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(54) **FUEL TANK**

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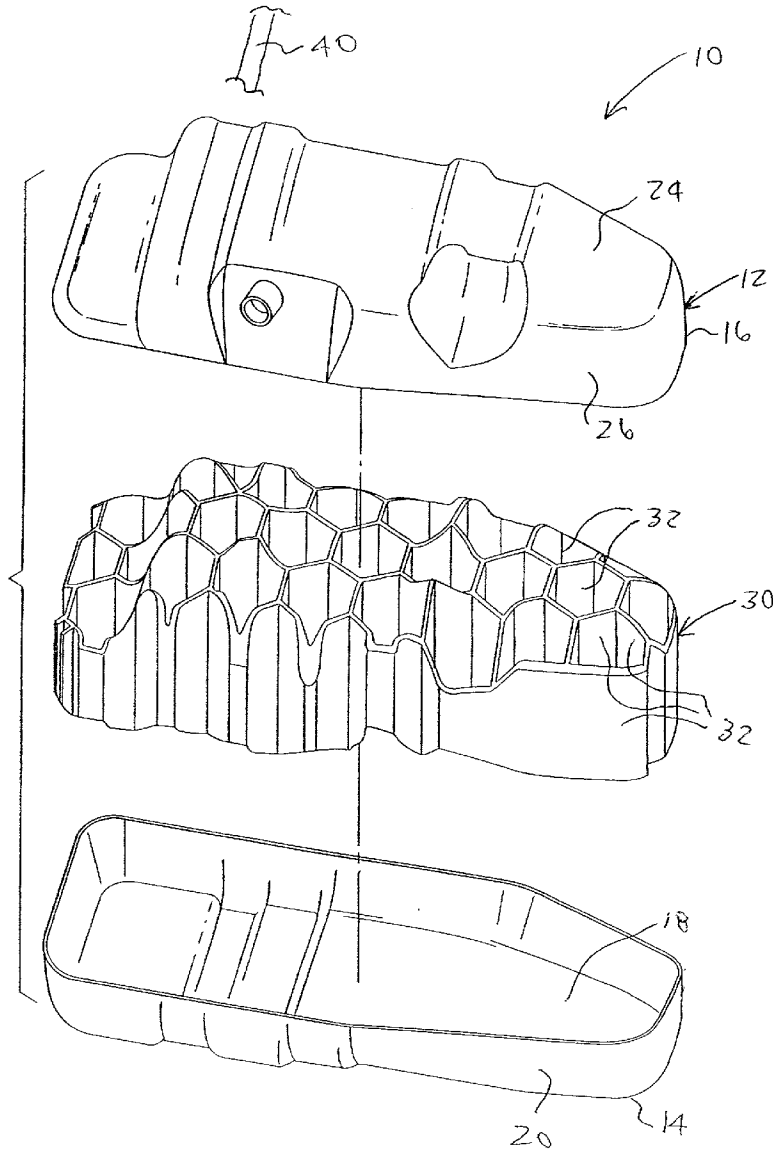
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(57) **ABSTRACT**

A fuel tank for a vehicle includes a plastic tank shell having a first half shell and a second half shell. The fuel tank also includes a support structure having a honeycomb configuration disposed between and connected to the first half shell and the second half shell to provide support to the tank shell.

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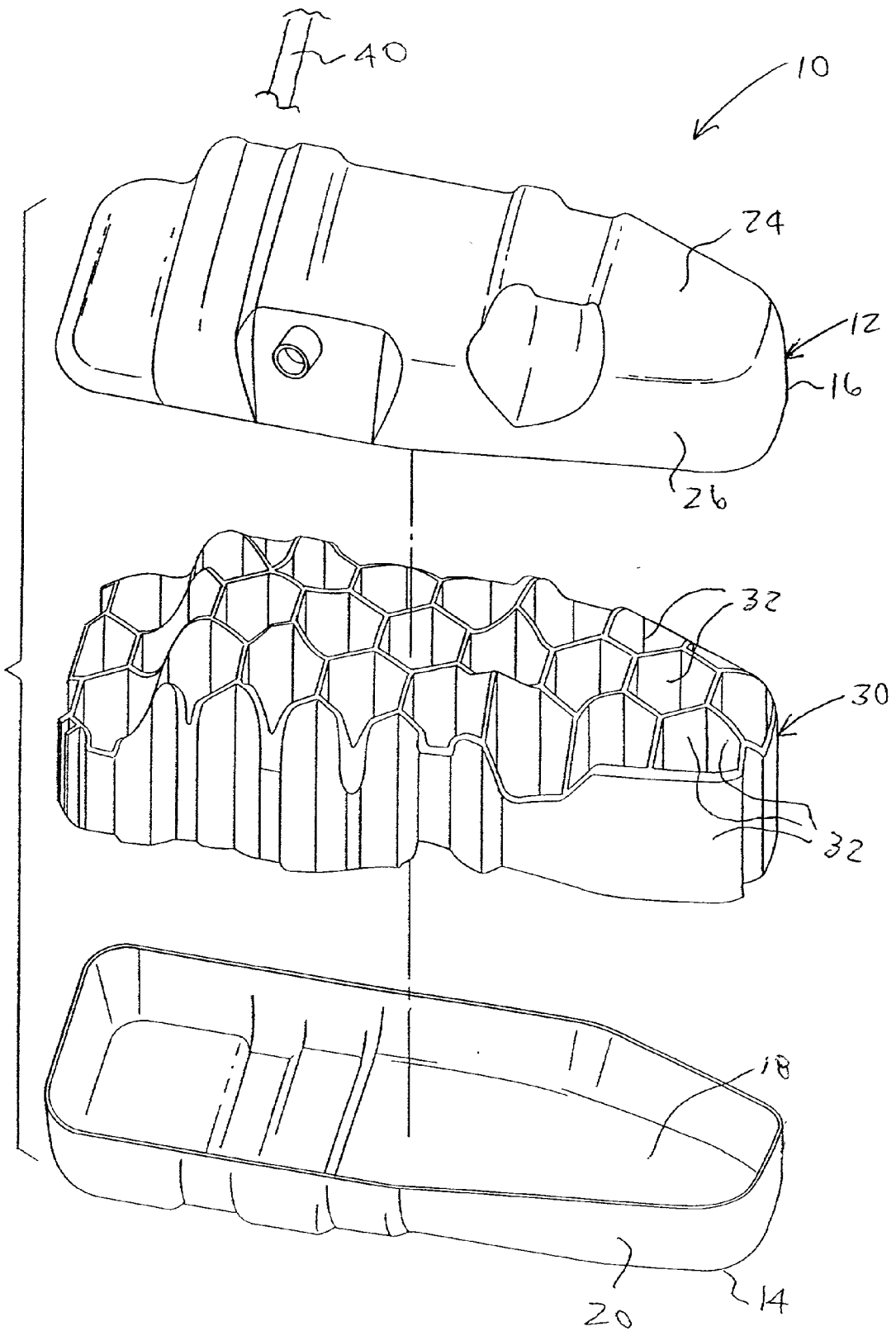


FIG. 1

## FUEL TANK

### TECHNICAL FIELD

[0001] The present invention relates generally to fuel tanks for vehicles and, more particularly, to a plastic fuel tank for a vehicle.

### BACKGROUND OF THE INVENTION

[0002] It is known to provide a fuel tank such as a metal or plastic fuel tank in a vehicle to hold fuel to be used by an engine of the vehicle. Typically, the fuel tank has a shell with a tank opening and a unit installed into the tank via the tank opening. An access cover is placed over the tank opening and is used to assemble and service the fuel pump and other related components. The access cover must be sealed to prevent fuel leakage and evaporative emissions. However, these fuel tanks may not be acceptable to meet zero evaporative emissions.

[0003] One commercial approach to resolve these concerns is to provide a non-vented fuel system to meet zero evaporative emissions. However, this requires a fuel tank to withstand higher pressures and vacuum levels than in the past.

[0004] Therefore, it is desirable to provide a plastic fuel tank for a vehicle that has can withstand higher pressure and vacuum levels than current tanks. It is also desirable to provide an internal support structure to support upper and lower half shells of plastic fuel tank.

### SUMMARY OF THE INVENTION

[0005] It is, therefore, one object of the present invention to provide a new plastic fuel tank for a vehicle.

[0006] It is another object of the present invention to provide a plastic fuel tank that has a support structure disposed inside the fuel tank.

[0007] To achieve the foregoing objects, the present invention is a fuel tank for a vehicle including a plastic tank shell having a first half shell and a second half shell. The fuel tank also include a support structure having a honeycomb configuration disposed between and connected to the first half shell and the second half shell to provide support to the tank shell.

[0008] One advantage of the present invention is that a new plastic fuel tank is provided for a vehicle. Another advantage of the present invention is that the plastic fuel tank is able to withstand much higher pressure and vacuum levels than conventional plastic fuel tanks. Yet another advantage of the present invention is that the plastic fuel tank incorporates an internal support structure to improve tank durability under pressure and vacuum. Still another advantage of the present invention is that the plastic fuel tank meets zero evaporative emissions requirements with a vacuum system. A further advantage of the present invention is that the plastic fuel tank allows thinner walls to be used than in conventional plastic fuel tanks and all components can be easily mounted inside the fuel tank. Yet a further advantage of the present invention is that the plastic fuel tank uses conventional manufacturing processes. Still a further advantage of the present invention is that the plastic

fuel tank incorporates an internal support structure to provide a strong plastic fuel tank at a lower cost than a metal fuel tank.

[0009] Other objects, features, and advantages of the present invention will be readily appreciated, as the same becomes better understood, after reading the subsequent description taken in conjunction with the accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0010] **FIG. 1** is an exploded perspective view of a fuel tank, according to the present invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] Referring to the drawings and in particular **FIG. 1**, one embodiment of a fuel tank **10**, according to the present invention, is shown for a vehicle (not shown). The fuel tank **10** includes a tank shell, generally indicated at **12**. In the embodiment illustrated, the tank shell **12** is of a generally rectangular type. The tank shell **12** includes a first or lower half shell **14** and a second or upper half shell **16**. The lower half shell **14** has a base wall **18** and a side wall **20** around a periphery of the base wall **18** and extending generally perpendicular thereto. The side wall **20** may have a flange (not shown) extending outwardly and generally perpendicular thereto. The upper half shell **16** has a base wall **24** and a side wall **26** around a periphery of the base wall **24** and extending generally perpendicular thereto. The side wall **26** may have a flange (not shown) extending outwardly and generally perpendicular thereto. The flanges **22** of the lower half shell **14** and upper half shell **16**, respectively, are joined together by suitable means such as by thermoforming, compression molding, or friction welding. The lower half shell **14** and upper half shell **16** are made of a plastic material such as a thermoformable plastic.

[0012] Referring again to **FIG. 1**, the fuel tank **10** includes an internal support structure, generally indicated at **30**, disposed between and attached to the lower half shell **14** and upper half shell **16**. In one embodiment, the support structure **30** is honeycomb shaped with a plurality of cavities **32** that are of a generally cylindrical and pentagonal cross-sectional shaped. The support structure **30** has a plurality of side walls **32** extending axially between the base walls **18** and **24** and extending generally perpendicular thereto. The side walls **32** form the cavities **32** in a closed cell configuration. The side walls **32** are joined to the lower half shell **14** and upper half shell **16**, respectively, by suitable means such as welding. The support structure **30** is made of a plastic material such as a thermoformable plastic. It should be appreciated that the support structure **30** may have a suitable honeycomb shape other than pentagonal such as triangular, elliptical, rectangular, or circular shaped. It should also be appreciated that the support structure **30** is integral, unitary, and one-piece.

[0013] In manufacturing the fuel tank **10**, several conventional processes may be used. Preferably, the lower half shell **14** and upper half shell **16** are formed by a conventional vacuum forming process. Vacuum formed plastic fuel tank **10** is made of multi-layer extruded sheets and vacuum formed into two shells, one to make the upper half shell **16** of the fuel tank **10** and the other for the lower half shell **14**

of the fuel tank 10. The support structure 30 is formed by extrusion or injection molding. The support structure 30 is placed between the lower half shell 14 and upper half shell 16 of the fuel tank 10. The support structure 30 is welded to the lower half shell 14 and the upper half shell 16 to support pressure loads. The upper half shell 16 is also welded to the lower half shell 14 in a mold, right after vacuum forming, creating a bond line where the two shell halves are fused. A circumferential steel band 40 may be added to the outside of the tank shell 12 to support the hoop stresses obtained from pressure. It should be appreciated that the support provided by the support structure 30 in the tank shell 12 with 6.0 millimeters (mm) walls will support up to eight pounds per square inch (8 psi) in vacuum at 80° C. and up to four pounds per square inch (4 psi) pressure at 80° C. as long as the plastic fuel tank 10 has no more than 100 mm of span in any direction unsupported. It should also be appreciated that if the tank wall is a different thickness, the span to thickness ratio should be approximately 17 to 1. It should further be appreciated that, for manufacturing purposes, there must be a 2 mm to 10 mm gap between the side walls 20, 26 of the fuel tank 10 and the support structure 30.

[0014] The present invention has been described in an illustrative manner. It is to be understood that the terminology, which has been used, is intended to be in the nature of words of description rather than of limitation.

[0015] Many modifications and variations of the present invention are possible in light of the above teachings. Therefore, within the scope of the appended claims, the present invention may be practiced other than as specifically described.

1. A fuel tank for a vehicle comprising:

a plastic tank shell having a first half shell and a second half shell; and

a support structure having a honeycomb configuration disposed between and connected to said first half shell and said second half shell to provide support to said tank shell.

2. A fuel tank as set forth in claim 1 wherein said support structure is made of a plastic material.

3. A fuel tank as set forth in claim 1 wherein said plastic material is a thermoformable plastic.

4. A fuel tank as set forth in claim 1 wherein said first half shell has a base wall and a side wall extending generally perpendicular to said base wall.

5. A fuel tank as set forth in claim 1 wherein said second half shell has a base wall and a side wall extending generally perpendicular to said base wall.

6. A fuel tank as set forth in claim 1 wherein said support structure has a plurality of side walls extending axially and generally perpendicular to said first half shell and said second half shell.

7. A fuel tank as set forth in claim 6 wherein said support structure has a plurality of cavities extending axially and formed by said side walls.

8. A fuel tank as set forth in claim 7 wherein said cavities have a closed cell configuration.

9. A fuel tank as set forth in claim 6 wherein said side walls are welded to said first half shell.

10. A fuel tank as set forth in claim 6 wherein said side walls are welded to said second half shell.

11. A fuel tank as set forth in claim 1 including a band disposed over said tank shell.

12. A fuel tank for a vehicle comprising:

a plastic tank shell having a lower half shell and an upper half shell; and

a plastic support structure having a honeycomb configuration disposed between and connected to said lower half shell and said upper half shell to provide support to said tank shell.

13. A fuel tank as set forth in claim 12 wherein said support structure has a plurality of side walls extending axially and generally perpendicular to said lower half shell and said upper half shell.

14. A fuel tank as set forth in claim 13 wherein said side walls form a plurality of cavities extending axially.

15. A fuel tank as set forth in claim 14 wherein said cavities have a closed cell configuration.

16. A fuel tank as set forth in claim 13 wherein said side walls are welded to said lower half shell.

17. A fuel tank as set forth in claim 16 wherein said side walls are welded to said upper half shell.

18. A fuel tank as set forth in claim 12 including a band disposed over said tank shell.

19. A fuel tank as set forth in claim 18 wherein said band is made of a metal material.

20. A fuel tank for a vehicle comprising:

a plastic tank shell having a lower half shell and an upper half shell, wherein said lower half shell has a lower base wall and a lower side wall extending generally perpendicular to said lower base wall, wherein said upper half shell has an upper base wall and an upper side wall extending generally perpendicular to said upper base wall; and

a plastic support structure disposed between and connected to said lower half shell and said upper half shell to provide support to said tank shell, wherein said support structure has a plurality of support side walls extending axially and generally perpendicular to said lower base wall and said upper base wall, said side walls being welded to said lower base wall and said upper base wall.

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