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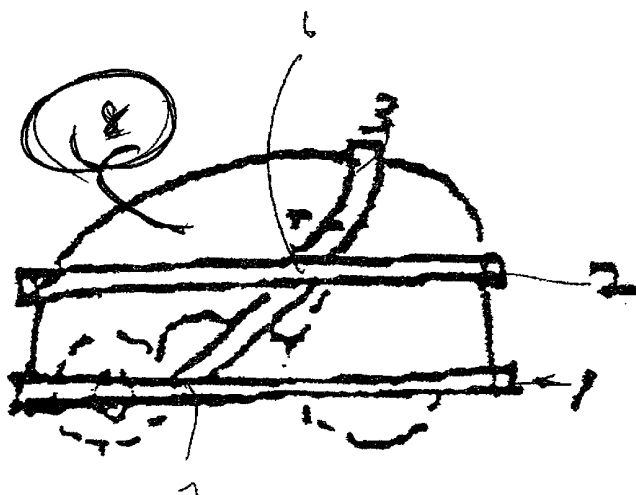
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ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: IMPROVED VEHICLE CHASSIS AND BODY CONSTRUCTIONS



(57) **Abstract:** A personal conveyance is herein disclosed wherein a space frame of roll cage of an integral passenger and engine compartment is fabricated from at least two, preferably elliptical, roll bars (1, 2 and 3) that are directly or indirectly associated with a floor pan. In each case, at least one roll bar is integral with and supportive of the perimeter of the floor pan and preferably permanently bonded thereto. A second roll bar is then arranged inboard of the horizontal roll bar, in a linear array along the length of the vehicle, and at an inclined angle relative to the plane of the floor pan. The horizontal roll bar is affixed to the inclined roll bar at each point of intersection (6) or coincidence thereof, so as to form an essential unitary structure or roll cage sufficient to accommodate both passenger and power plant compartments.



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**IMPROVED VEHICLE CHASSIS & BODY CONSTRUCTION****FIELD OF THE INVENTION**

5           This invention relates to an article of manufacture. More specifically, this invention relates to a unique vehicle spaceframe, and to the combination thereof with readily replaceable body panels. The vehicle of this invention is useful either as an individual or personal conveyance, or a car pool vehicle, to be used by commuters in a quasi-public transportation system.

10

**DESCRIPTION OF THE PRIOR ART**

          The design and assembly of an inexpensive vehicular conveyance from interchangeable and readily replaceable parts has up to now proven to be an illusive, although highly desirable goal. The problems encountered typically involve the often conflicting objectives of reducing vehicle weight (to improve fuel economy), minimizing damage and cost of repairs (from impact  
15 related contact) and yet at the same time enhancing the safety of the vehicle passengers. All of the foregoing is to be achieved without sacrificing structural integrity. Various attempts have been made to achieve such objective such as by substituting different materials for part, or all of the vehicle frame. Although materials such as aluminum or composites have lightweight  
20 advantages, structural strength is typically sacrificed. Moreover, many substitute materials prove prohibitively expensive and, therefore, are not feasible.

          The limitations on the substitution of such alternative materials are also directly related to vehicle assembly constraints. More specifically, conventional vehicle frame designs often dictate/limit the available options incident to the assembly process. For example, vehicle frames

include forwardly extending midrails that protrude through the area that serves as the engine compartment. Assembly of the drivetrain and the front suspension system for the vehicle is more difficult because of the presence of these midrails. It would be advantageous, for example, to be able to completely assemble the suspension system before mounting it on the vehicle.

5 Conventional frames, however, make such pre-assembly impractical or impossible.

Alternative structural systems and assembly methods for motor vehicle and other means of personal conveyance have been disclosed in both the press, trade journals, technical and patent literature. The following prior art is representative of such past efforts.

*U.S. Patent No. 6,017,084* (to *Carroll* et al, issued January 25, 2000) describes an energy  
10 absorbing lattice for incorporation within automotive vehicle body panels. The objective of the *Carroll* invention is to improve crash test performance and passenger safety and yet permit elimination of much of the conventional frame and passenger cage commonly utilized to support and protect the vehicle's occupants. According to the *Carroll* concept, a reinforcing energy absorbing member is laminated to the inner face of a "contact surface" (automobile body panel)  
15 in a manner and configuration calculated to optimize absorption/dissipation of impact energies to the contact surface. The reinforcing energy absorbing member, unlike the so-called crush boxes typically found in bumpers, is composed of an interconnected lattice of a molded or fabricated mass of steel, plastic, or composite thereof, which defines a plurality of cells. The foregoing configuration reportedly enhances the crash worthiness of the vehicle, thus, permitting  
20 reduction in size and in some cases elimination of energy absorbing pillars and headrails.

*U.S. Patent No. 6,010,182* (to *Townsend* et al, issued January 4, 2000), describes a unique chassis and body panel combination for various conveyances, e.g. cars, boats, aircraft and personal "people power vehicles" (also PPV). The *Townsend* "system" utilizes a module or

spaceframe and body panel wherein each of the frame and panels have complimentary fittings to firmly engage the panel to the frame. The complimentary fittings are releasable, to allow for change or replacement of a given panel; or to allow for change or replacement of all, or a group of panels, so as to modify the utility or appearance of the vehicle. The *Townsend* module or spaceframe closely resemble the traditional unibody vehicle construction, through its utilization of a series of welded pillars and posts to define a passenger and engine compartment. The *Townsend* invention, reportedly represents a substantial improvement in ease of vehicle manufacture, without sacrifice in structural stiffness and durability of the frame. Moreover, the design freedom afforded by the *Townsend* invention also reportedly permits for improved passenger safety through such enhancements in the design of the car body frame.

Notwithstanding the strides made in the prior art, including those specifically referenced and discussed herein, there is a continuing need to further enhance passenger safety, without compromise of fuel economy or added expense. To the extent that each of the *Carroll* and *Townsend* concepts have made certain strides in that direction, each is limited by introduction of complexities that require relatively substantial departures from traditional manufacturing process and materials, and, thus, have not been adopted to any substantial degree. Moreover, while each of the directions taken by *Carroll* and *Townsend* to improve vehicle performance and manufacture, are laudable, they appear to be impractical for application to problems associated with personal conveyance of large populations of individuals at relatively modest cost (approaching that of public transportation).

**OBJECTS OF THE INVENTION**

It is the object of this invention to remedy the above as well as related deficiencies in the prior art.

5 More specifically, it is the principle object of this invention to provide a personal conveyance that can meet the needs of the urban commuter at a fraction of the cost of present day automobiles.

It is another object of this invention to provide a personal conveyance that is part of a pool of essential identical and interchangeable commuter cars, so as to permit their use as integral part of a mass transit system.

10 It is yet another object of this invention to provide a method for the fabrication of a personal conveyance that has both the integrity and rigidity of larger and heavier vehicles.

It is still yet another object of this invention to provide a vehicle having enhanced protection of its body panels from damage and yet readily replaceable in the event of collision or abuse.

15 Additional objects of this invention include the adaptation of the conveyance of this invention to both gasoline and electric power, and to hybrid power plants.

**SUMMARY OF THE INVENTION**

20 The above and related objects are achieved by providing a personal conveyance wherein a space frame is fabricated from at least two (2), preferably elliptical, roll bars that are directly or indirectly associated with a floor pan, so as to define an integral occupant and power plant compartment. In each case, at least one (1) roll bar is integral with and supportive of the perimeter of a floor pan and preferable permanently bonded (e.g. welded) thereto. The preferred

space frame contemplates that a second, essentially horizontally disposed, roll bar be positioned relative to the first roll bar and floor pan, at approximately midway between the plane of the floor pan and the top of the vehicle. An optional third, (and possible multiple rolls bars), is then arranged, inboard of each of the first and second horizontal roll bars, in a linear array along the length of the vehicle, and at an inclined angle relative to the plane of the floor pan. Each of the two horizontal roll bars are affixed to the inclined roll bar(s) at each point of intersection or coincidence thereof, so as to form an essential unitary structure or cage sufficient to accommodate both passenger and power plant (battery) compartments. This cage or X-O-Skeleton™-like structure is further modified on the inboard surface of the passenger and power plant compartments to receive and retain fasteners that are associated with body panels and windscreen/windows. The complimentary fasteners and fittings on such panels and inboard surfaces of the roll bars permit wind and water tight enclosure of the passenger and engine compartments defined by such cage or X-O-Skeleton™.

Attachment of the body panels is made from the inside of the X-O-Skeleton™ structure so the panels cannot be removed from the outside, thus preventing theft. Also, the roll bars can be coated with rubberized paint, or other protective material, and the electrical harness for the vehicle can be placed within the roll bars.

In one of the preferred embodiments of the invention, the vehicle is powered by a conventional gasoline engine. In another of the preferred embodiments, the vehicle is power by electric motors mounted in each of the drive wheels, and electrical power supplied by a hybrid power plant (fossil fuel and battery power).

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is perspective of a preferred embodiment of the vehicle of this invention.

FIG. 2 is planar view of the floor pan of the vehicle of the FIG. 1.

FIG. 3 is a cross-sectional view of the floor plan of FIG. 2 at AA.

5 FIG. 4 is a perspective view of a stretch version of the vehicle of FIG. 1.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

This invention relates to a space frame and body panel structure for a wide variety of vehicles, including automobiles, motorcycles, water vessels, aircraft and human powered  
10 vehicles, such as bicycles or tricycles, principally comprising a unitary roll cage and floor pan.

FIG. 1 depicts the invention in its simplest embodiment. In the configuration thereof illustrated therein, three roll bars (1,2,3) are shown to form an integral cage or spaceframe. It is to be understood that at least two roll bars are required, one horizontal and one vertical, but that multiple roll bars could be used. Each of the roll bars are essentially elliptical and associated  
15 either directly or indirectly with each other and a floor pan (4) (see FIG. 2). In the embodiment of the invention illustrated in FIG.1 and more particularly in FIG. 2, a first horizontal roll bar (1) is integrally joined to a floor pan (4) at the perimeter thereof so as to afford both enhanced structural integrity to the floor pan and a more substantial mass of material to which other vehicle components can be affixed (e.g. steering mechanism, front and rear suspension, power plant,  
20 etc.). The floor pan (4) may, by design, comprise molded material which could include "corrugation-like" structures (5) or "folds" (4',4") to further enhance its rigidity and torsional stability. This is illustrated in FIG. 3. In the embodiment of the invention illustrated in FIG. 1, a second horizontal roll bar (2) is shown to be positioned about mid-way between the floor pan

and the top of the vehicle, or approximately at the "belt-line" level of the vehicle. The relative position of this second horizontal roll bar (2) is intended to afford protection to passengers from side impact collisions. A third roll bar (3) is also utilized in the vehicle illustrated in FIG. 1. This third roll bar is inclined at an angle relative to the plane of the floor pan, and located inboard  
5 of each of the horizontally disposed roll bars (1,2). This inboard roll bar can be affixed to each of the horizontally positioned roll bars at the intersection thereof (6,7) by welding or other semi-permanent attachment.

In another of the alternative embodiments of the vehicle illustrated in FIG. 4, an array or series of inboard roll bars (3,3') are arranged along the length of the vehicle to provide additional  
10 dimensional support and passenger compartment capacity. Essentially the same relationships of the various component parts are maintained in FIG. 4 as in FIG. 1, without departure from the basic concept or advantages of the invention.

It is to be understood that body panels (8), FIG. 1, are attached to the inside of roll bars 1, 2 and 3. The body panels are designed to be easily removable from the inside (but not the  
15 outside) of the vehicle, and can be provided in various colors and finishes. If damaged, the body panels can be easily replaced and, of course, must be attached in a manner that will make the vehicle water proof. Design and attachment of such panels, which would include windows and doors of the vehicle, would be apparent to one skilled in the automotive area and, thus, will not be further described herein.

20 The roll bars may also be covered with a rubberized material (or equivalent) to protect the roll bars and provide a safety feature. Also, the wiring harness for the vehicle may be placed inside the roll bars and the roll bars will serve as attachment points for mudguards, lights, roof, etc.



The foregoing description of this invention has been provided as illustrative of a number of the preferred embodiments thereof and is not intended as defining the metes and bounds of the invention, which has been reserved for the following claims.

**WHAT IS CLAIMED IS:**

1. In a self-propelled conveyance having a space frame, which includes a roll cage and a floor pan, for defining a compartment for carrying passengers and a power plant, and  
5 means for protection of said passengers from the elements and possible injury from collision, the improvement comprising:
- a) a space frame comprising at least two essentially elliptical roll bars and a floor pan, wherein a first horizontally disposed roll bar is integrally bonded to said floor pan at the perimeter thereof, and a second roll bar positioned inboard of said  
10 horizontal roll bars and at an inclined angle relative to said floor pan; and
  - b) means for connecting said horizontal roll bar to said inclined roll bar at each intersection point thereof.
2. The improved self-propelled conveyance of Claim 1, wherein said space frame  
15 comprises a plurality of inclined roll bars arranged in a linear array along the length of said conveyance.
3. The improved self-propelled conveyance of Claim 1, wherein said space frame includes means for attachment of body panels, doors and windows to said roll bars of said space  
20 frame so as to define a compartment that is essentially isolated from wind and weather.
4. The improved self-propelled conveyance of Claim 1, wherein said space frame includes a floor pan having an integral array of structural reinforcement formed therein.

5. The improved self-propelled conveyance of Claim 5, wherein said floor pan includes integral structural reinforcement formed in an array of preformed beams at rights angles to one another.

5

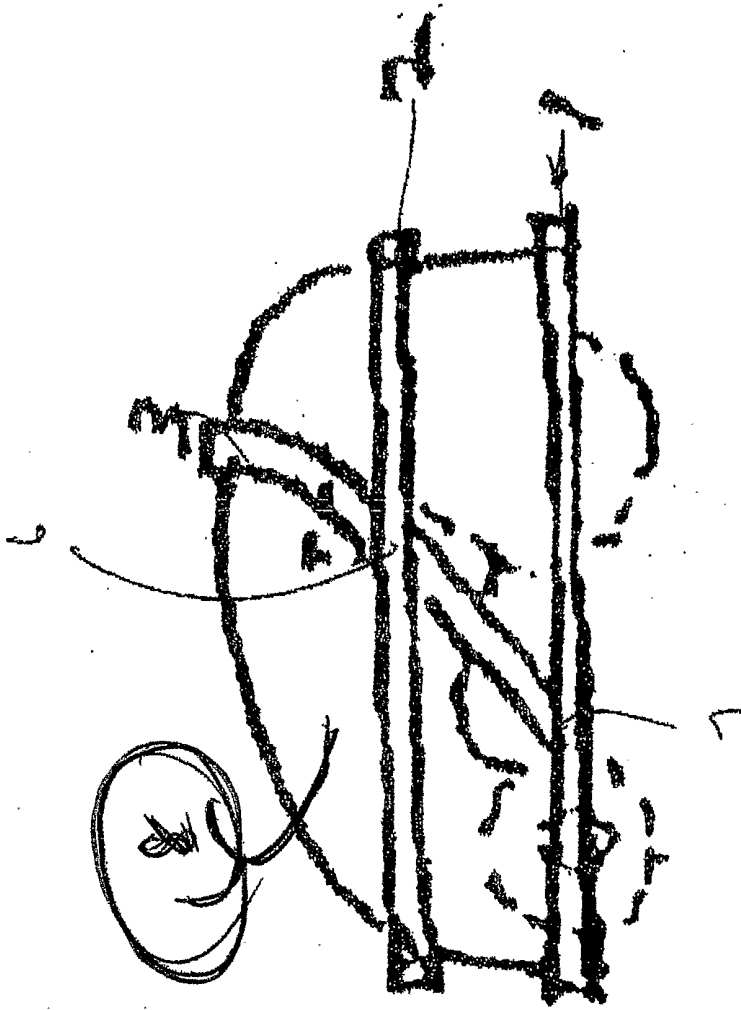


FIG 1

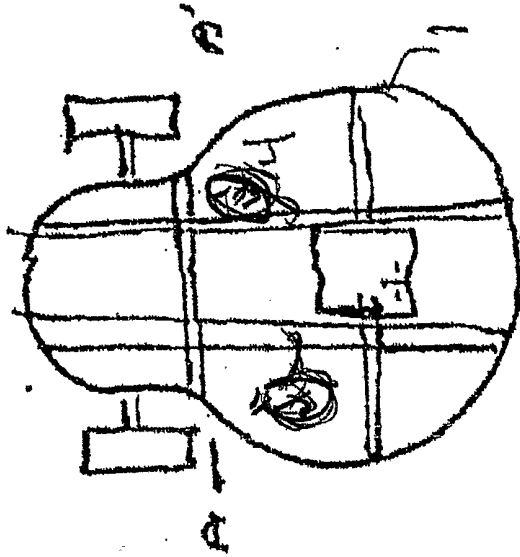


Fig 2

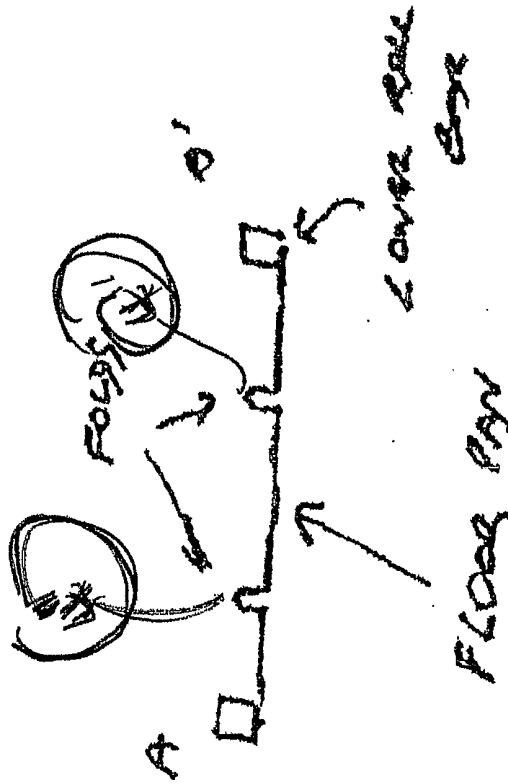


Fig 3

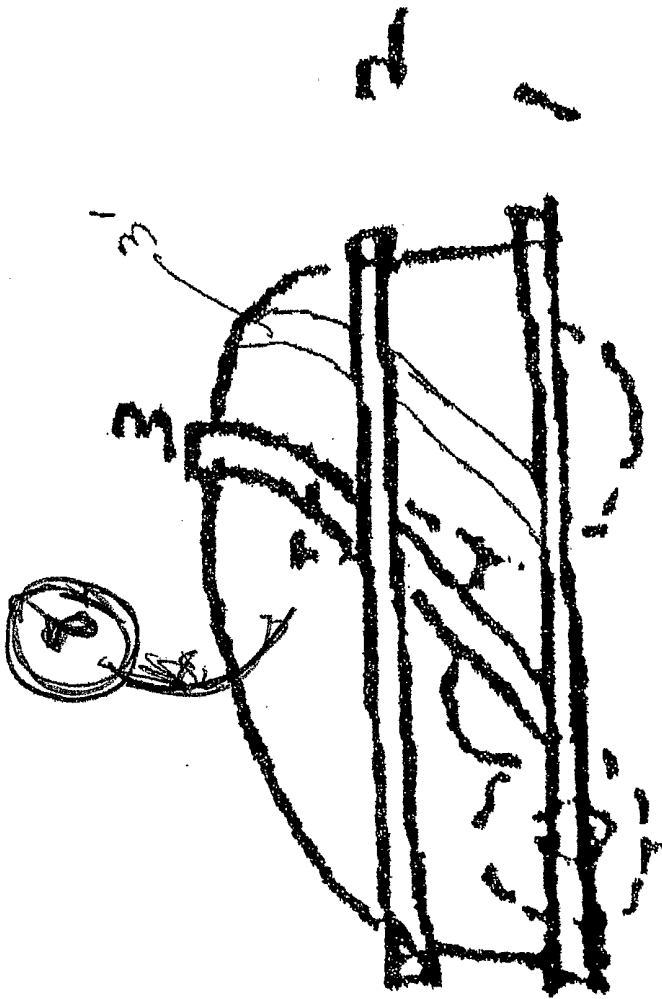


FIG 4

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/48830

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B60R 27/00

US CL : 296/187, 193, 194, 195, 197, 203.01, 203.02, 203.03, 203.04, 204, 205

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 296/187, 193, 194, 195, 197, 203.01, 203.02, 203.03, 203.04, 204, 205

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Please See Continuation Sheet

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages               | Relevant to claim No. |
|------------|--|-----------------------|
| X          | US 4,217,970 A (CHIKA) 19 August 1980 (19.08.1980),<br>see entire document and Figures 2 and 10. | 1-5                   |
| X          | US 4,045,075 A (PULVER) 30 August 1977 (30.08.1977),<br>see entire document.                     | 1-3                   |
| X          | US 4,810,028 A (HENRICKS) 07 March 1989 (07.03.1989),<br>see entire document.                    | 1-5                   |
| X          | US 4,205,872 A (BOLLINGER) 03 June 1980 (03.06.1980),<br>see entire document.                    | 1-3                   |

Further documents are listed in the continuation of Box C.

See patent family annex.

| * Special categories of cited documents:  | "T"  |
|---|--|
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| "P" document published prior to the international filing date but later than the priority date claimed  |  |

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**INTERNATIONAL SEARCH REPORT**

International application No.

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**Continuation of B. FIELDS SEARCHED Item 3:**

**EAST**

Search terms: space frame, roll cage, elliptical roll bars, floor, structural reinforcement