itself.

The constant increase of the number of circulating vehicles always raises the problem of parking, thus increasing the extension and the areas intended for parking vehicles has become an issue of vital importance. However, especially in high traffic density urban areas, there particularly arises the need of optimising the available spaces, searching for solutions allowing, on the contrary, reducing the dimensions of the single parking areas so as to allow the storage of a greater number of vehicles considering the same extension of the overall area occupied. This entails an increasing difficulty of access for the driver and the passengers into the vehicles, in that such vehicles are parked more and more closer to each other.

Thus, embodimentsan object of the present invention seek tois that of providinge a four-wheeled vehicle, in particular a quadricycle, capable of overcoming the aforementioned drawbacks of the prior art in an extremely simple, inexpensive and particularly functional manner.

In particular, embodimentsan object of the present invention seek tois that of providinge a four-wheeled vehicle which is extremely small in terms of dimensions and weight, simultaneously being capable of accommodating, in a comfortable and functional manner, at least three people including the driver.

EmbodimentsAnother object of the present invention also seek tois that of providinge a four-wheeled vehicle capable of providing

adequate guarantees in terms of safety and structural resistance.

~~FA further~~, embodiments~~object~~ of the present invention also seek to~~is that of~~ provid~~inge~~ a four-wheeled vehicle capable of directly transferring most of the stresses generated by the engine unit thereof to the wheels, so as to reduce the stresses that are usually transmitted to the frame thus improving the comfort level for the occupants.

Embodiments of the present invention also seek to~~Still another object is that of~~ provid~~inge~~ a four-wheeled vehicle capable of reducing the transverse space required to enter and exit from the vehicle itself, with evident advantages in terms of use in urban centres and park possibilities.

Lastly, embodiments~~another object~~ of the present invention seek to~~is that of~~ provid~~inge~~ a four-wheeled vehicle capable of offering functionalities and characteristics suitable to meet short distance urban transport needs, representing a valid alternative both for motorcycles and automobiles and combining the advantages of the former (agility, manoeuvrability, easy to use) with those of the latter (comfort and safety).

According to an aspect of the present invention, there is provided a vehicle comprising a bearing frame of the tubular trestle type, two front steered wheels, two rear wheels with fixed axis, an engine unit, steering means through which it is possible to operate on the front wheels, a front suspension unit, connecting the frame to the front wheels, a rear suspension unit, connecting the frame to the rear wheels, a transmission unit, interposed between the engine unit and the axle shafts of the rear wheels, a seat for the driver of the vehicle, arranged at a central position with respect to the vehicle, and at least two seats for the passengers of the vehicle adjacent to each other, arranged laterally and receded according to a predefined distance with respect to the seat for the driver of the vehicle, **characterised in that** the engine unit is elastically constrained with respect to the rear suspension unit through at least one suspension mechanism, which provides a first level for filtering the stresses generated by the operation of the engine unit and so that the rear suspension unit is capable of supporting the overall weight of the engine unit, and **in that** the rear suspension unit is elastically constrained to the frame through at least one auxiliary suspension mechanism which, alongside the elasticity of the tyres of the rear wheels, forms a second level for filtering the stresses generated by the operation of the engine unit. ~~These objects according to the present invention are attained by providing a four wheeled vehicle, in particular a quadricycle, as outlined in claim 1.~~

Further characteristics of embodiments of the invention are highlighted by the dependent claims, which form an integral part of the present description.

Characteristics and advantages of a four-wheeled vehicle, in particular a quadricycle, according to embodiments of the

CLAIMS

1. Vehicle ~~(10)~~ comprising a bearing frame ~~(12)~~ of the tubular trestle type, two front steered wheels ~~(14, 16)~~, two rear wheels ~~(18, 20)~~ with fixed axis ~~(144)~~, an engine unit ~~(22)~~, steering means ~~(24)~~ through which it is possible to operate on the front wheels ~~(14, 16)~~, a front suspension unit ~~(26)~~, connecting the frame ~~(12)~~ to the front wheels ~~(14, 16)~~, a rear suspension unit ~~(28)~~, connecting the frame ~~(12)~~ to the rear wheels ~~(18, 20)~~, a transmission unit, interposed between the engine unit ~~(22)~~ and the axle shafts of the rear wheels ~~(18, 20)~~, a seat ~~(44)~~ for the driver of the vehicle ~~(10)~~, arranged at a central position with respect to the vehicle ~~(10)~~, and at least two seats ~~(44')~~ for the passengers of the vehicle ~~(10)~~ adjacent to each other, arranged laterally and receded according to a predefined distance with respect to the seat ~~(44)~~ for the driver of the vehicle ~~(10)~~, **characterised in that** the engine unit ~~(22)~~ is elastically constrained with respect to the rear suspension unit ~~(28)~~ through at least one suspension mechanism ~~(72, 74; 84, 90, 92)~~, which provides a first level for filtering the stresses generated by the operation of the engine unit ~~(22)~~ and so that the rear suspension unit ~~(28)~~ is capable of supporting the overall weight of the engine unit ~~(22)~~, and **in that** the rear suspension unit ~~(28)~~ is elastically constrained to the frame ~~(12)~~ through at least one auxiliary suspension mechanism ~~(96, 98)~~ which, alongside the elasticity of the tyres of the

rear wheels ~~(18, 20)~~, forms a second level for filtering the stresses generated by the operation of the engine unit ~~(22)~~.

2. Vehicle ~~(10)~~ according to claim 1, characterised in that said suspension mechanism of the engine unit ~~(22)~~ comprises a pair of lateral elastic support pins ~~(72, 74)~~, directed according to the same axis which substantially passes through the centre of mass ~~(70)~~ of the engine unit ~~(22)~~ and arranged so as to support each about half the weight of said engine unit ~~(22)~~.

3. Vehicle ~~(10)~~ according to claim 2, characterised in that said elastic support pins ~~(72, 74)~~ are constrained to the engine unit ~~(22)~~ respectively by means of a first pair of brackets ~~(76, 78)~~, arranged at the left side with respect to the centreline axis ~~(Z-Z)~~ of the vehicle ~~(10)~~, and a second pair of brackets ~~(80, 82)~~, arranged on the right side with respect to the centreline axis ~~(Z-Z)~~ of the vehicle ~~(10)~~ with reference to the direction of motion of said vehicle ~~(10)~~, the brackets ~~(76, 80)~~ arranged towards the outer sides of the vehicle ~~(10)~~ being integral with the rear suspension unit ~~(28)~~, while the brackets ~~(78, 82)~~ arranged internally towards the centreline axis ~~(Z-Z)~~ of the vehicle ~~(10)~~ being integral with the engine unit ~~(22)~~.

4. Vehicle ~~(10)~~ according to claim 2 or 3, characterised in that said suspension mechanism further comprises reaction rod ~~(84)~~ whose lower end ~~(86)~~ is constrained, by means of a first elastic bushing ~~(90)~~,

to the rear suspension unit ~~(28)~~ of the vehicle ~~(10)~~, and whose upper end ~~(88)~~ is constrained, by means of a second elastic bushing ~~(92)~~, to the engine unit ~~(22)~~ through an adapter bracket ~~(94)~~, said reaction rod ~~(84)~~ being capable of supporting the share part of weight of the engine unit ~~(22)~~ not supported by the lateral elastic support pins ~~(72, 74)~~ and reacting to the drive torque of said engine unit ~~(22)~~.

5. Vehicle ~~(10)~~ according to any one of claims 1 to 4, characterised in that said auxiliary suspension mechanism comprises a front elastic bushing ~~(96)~~ which provides the elastic constraint between the rear suspension unit ~~(28)~~ and the frame ~~(12)~~ through a bracket ~~(98)~~, said auxiliary suspension mechanism also operating through the vertical elasticity of the tyres of the rear wheels ~~(18, 20)~~.

6. Vehicle ~~(10)~~ according to any one of claims 1 to 5, characterised in that the distance ~~(A)~~ between the point of constraint ~~(68)~~ of the rear suspension unit ~~(28)~~ to the frame ~~(12)~~ and the centre of mass ~~(70)~~ of the engine unit ~~(22)~~, measured in the direction of the centreline axis ~~(Z-Z)~~ of the vehicle ~~(10)~~, is greater than the distance ~~(B)~~ between said centre of mass ~~(70)~~ and the axle ~~(144)~~ of the rear wheels ~~(18, 20)~~, also measured in the direction of the centreline axis ~~(Z-Z)~~ of the vehicle ~~(10)~~.

7. Vehicle ~~(10)~~ according to any one of claims 1 to 6, characterised in that the rear suspension unit ~~(28)~~ is of the rigid bridge ~~(124)~~ type and that the front

suspension unit ~~(26)~~ instead has an independent wheels scheme of the "McPherson" type.

8. Vehicle ~~(10)~~ according to claim 7, characterised in that the rear suspension unit ~~(28)~~ is provided with a leaf-spring-shaped flexible element ~~(122)~~, arranged transversely with respect to the centreline axis ~~(Z-Z)~~ of the vehicle ~~(10)~~ and arranged at the rear end of the bridge ~~(124)~~ of said rear suspension unit ~~(28)~~, said leaf-spring-shaped flexible element ~~(122)~~ being capable of vertically guiding and transversely constraining the bridge ~~(124)~~ in the respective rebound and roll motions with respect to the frame ~~(12)~~.

9. Vehicle ~~(10)~~ according to claim 8, characterised in that said leaf-spring-shaped flexible element ~~(122)~~ is provided, at the opposite ends thereof, with two cylindrical cavities ~~(126)~~ suitable to accommodate respective elastic bushings ~~(128)~~ for connection between said leaf-spring-shaped flexible element ~~(122)~~ and the bridge ~~(124)~~ by means of pins ~~(130)~~, a third elastic bushing ~~(132)~~, constrained to the centre of said leaf-spring-shaped flexible element ~~(122)~~, constraining the centreline of said leaf-spring-shaped flexible element ~~(122)~~ to the frame ~~(12)~~ by means of a bracket ~~(136)~~ and preventing the displacement of the frame ~~(12)~~ in transverse direction of said leaf-spring-shaped flexible element ~~(122)~~.

10. Vehicle ~~(10)~~ according to claim 9, characterised in that the virtual elastic centre ~~(E)~~ of the third elastic bushing ~~(132)~~ is positioned behind the axle

~~(144)~~ of the rear wheels ~~(18, 20)~~ and it is arranged at a vertical height ~~(H1)~~ greater than the vertical height ~~(H2)~~ of the virtual elastic centre ~~(F)~~ of a front elastic bushing ~~(138)~~ which fixes the bridge ~~(124)~~ to the frame ~~(12)~~ by means of a bracket ~~(140)~~, the pin of said front elastic bushing ~~(138)~~ and the pin of said third elastic bushing ~~(132)~~ forming the only two points for fixing the rear suspension unit ~~(28)~~ to the frame ~~(12)~~, so as to reduce the times and the costs of assembling the vehicle ~~(10)~~.

11. Vehicle ~~(10)~~ according to claim 10, characterised in that the elasticity, measured in the transverse direction ~~(Q)~~ with reference to the centreline axis ~~(Z-Z)~~ of the vehicle ~~(10)~~, of the assembly made up of the two elastic bushings ~~(128)~~ for connection between the leaf-spring-shaped flexible element ~~(122)~~ and the bridge ~~(124)~~ and the third elastic bushing ~~(132)~~ is equivalent to about half of the lateral elasticity of the front elastic bushing ~~(138)~~ of the bridge ~~(124)~~.

12. Vehicle ~~(10)~~ according to any one of claims 1 to 11, characterised in that it comprises at least one door ~~(34)~~ for access to the vehicle ~~(10)~~, provided with a mechanism for connection to the frame ~~(12)~~ and with "pantograph-like" opening/closing, comprising a support arm ~~(100)~~, provided with a first end joint ~~(104)~~ with respect to the frame ~~(12)~~ and a second end joint ~~(106)~~ with respect to the door ~~(34)~~, and a guide arm ~~(102)~~, also provided with a first end joint ~~(108)~~ with respect to the frame ~~(12)~~ and a second end joint ~~(110)~~ with

respect to the door ~~(34)~~.

13. Vehicle ~~(10)~~ according to claim 12, characterised in that the transverse section of the guide arm ~~(102)~~ has a smaller area with respect to the area of the transverse section of the support arm ~~(100)~~, given that said support arm ~~(100)~~ is suitable to support the weight of the door ~~(34)~~, while said guide arm ~~(102)~~ solely serves the function of univocally defining the trajectory of said door ~~(34)~~.

14. Vehicle ~~(10)~~ according to claim 12 or 13, characterised in that the frame ~~(12)~~ is provided, at the intersection between each door compartment and the floor of the vehicle ~~(10)~~, with specific tubular elements ~~(118)~~ folded inwards towards the centreline axis ~~(Z-Z)~~ of said vehicle ~~(10)~~, said folded tubular elements ~~(118)~~ forming a "discharge" which reduces the transverse distance between the seat ~~(44)~~ for the driver of the vehicle ~~(10)~~ and the door compartment, the remaining portion of the floor of the vehicle ~~(10)~~, due to the presence of said folded tubular elements ~~(118)~~, being obtained in the lower part ~~(120)~~ of each door ~~(34)~~, so as to restore the continuity of the entire floor of the vehicle ~~(10)~~ when the doors ~~(34)~~ are closed.

15. Vehicle ~~(10)~~ according to any one of the preceding claims, characterised in that the floor or deck of the vehicle ~~(10)~~ is made up of a tank shaped structural element ~~(42)~~, made integral with the frame ~~(12)~~ and operating as element for supporting the driver ~~(44)~~ and

passenger ~~(44')~~ seats, said tank shaped structural element ~~(42)~~ being configured to ensure, besides the necessary functionality and ergonomics features for the people inside the vehicle ~~(10)~~, also the safety measures regarding any possible shock or external impact the vehicle ~~(10)~~ may be subjected to.

16. Vehicle ~~(10)~~ according to claim 15, characterised in that said tank shaped structural element ~~(42)~~ comprises, made in a single piece therewith, the front wheelhouses ~~(46, 48)~~ for the front wheels ~~(14, 16)~~ and the rear wheelhouses ~~(50, 52)~~ for the rear wheels ~~(18, 20)~~, underneath said tank shaped structural element ~~(42)~~ there further being obtained a cavity suitable to contain the engine unit ~~(22)~~, the transmission unit and a possible luggage compartment for the vehicle ~~(10)~~.

17. Vehicle ~~(10)~~ according to claim 16, characterised in that said tank shaped structural element ~~(42)~~ is centrally provided with a raised platform ~~(54)~~, which forms the base for supporting the driver seat ~~(44)~~, on the rear edges of said tank shaped structural element ~~(42)~~, above said rear wheelhouses ~~(50, 52)~~, also respectively obtained being two further raised platforms ~~(56, 58)~~, which form the base for supporting the passenger seats ~~(44')~~.

18. Vehicle ~~(10)~~ according to claim 17, characterised in that the frame ~~(12)~~ is provided with one or more specific tubular elements ~~(60)~~ which are inserted in shape coupling into and underneath the cavity provided for in the raised platform ~~(54)~~ which forms the base

for supporting the driver seat ~~(44)~~, thus guaranteeing the required structural rigidity of the tank shaped structural element ~~(42)~~.

19. Vehicle ~~(10)~~ according to claim 17 or 18, characterised in that the frame ~~(12)~~ is provided with two tubular portions ~~(62, 64)~~ arranged in shape coupling underneath the two raised platforms ~~(56, 58)~~ which form the base for supporting the passenger seats ~~(44')~~, said two tubular portions ~~(62, 64)~~ in turn forming the base for supporting said two raised platforms ~~(56, 58)~~.

20. Vehicle ~~(10)~~ according to claim 17, characterised in that said cavity suitable to contain the engine unit ~~(22)~~ is provided for between the two raised platforms ~~(56, 58)~~ which form the base for supporting the passenger seats ~~(44')~~, said engine unit ~~(22)~~ being positioned, in said cavity, longitudinally with respect to the vehicle ~~(10)~~.

21. Vehicle ~~(10)~~ according to claim 17, characterised in that in said cavity provided for in the raised platform ~~(54)~~ which forms the base for supporting the driver seat ~~(44)~~ there may be positioned batteries and systems for controlling the engine unit ~~(22)~~, said raised platform ~~(54)~~ thus being provided with one or more inspection ports for carrying out the maintenance of said engine unit ~~(22)~~.

22. Vehicle ~~(10)~~ according to any one of claims 15 to 21, characterised in that said tank shaped structural element ~~(42)~~ is made of fibreglass or a material having

similar features.

23. Vehicle ~~(10)~~ according to any one of the preceding claims, characterised in that the engine unit ~~(22)~~ may be of the internal combustion engine, electric motor or hybrid engine type, i.e. with an internal combustion engine and an electric motor operatively connected to each other.

24. Vehicle ~~(10)~~ according to any one of the preceding claims, characterised in that the transmission unit is an automatic continuously variable transmission unit (CVT) provided with a differential-reduction gear-inverter unit.

25. Vehicle ~~(10)~~ according to any one of the preceding claims, characterised in that the frame ~~(12)~~ is configured to be suitably covered with a closed or open type body which is provided with an opening rear door ~~(30)~~, a rear panel ~~(32)~~, having the function of covering the engine unit ~~(22)~~, two doors ~~(34)~~ for access to the vehicle ~~(10)~~, one for each side of said vehicle ~~(10)~~, and a roof ~~(40)~~ of the fixed or opening type, either partially or completely.