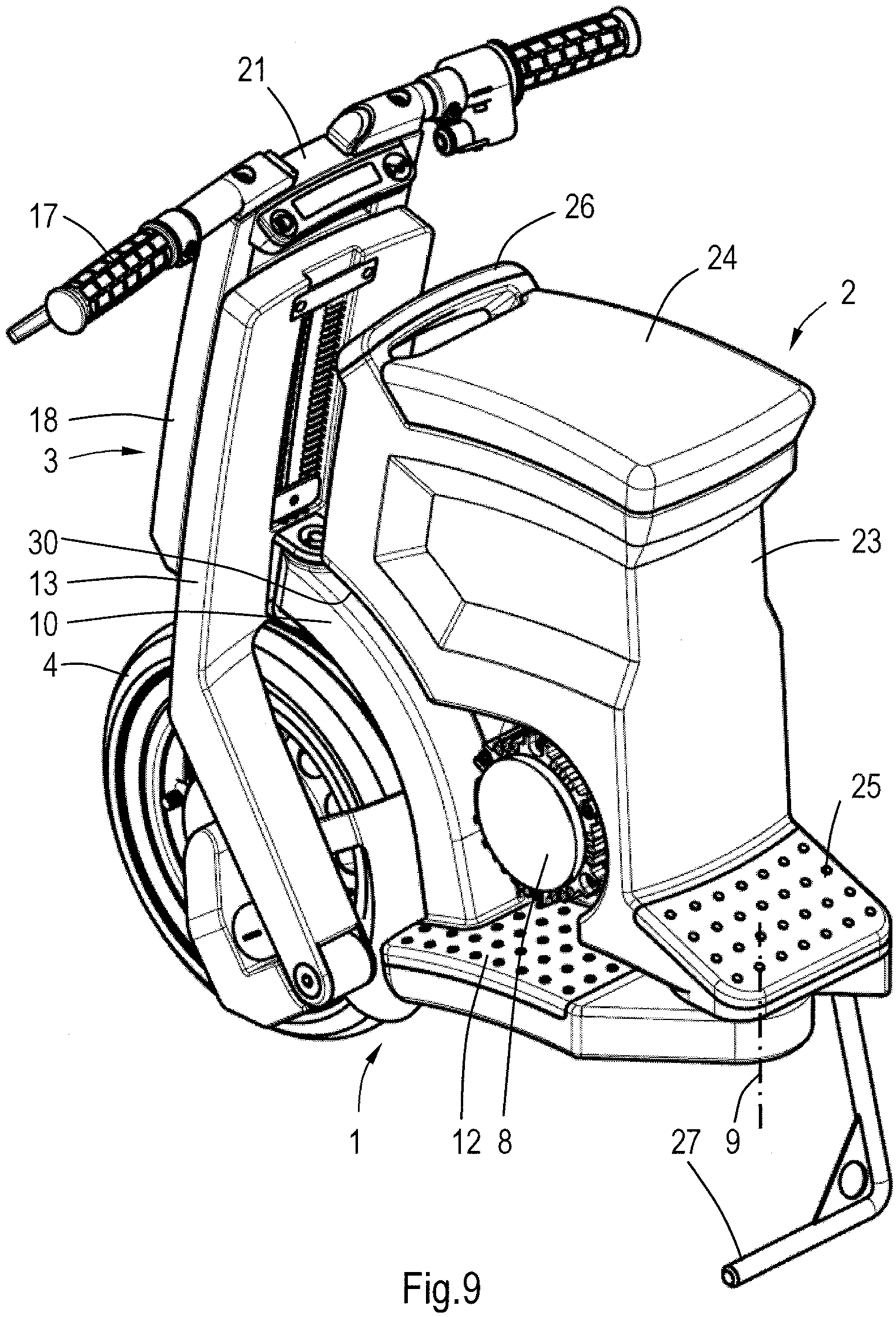

Fig.9

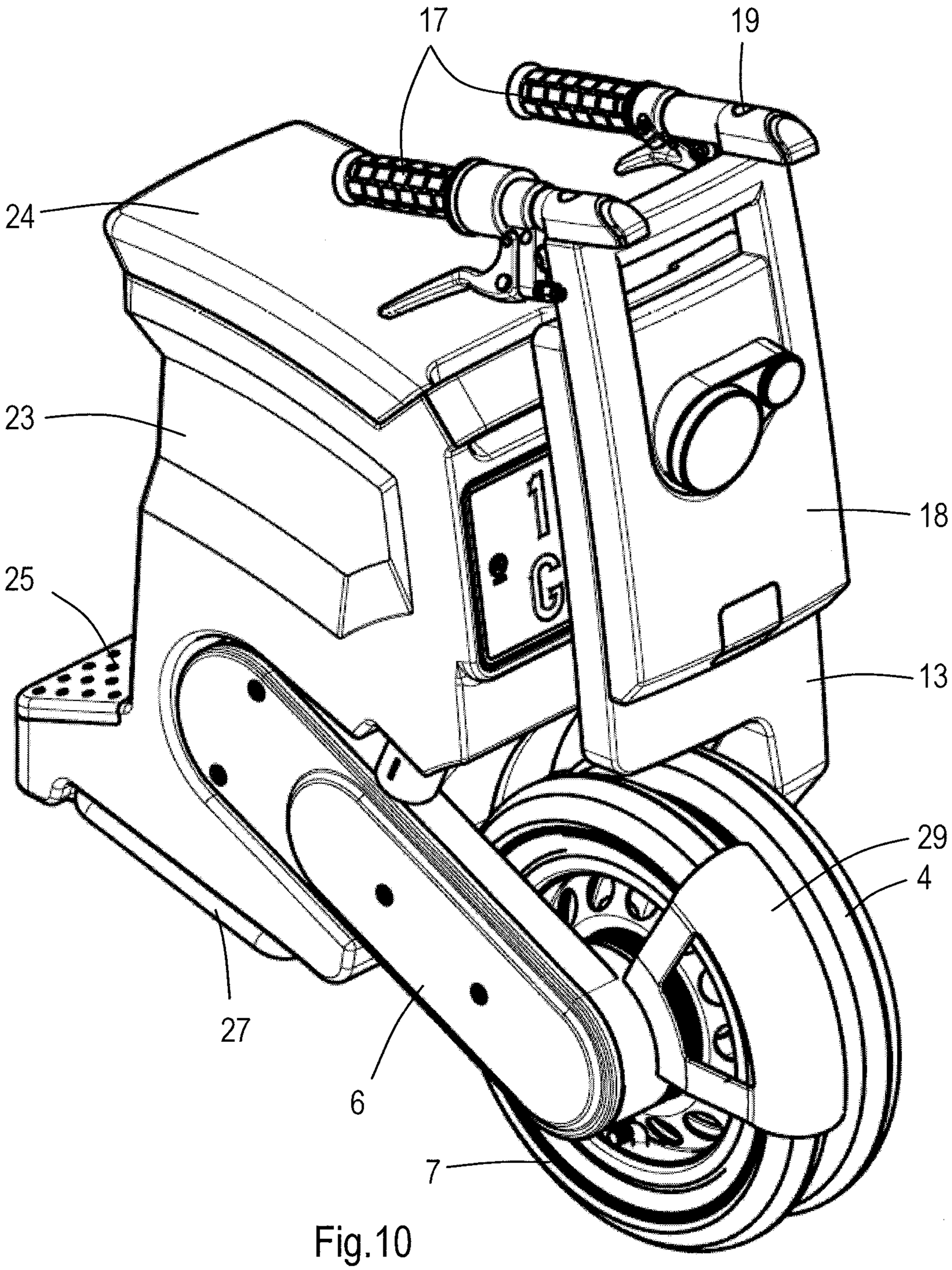

Fig.10

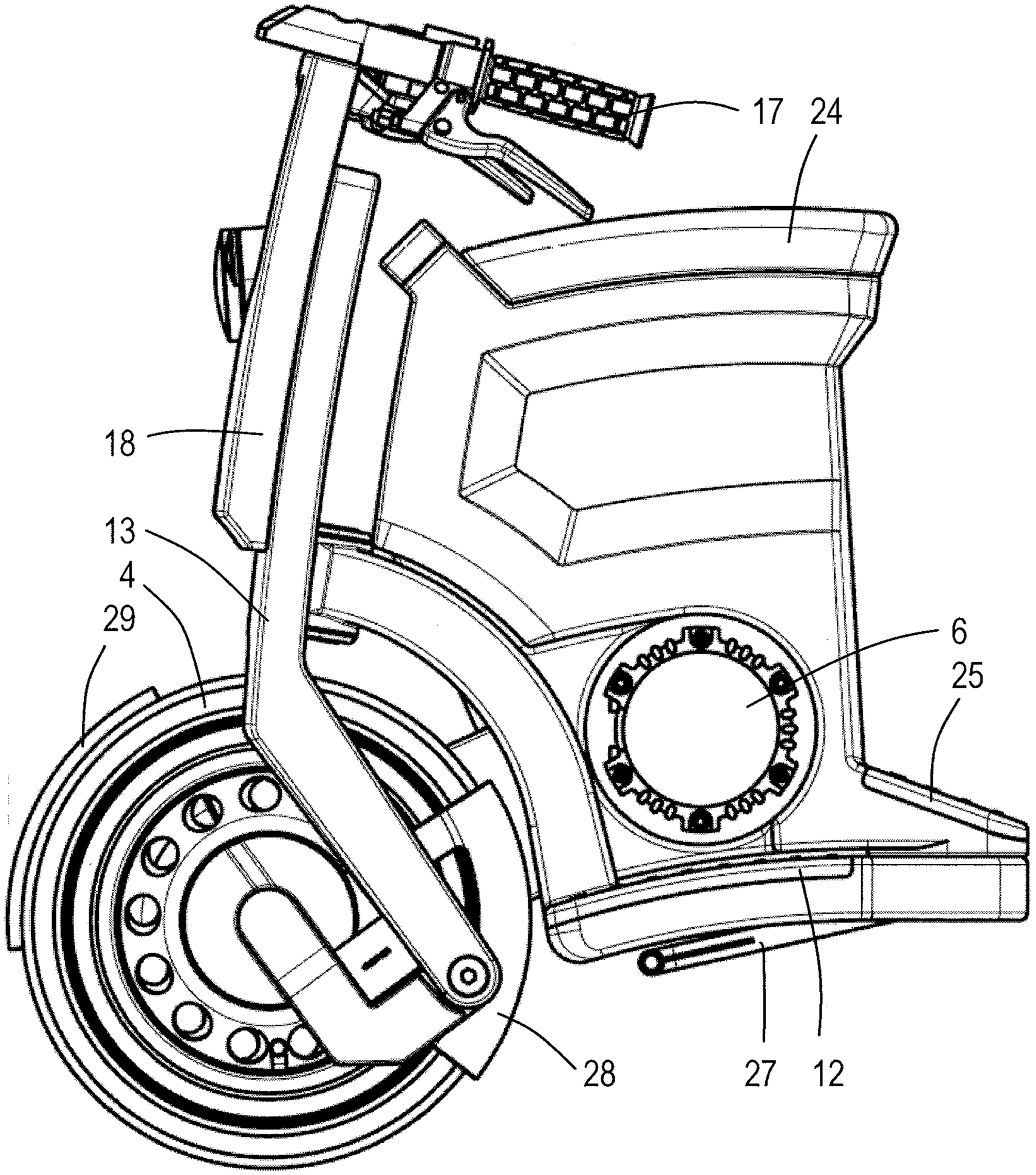

Fig.11

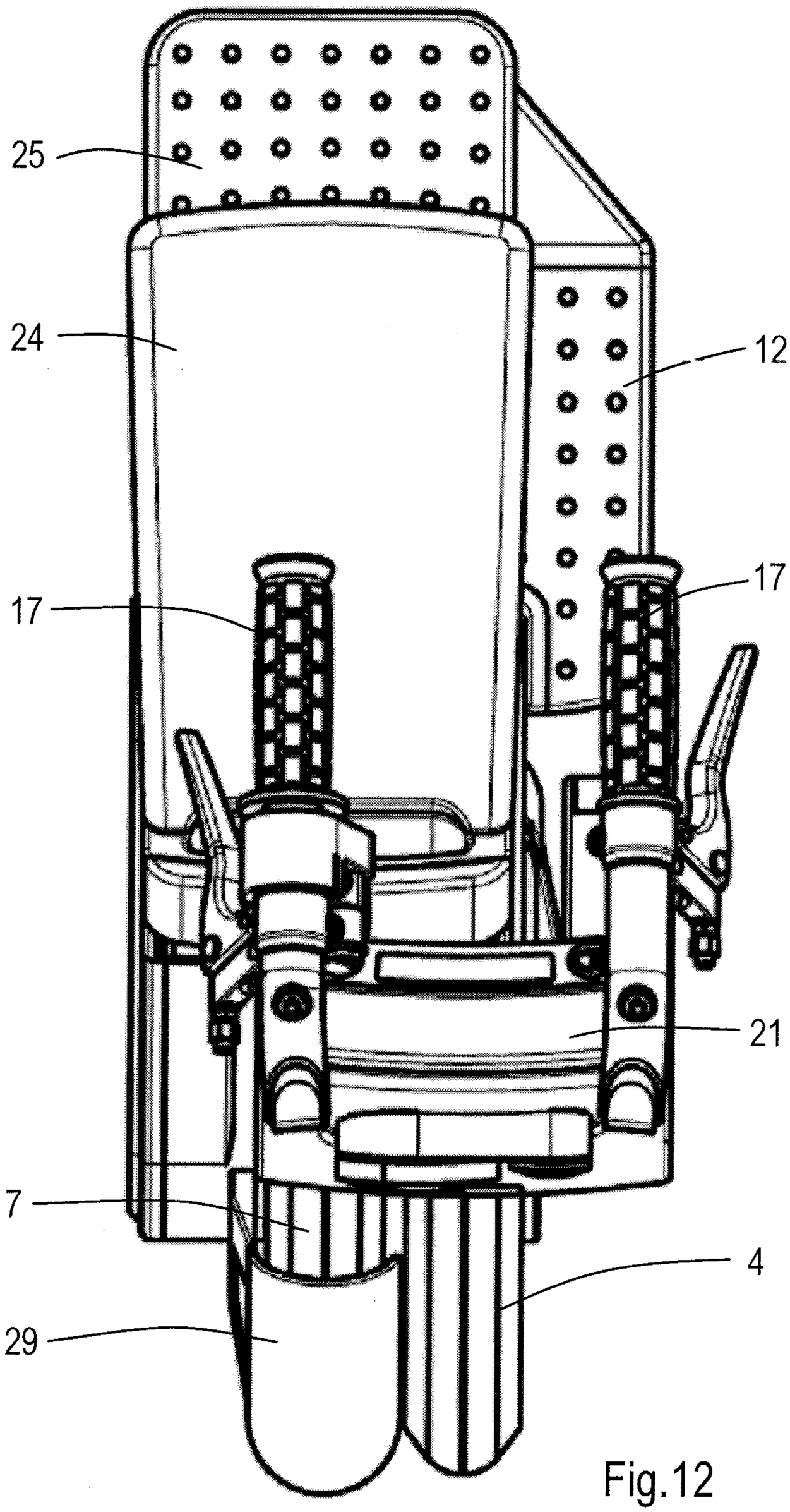

Fig.12

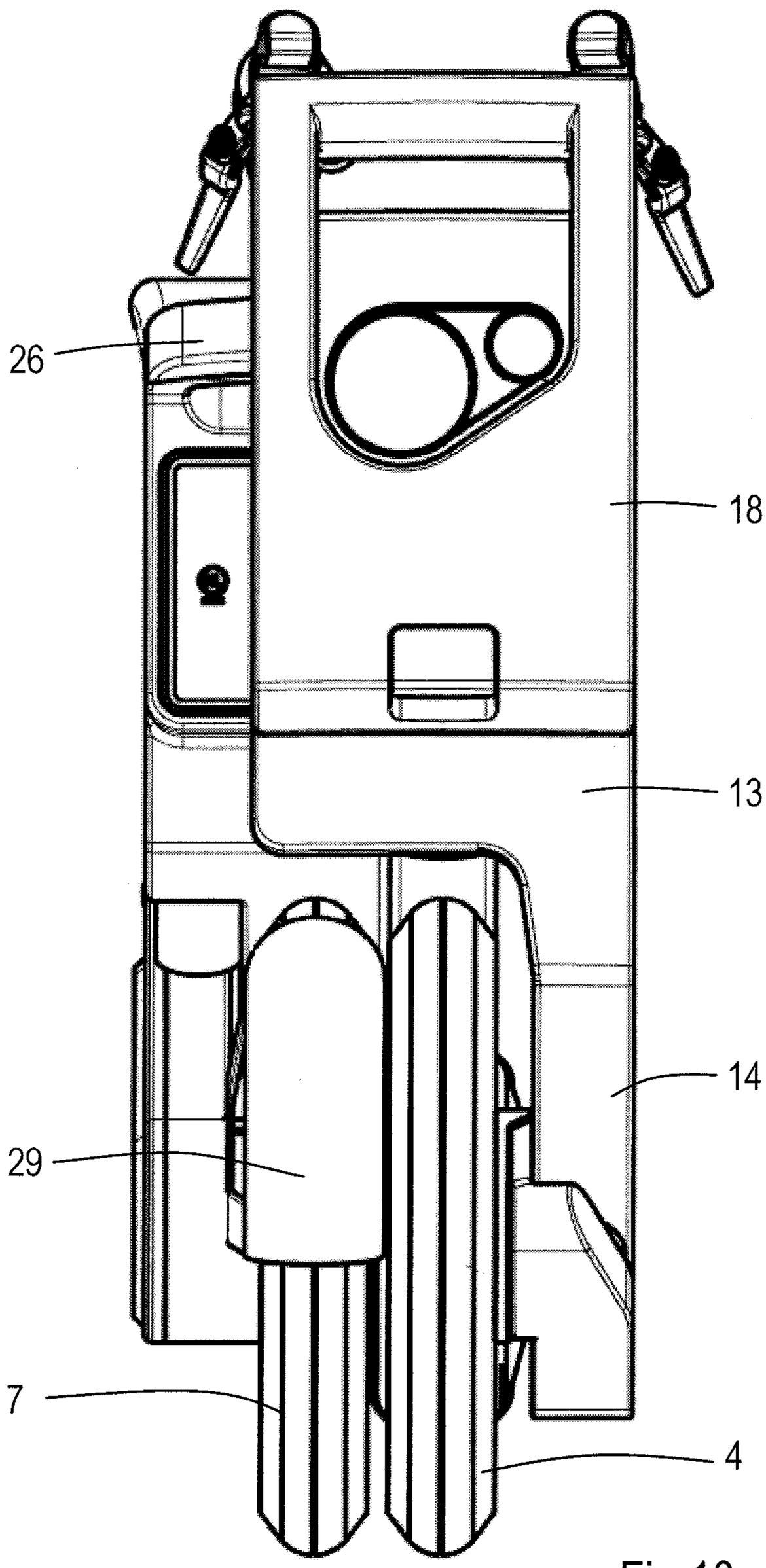

Fig.13

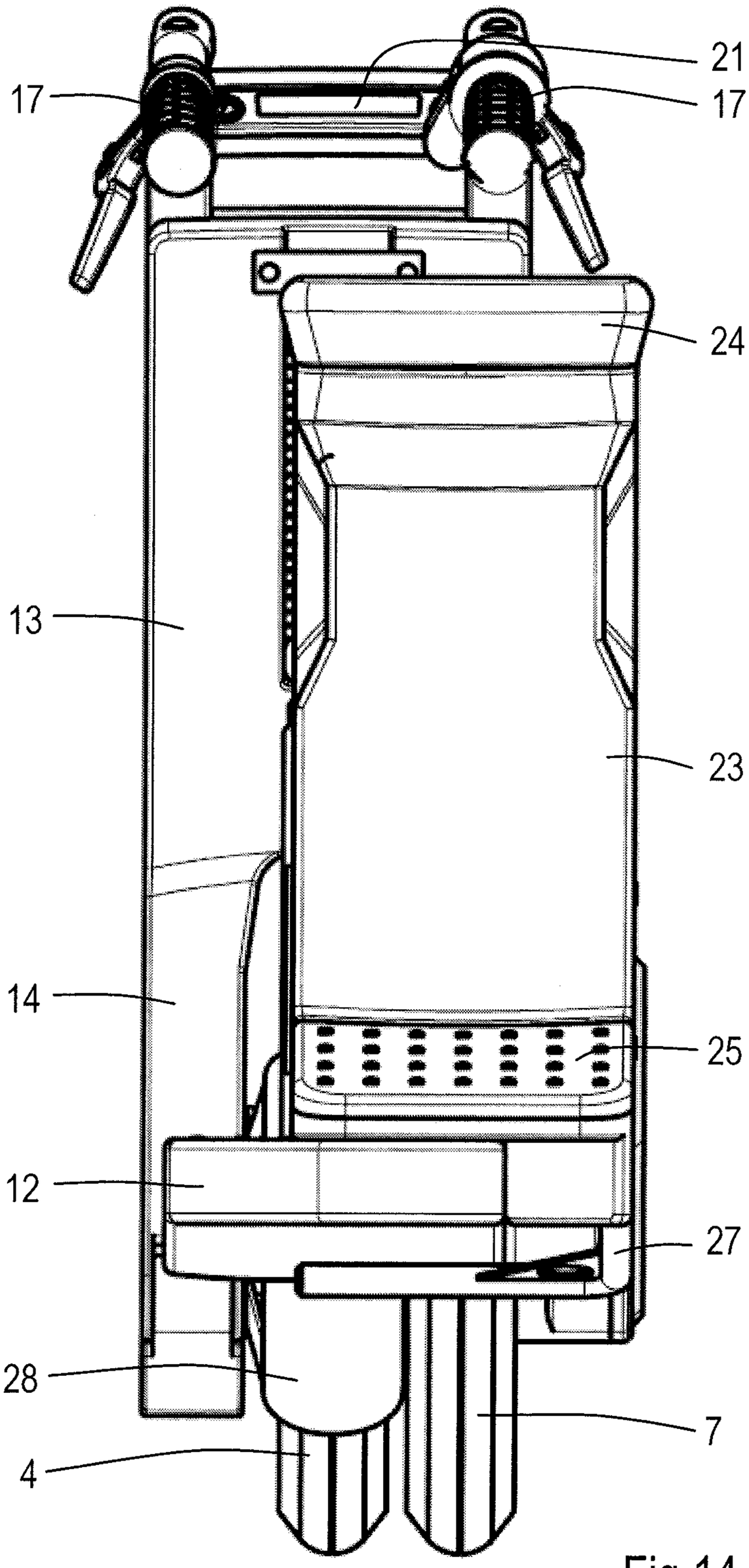

Fig.14

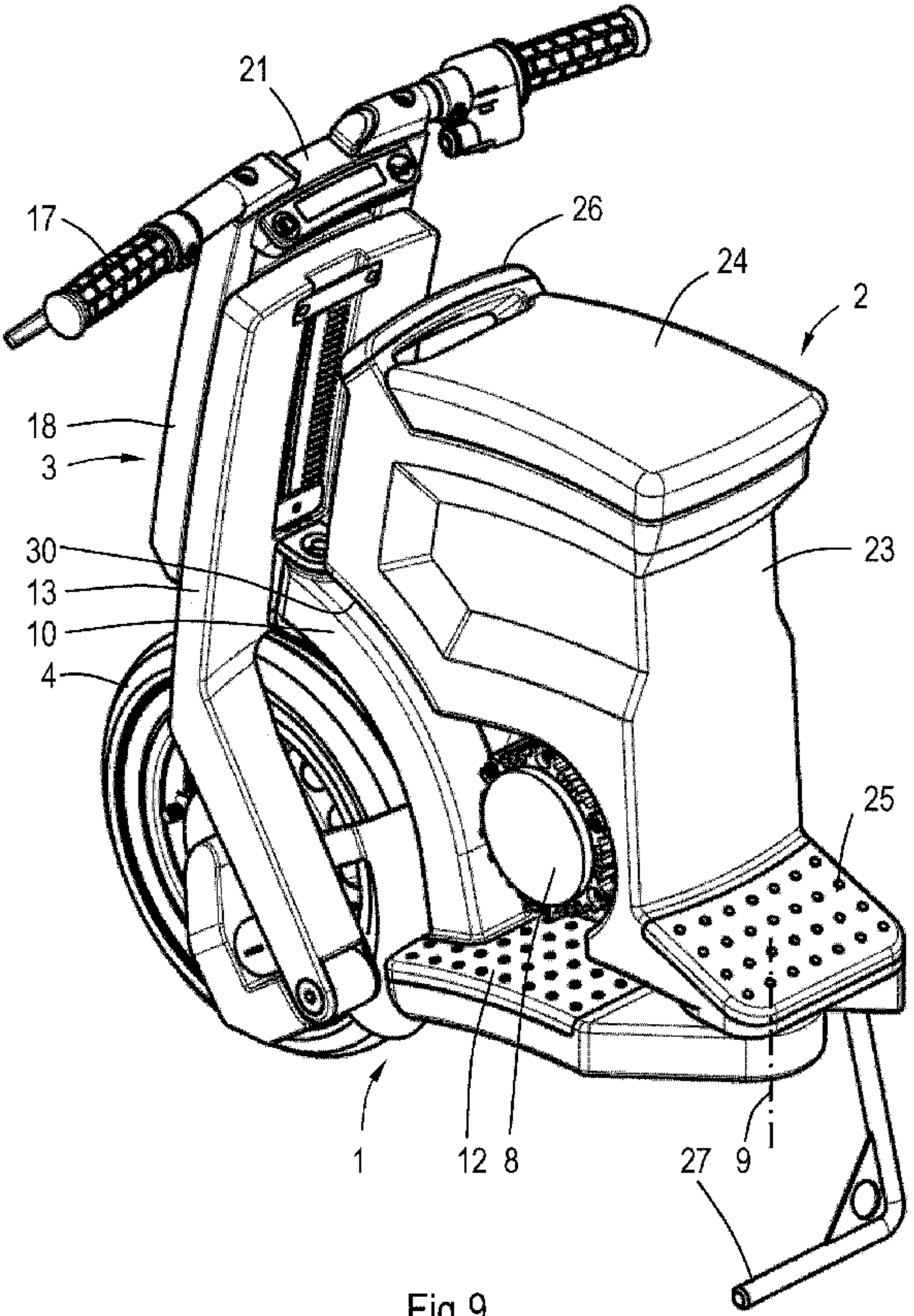

Fig.9