

A folding scooter and a method of folding the folding scooterField of the Invention

The invention relates to two-wheeled vehicles, in particular scooters. Scooter primarily refers to an electric scooter, but also a normal scooter.

Background of the Invention

In recent years, two-wheeled vehicles, in particular scooters, have started to be used instead of public transport. These two-wheeled vehicles are often a more efficient solution to user's need for transport from place to place than public transport; however, scooters have their own disadvantages. These disadvantages include the inability to fold a scooter, especially when transporting the scooter by car or public transport, but also when storing it at home or at the workplace.

Folding scooters that can be folded down to a smaller size for transport or storage seek to address the above disadvantage with several folding options already published.

The common disadvantages of known folding scooters are usually the narrow deck and the small size of the wheels. The narrow deck makes it more difficult for the user to maintain stability on the scooter. At the same time, the low stability of the scooter is often affected by the small wheels, which are not very stable, especially on rough or uneven surfaces.

An example of a possible solution for the folding scooter is given in document EP 3 103 712, which describes a scooter having three mechanical joints for folding the scooter, where two of the mechanical joints are at the ends of the deck and the third mechanical joint is arranged in the middle of the deck to shorten the wheelbase of the scooter. However, a disadvantage of such a solution for the folding scooter is that the scooter still takes up a large amount of space when folded and it is difficult to easily carry the scooter folded in this way.

Another known solution for the folding scooter is the invention according to document US 2017/0 073 032. The folding scooter has two mechanical joints, where the first mechanical joint is arranged between the front wheel and the deck, and the second mechanical joint is arranged between the deck and the rear wheel. In the folded state of the folding scooter, the wheels are placed on the deck so that the scooter is shortened in the folded state, but when viewed from above the scooter remains wide and is difficult to handle.

The above disadvantages have been partially eliminated by the invention of US 9 187 144, which presents a folding scooter with two mechanical joints. The front mechanical joint allows the front wheel frame to rotate relative to the middle frame of the deck. The rear mechanical joint allows rotation of the middle frame relative to the rear wheel frame. The rear wheel is positioned under the deck in the folded state of the scooter and is folded with the deck towards the front wheel. This solution is not ideal, as the folding method requires a lot of handling, making it not simple and fast enough for the user. Also, this known solution does not allow the user to easily handle the folded scooter.

The object of the invention is therefore to provide a foldable scooter having a wide deck and large wheels to provide stability to the user when riding the scooter, and which can be easily converted from unfolded state for riding into folded state for transport and storage, requiring minimum space and allowing comfortable handling in the folded state.

Summary of the Invention

The stated object is solved by providing a folding scooter according to the invention described below.

For stable riding and comfortable handling, the folding scooter includes a front wheel frame that is fitted with folding handlebars to be folded to the front wheel in the folded state of the folding scooter for transport and storage, while in the unfolded state of the folding scooter the handlebars are used to steer the scooter. Furthermore, the folding scooter includes a middle frame fitted with a deck for the user to stand on while riding the folding scooter. And further,

the folding scooter includes a rear wheel frame, wherein the front frame and the rear frame are mechanically joined to the middle frame for converting the folding scooter from folded state into unfolded state for riding and back.

The essence of the invention is that the front frame is connected to the middle frame by a mechanical joint, and the rear frame is connected to the middle frame by a mechanical joint, wherein the mechanical joints of the front frame and the rear frame can be hinged to the sides of the folding scooter to bring the wheels to the middle frame in the folded state of the folding scooter. Preferably, the axles of the wheels are not aligned and do not interfere with the middle frame when the scooter is folded, so that the wheels can be folded very close to the frame, which contributes to the overall compactness of the folding scooter when folded.

In one of the embodiments, the middle frame is a drop frame with a horizontal part and a part raised above the horizontal part, with the deck being arranged to the horizontal part of the middle frame. At the same time, the front frame is connected to the middle frame at the end of the raised part of the middle frame and the rear frame is connected to the middle frame at the end of the horizontal part of the middle frame. This is advantageous because the drop middle frame, including the front and rear frame arrangement, allows large wheels to be used on the folding scooter at the front and rear. The larger wheels improve the rideability of the scooters.

In one of the possible preferred embodiments, the deck is foldable from the horizontal plane to the vertical plane, so that the deck in the horizontal plane is wide enough for the user of the folding scooter to stand comfortably and safely, while when folded vertically the wide deck reduces the width towards the sides of the scooter as if it were narrow and not folded. This is advantageous in the folded state of the scooter for storage and transport. At the same time, it is advantageous that the deck can be folded when guiding the scooter by the user to reduce the likelihood of the user's ankle touching the deck.

The advantages of the invented design of the folding scooter are that the scooter can be made of components suitable for stable and comfortable riding, i.e., it is provided with large wheels and a wide deck. At the same time, the scooter can be folded into the folded state for transport

and storage, in which the front and rear wheels are parallel to each other, while the wide deck, folded vertically, is located between them, so that the scooter does not take up unnecessarily much space, making it easier to carry the scooter in hand without interfering with the user's side. Moreover, folding the wheels to the sides of the folding scooter is easy and the likelihood of the user getting dirty is greatly reduced, compared to the known handling of folding scooters where the wheels fold under or above the deck. Furthermore, it is advantageous that the design of the scooter allows folding in such a way that the scooter in folded state is only as long as the length of the middle frame, which the folding designs referred to in the background of the invention do not allow.

In one embodiment of the invention of the folding scooter, it is advantageous if the deck comprises of two folding plates connected by a common hinge formed by the axis of rotation of the deck, wherein the axis of rotation lies in the horizontal part of the middle frame. The handling of the deck, similarly to the opening and closing of a book, is very easy and intuitive. In addition, this variant has no limits to the overall width of the deck. In another preferred embodiment, the plates may be foldable along two parallel axes of rotation.

Alternatively, in another embodiment of the invention of the folding scooter, it is advantageous if the deck comprises a single plate attached to at least one revolute joint for folding the plate between the horizontal plane and the vertical plane, with the revolute joint being attached to the horizontal part of the middle frame. By rotating the deck about the axis of the horizontal part of the middle frame, it is possible to reduce the overall width of the folding scooter for its folded state for transport and storage.

In a preferred embodiment of the invention, it is preferred that the rear frame is provided with a removable seat with fixed or telescopic seat post. Some users like to use a seat on scooters, especially when going downhill, and it is essential for riding while sitting to keep the scooter stable, which the folding scooter with the design according to the above invention fully satisfies.

Preferably, the wheels of the folding scooter have a rim diameter of at least 0.4 m, more preferably 0.5 m, which corresponds to the wheels conventionally referred to as 20-inch wheels.

Wheels of 20" or more are considered by the professional public to be already stable when riding over uneven terrain.

Preferably, the deck of the folding scooter has an average width of at least 0.2 m. This or a greater width are already considered comfortable and safe enough to stand with both feet on the deck of the folding scooter.

It is advantageous if the folding scooter is designed as an electric scooter that is equipped with an electric drive unit and an electric power source. The electric drive turns the invented folding scooter into a universal means of transport which can be stored well in the folded state, e.g. in the office, at home, in the trunk of a passenger car, in parking lots, etc.

In addition, the invention includes a method of converting the folding scooter made according to the above invention from folded state for riding into folded state for transport and storage.

The essence of the invented method consists in first unlocking the mechanical joints and then folding the front frame with the wheel to one of the sides of the middle frame with the folded deck and folding the rear frame to the other of the side of the middle frame with the folded deck. This is advantageous in that folding to the sides of the middle frame is easy to accomplish with the folding scooter on the ground, has little risk of the user getting dirty, and that the folded folding scooter is a compact body.

In one embodiment of the method according to the invention, before the mechanical joints are unlocked, the folding handlebars are first folded next to the front frame with the front wheel and the middle frame deck is folded from the horizontal plane to the vertical plane. This is an important step to ensure that the wide deck does not interfere, and the folding scooter is a compact body when folded. In some cases, the handlebars do not have to be folded, e.g. the folded scooter can be guided by the handlebars.

It is advantageous if the deck is folded from the horizontal plane to the vertical plane like the cover of a book. This folding like closing an open book saves a lot of space and allows the deck to be wide.

Alternatively, it is advantageous if the deck is folded from the horizontal plane to the vertical plane by rotating it around the horizontal part of the middle frame. Rotation about the axis also saves a lot of space to make the invented folded scooter a compact body.

Preferably, after folding the folding handlebars and folding the deck, the seat, if the scooter is fitted with one, with a fixed or telescopic seat post is partially retracted downwards in the direction of the rear frame. The retraction of the seat post shortens the seat post and the seat does not protrude so that the compactness of the body of the folded scooter according to the invention is not compromised.

The advantages of the invention may include the excellent rideability of the folding scooter according to the invention, although for a folding scooter its rideability is usually limited by its ability to fold. The excellent rideability allows the safe use of the seat. The folding scooter according to the invention can be folded into a compact body, and in the folded state there is nothing protruding from the compact body that would force the carrying user to lean excessively to the side to avoid contact between his/her side and the folded folding scooter, so that transport of the scooter according to the invention in the folded state is comfortable. Moreover, the conversion of the folding scooter from the unfolded state for riding into the folded state for transport and storage is a very trivial action, thanks to the folding of the front and rear frames to the sides of the folding scooter, in which the user does not strain himself/herself and there is little chance of getting dirty. A side advantage of the folding scooter according to the invention is that it allows the use of large bicycle wheels, making it cheaper to manufacture and service than scooters requiring specifically sized scooter wheels.

Explanation of drawings

The present invention will be explained in detail by means of the following figures where:

- Fig. 1 shows an axonometric view of a folding scooter without a seat according to the invention in an unfolded state for riding,
Fig. 2 shows a side view of a folding scooter as shown in Fig. 1,
Fig. 3 shows an axonometric view of a folding scooter with a seat according to the invention in an unfolded state for riding,
Fig. 4 shows an axonometric view of a folding scooter as shown in Fig. 3 with folded handlebars and folded deck,
Fig. 5 shows an axonometric view of a folding scooter as shown in Fig. 3 with unlocked mechanical joints and wheels folded on the sides of the folding scooter,
Fig. 6 shows an axonometric view of a folding scooter as shown in Fig. 3 in a folded state,
Fig. 7 shows a top view of a folding scooter in a folded state as shown in Fig. 6.

Examples of the invention embodiments

It shall be understood that the specific cases of the invention embodiments described and depicted below are provided for illustration purposes only and do not limit the invention to the examples provided here. Experienced professionals will be able to find or, based on routine experiment, will be able to provide a greater or lesser number of equivalents to the specific embodiments of the invention which are described here.

A possible example of the embodiment of a folding scooter is shown in Fig. 1. The folding scooter is of a standard scooter concept, i.e., it comprises a front frame 1 with a single front wheel, handlebars 2 arranged to the front frame 1 having conventional two handles for gripping by hand of the user of the scooter according to the invention, a rear frame 5 with a single rear wheel, and further a middle frame 3 for carrying a deck 4 for the user of the folding scooter to stand on.

An expert knows that scooters are usually fitted with accessories such as brakes, reflectors, fenders, etc. These accessories are not illustrated for illustration of the embodiment, as they do not have a significant effect on the folding and unfolding of the folding scooter according to the invention, but the presence of at least some of them is assumed on the scooter according to the invention.

The front frame 1, the middle frame 3 and the rear frame 5 are made of light alloy profiles, such as duralumin, or only aluminium, or composite materials. The wheels are a standard catalogue article. The deck 4 is made of the same material as the rest of the split frame of the folding scooter and has an anti-slip surface finish.

The middle frame 3 in the illustrated embodiment is a drop frame and has a horizontal part and a raised part, so that it is similar in shape to the letter L. In another embodiment, it may not be the drop frame. The horizontal part of the middle frame 3 has a deck 4 attached to it, which may be fixed or foldable. In the illustrated embodiment, it is foldable and is split in half along the axis of the horizontal part of the middle frame 3. Each of the halves of the deck 4 comprises a plate which is foldable, like a book or like butterfly wings, to a vertical position above the horizontal part of the middle frame 3. The axis of rotation may be one common axis, or there may be two parallel axes of rotation.

The connection of the front frame 1 or the rear frame 5 to the middle frame 3 is made via a mechanical joint 6. In the illustrated embodiment, the mechanical joint 6 is formed in such a way that the adjacent parts of the ends of the frames 1, 3 and 5, are terminated by flat surfaces, wherein there is a hinge on one side of the flat surfaces for folding the front frame 1 or the rear frame 5 relative to the middle frame 3 to the side of the folding scooter, and, on the other side of the flat surfaces, lugs are formed which are aligned above each other when the folding scooter is unfolded for riding and in which a removable locking pin is inserted. The mechanical joints 6 are designed so that the front frame 1 and the rear frame 5 do not fold to the same side of the middle frame 3 of the folding scooter, i.e. the so-called “zigzag” design.

The above design of the mechanical joint 6 shown in the embodiment is one of the possible solutions. A professional designer will be able to design other equivalent solutions for the mechanical joint 6 allowing the front frame 1 or the rear frame 5 to be folded to the sides of the middle frame 3 of the folding scooter.

Fig. 3 shows an embodiment of the folding scooter according to the invention having a seat 7 with a telescopic seat post. The seat post of the seat 7 is inserted into an opening in the rear frame 5. The seat 7 was not developed for the invention, it is a catalogue article. An expert will be able to suggest the use of many material- or shape-different seats 7 with telescopic seat posts, or alternatively a fixed seat post may be used instead of a telescopic seat post.

The folding scooter is converted from its unfolded state for riding into its folded state for transport and storage as follows. First, the folding handlebars 2 are folded along the front wheel mounted in the front frame 1, and the deck 4 on the middle frame 3 is folded as a book cover, see Fig. 4. If the folding scooter is fitted with a seat 7 with a telescopic seat post, the telescopic seat post of the seat 7 is shortened by retracting it towards the rear frame 5. Then the mechanical joint 6 between the front frame 1 and the middle frame 3 is unlocked, and the mechanical joint 6 between the middle frame 3 and the rear frame 5 is also unlocked, see Fig. 5. Subsequently, the wheels including frames 1 and 5 are folded to the sides of the middle frame 3 as shown in Fig. 6 and 7. In another possible folding method, the folding handlebars 2 are not folded, e.g. when they are needed to guide the scooter. In another possible folding method, the deck 4 is not folded, e.g. when the deck 4 is a fixed part of the middle frame 3.

In another non-illustrated embodiment of the invention of the folding scooter, the deck 4 is folded by rotating around a horizontal part of the middle frame 3. This is achieved by having at least one lockable bearing attached to the horizontal part of the middle frame 3, to the outer circumference of which the deck 4 is attached. After unlocking the lockable bearing, the deck 4 can be folded from the horizontal to the vertical plane.

The folding scooter according to the invention is fitted with identically sized wheels having a diameter of at least 20", which is at least 0.5 meters in SI units. However, a variant is possible

when the front wheel is larger than the rear wheel. In another possible embodiment, the wheels have a diameter of at least 0.4 m.

The deck 4 has been tested in widths of 0.2 m, 0.25 m and 0.30 m. An expert will have no problem varying the width of the deck 4 further. All of these widths of the deck 4 were comfortable for the test user - a male with shoe size 47. The length of deck 4 has been tested in the range from 0.3m to 0.6m, but to suggest other lengths of the deck is not something that would require the expert to go beyond the scope of professional skills.

In another non-illustrated embodiment of the invention, the folding scooter was designed as a child's folding scooter, and was not changed in principle from the embodiment of the invention described above, only the dimensions of the folding scooter were adjusted to make it suitable for children of different ages.

Furthermore, an embodiment of the folding scooter according to the invention was created, in which the folding scooter is an electric scooter. A 1 kW electric hub motor was integrated into the rear wheel of the electric folding scooter, and its maximum speed was limited to 25 km/h by programming its control unit. A commercially available Li-Ion battery was inserted into the middle part of the frame 3 to serve as the power source for the electric motor. The electric motor control buttons and the information display were mounted on the folding handlebars 2. The transmission of electricity and signals is carried out via electric conductors.

Industrial applicability

The folding scooter according to the invention will find its application in the field of passenger transport by means of two-wheeled vehicles.

List of index reference numerals

- 1 front frame
- 2 folding handlebars
- 3 middle frame
- 4 deck
- 5 rear frame
- 6 mechanical joint
- 7 seat

CLAIMS

1. A folding scooter for stable riding and comfortable handling comprising a front frame (1) of the front wheel fitted with folding handlebars (2) for folding them to the front wheel in the folded state of the folding scooter for transport and storage, further comprising a middle frame (3) fitted with a deck (4), and further comprising a rear frame (5) of the rear wheel, where the front frame (1) and the rear frame (5) are mechanically joined to the middle frame (3) for converting the folding scooter between the folded state and the unfolded state for riding, **characterized by that** the front frame (1) is connected to the middle frame (3) by a mechanical joint (6) and the rear frame (5) is connected to the middle frame (3) by a mechanical joint (6), where the mechanical joints (6) of the front frame (1) and the rear frame (5) can be folded to the sides of the folding scooter for bringing the wheels to the middle frame (3) in the folded state of the folding scooter.
2. The folding scooter according to claim 1, **characterized by that** the deck (4) can be folded from the horizontal plane to the vertical plane.
3. The folding scooter according to claim 2, **characterized by that** the deck (4) comprises two folding plates with one common axis of rotation or with two parallel axes of rotation.
4. The folding scooter according to claim 2, **characterized by that** the deck (4) comprises a single plate attached to at least one revolute joint for folding the plate of the deck (4) between the horizontal plane and the vertical plane, with the revolute joint being attached to the horizontal part of the middle frame (3).
5. The folding scooter according to any of claims 1 to 4, **characterized by that** the rear frame (5) is fitted with a removable seat (7) having a fixed or telescopic seat post.
6. The folding scooter according to any of claims 1 to 5, **characterized by that** the wheels have a rim diameter of at least 0.4 m.

7. The folding scooter according to any of claims 1 to 6, **characterized by that** the width of the deck (4) is at least 0.2 m.
8. The folding scooter according to any of claims 1 to 7, **characterized by that**, when folded, the folding scooter's front wheel and rear wheel axles are not aligned and do not interfere with the middle frame (3).
9. The folding scooter according to any of claims 1 to 8, **characterized by that** it is provided with at least one electric drive unit and at least one battery storage system for electrically powering the electric drive unit.
10. The folding scooter according to any of claims 1 to 9, **characterized by that** the middle frame (3) is the drop frame with the horizontal part and the part raised above the horizontal part, where the deck (4) is attached to the horizontal part of the middle frame (3), the mechanical joint (6) of the front frame (1) and the middle frame (3) is at the end of the raised part of the middle frame (3), and the mechanical joint (6) of the rear frame (5) and the middle frame (3) is at the end of the horizontal part of the middle frame (3).
11. The method of converting the folding scooter according to any of claims 1 to 10 from the unfolded state for riding to the folded state for transport and storage, **characterized by that** the mechanical joints (6) are unlocked and the front frame (1) with the wheel is folded to one of the sides of the middle frame (3) and the rear frame (5) is folded to the other of the sides of the middle frame (3).
12. The method of converting the folding scooter according to claim 11, **characterized by that** the deck (4) is folded.
13. The method according to claim 12, **characterized by that** the deck (4) is folded from the horizontal plane to the vertical plane like the cover of a book.

14. The method according to claim 12, **characterized by that** the deck (4) is folded from the horizontal plane to the vertical plane by rotating it around the horizontal part of the middle frame (3).
15. The method according to any of claims 12 to 14, **characterized by that** the seat (7) with fixed or telescopic seat post is partially retracted downwards in the direction of the rear frame (5).
16. The method according to any one of claims 11 to 14, **characterized by that** the folding handlebar (2) is folded next to the front frame (1) with the front wheel.