United States Patent

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[54] AIR-CUSHION VEHICLE WITH BRUSH SUPPORT

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[21] Appl. No.: **13,986**

[52] **U.S. Cl.**.....**180/116**, 180/120, 180/127

[51] **Int. Cl.**.....**B60v 1/00**

[58] **Field of Search**.....180/127, 128, 120, 116, 119, 180/121

[56] **References Cited**

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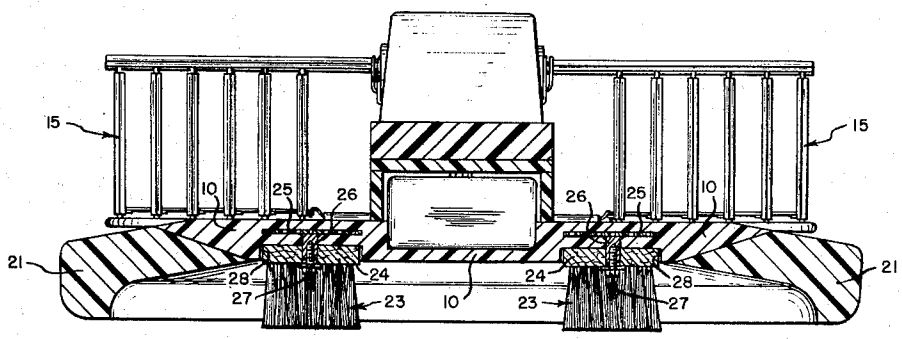
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[57] **ABSTRACT**

An air-cushion vehicle has a plurality of brushes mounted on the body within the boundary of the downwardly extending peripheral wall or skirt thereof, and extending downwardly to or below the level of the peripheral wall or skirt to support the vehicle while at rest without substantial deformation of the wall or skirt. The individual flexibility of the bristles allows the brushes to pass over obstacles, or to part so as to allow an obstacle to pass therethrough.

1 Claims, 6 Drawing Figures



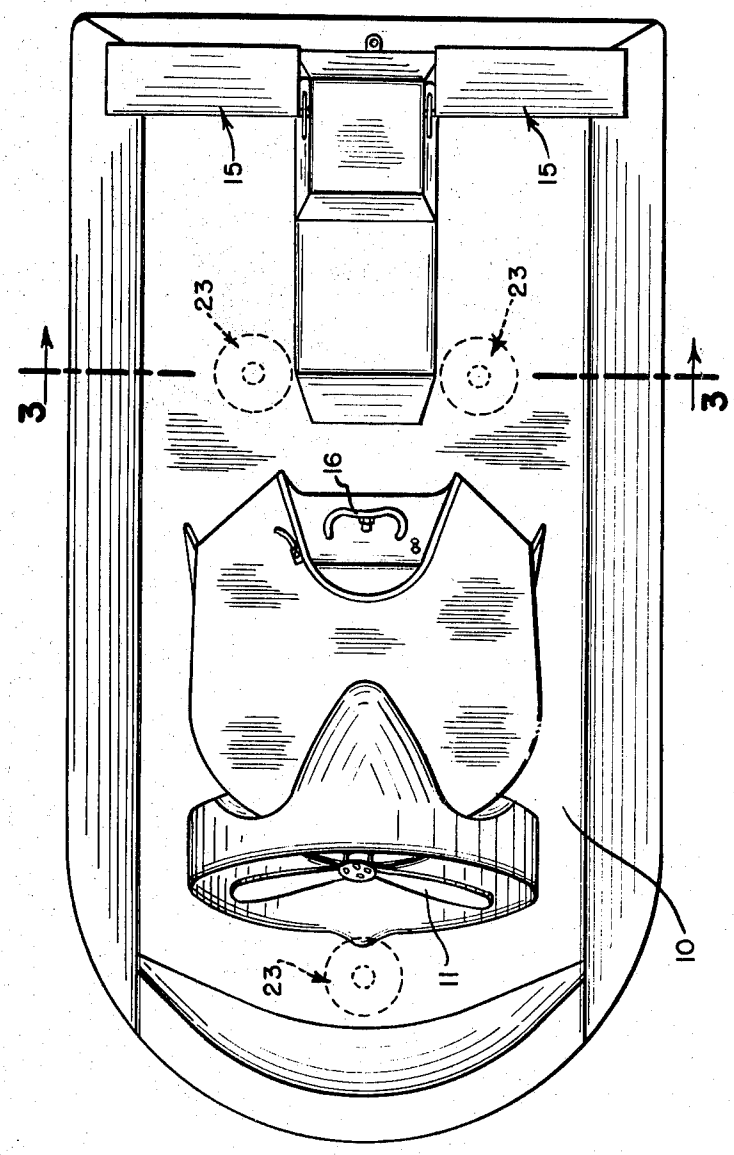


FIG. 1

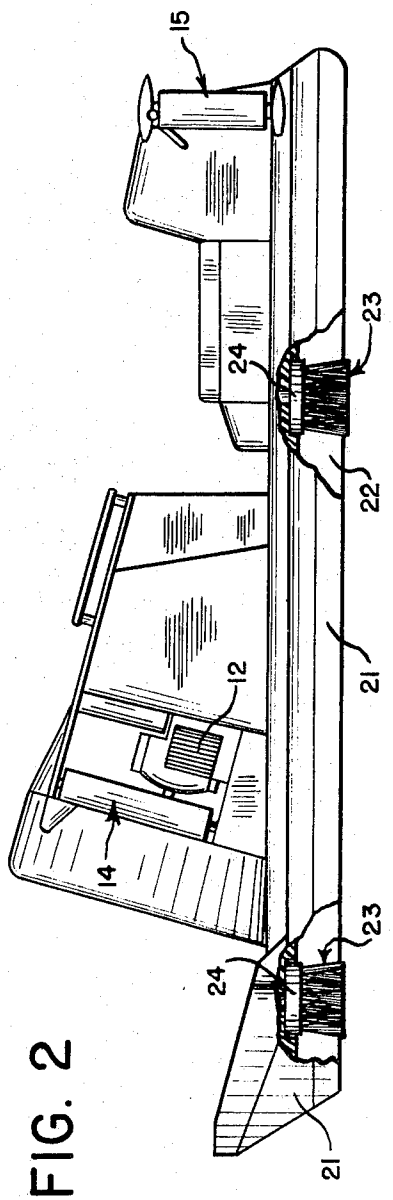


FIG. 2

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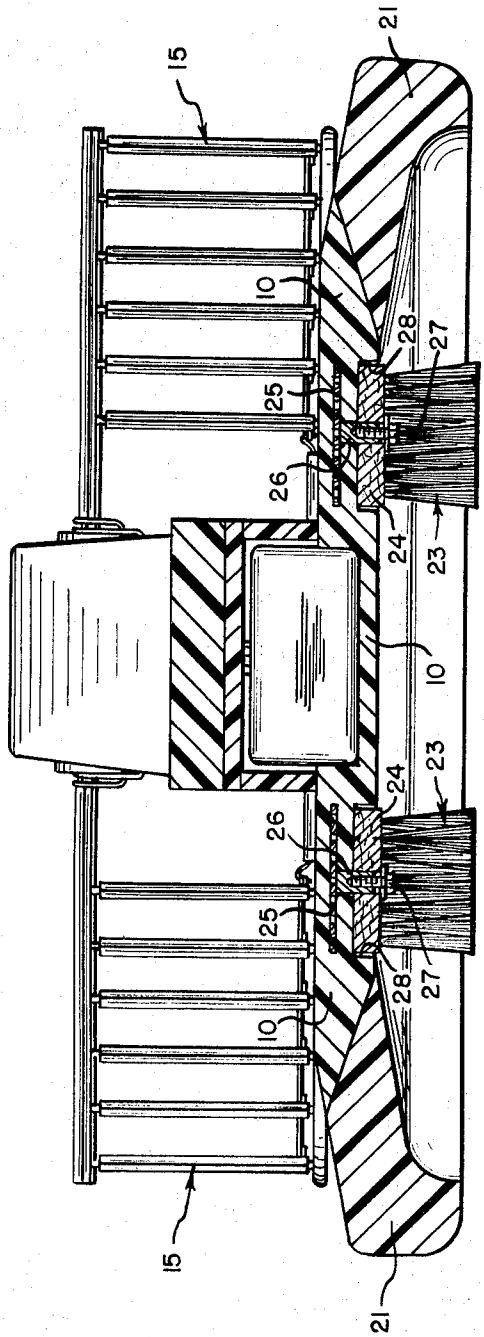


FIG. 3

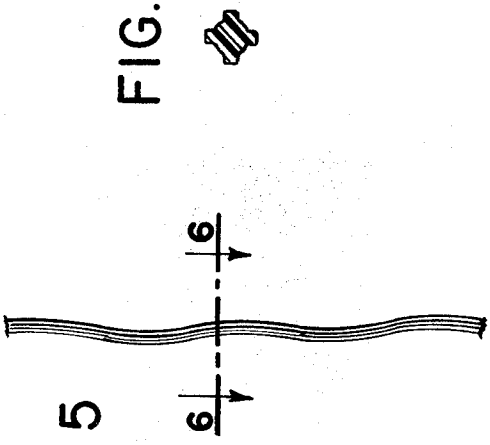


FIG. 5

FIG. 6

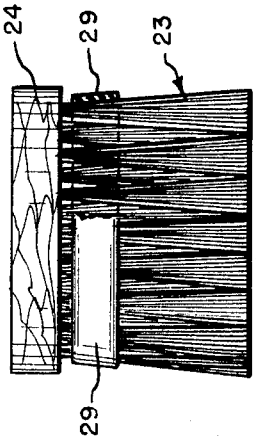


FIG. 4

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AIR-CUSHION VEHICLE WITH BRUSH SUPPORT

BACKGROUND OF THE INVENTION

Air-cushion vehicles utilize an arrangement for producing a cushion of air under pressure beneath the vehicle so as to raise the vehicle a short distance from the supporting surface. The supporting surface may be water, ground, snow, ice, etc.

Two principal types of structures are commonly employed for producing the air cushion. One type employs an open plenum chamber beneath the vehicle with a relatively large volume of low pressure air supplied thereto. The plenum chamber usually is formed of a downwardly extending peripheral wall or skirt which, together with the bottom of the vehicle, forms a chamber which is open at the bottom. The other principal type employs a peripheral slot or jet which produces a downwardly and inwardly sloping curtain of air under relatively high pressure. Usually the curtain of air is produced by supplying air under high pressure to a slot in a peripheral wall or skirt.

The peripheral walls or skirts are frequently sufficiently deformable so that, when the vehicle encounters surface obstructions, the wall or skirt can flex without being ruptured. Flexible or semi-rigid materials are frequently used for the wall or skirt.

If, when the vehicle is at rest for long periods of time, the weight of the vehicle is supported by the wall or skirt, a permanent or semi-permanent deformation of the wall or skirt may result. This may adversely affect the performance of the air cushion, and in any event will alter the clearance of the vehicle from the supporting surface.

In the past, various means have been provided for holding the vehicle off the ground while at rest, such as retractable skids and the like. While such expedients may be effective to prevent adverse deformation of the wall or skirt, the retracting mechanism adds to the complexity, weight and cost of the vehicle. This is undesirable, particularly in small vehicles. On the other hand, if the supports are not retractable and are left in place below the skirt level, they may interfere with normal operation, particularly over rough terrain.

The present invention provides a simple and inexpensive means for supporting the vehicle when at rest, which does not require retraction and yet does not interfere with normal operation of the vehicle.

SUMMARY OF THE INVENTION

In accordance with the invention, a plurality of brushes are attached to the body of the air-cushion vehicle within the boundary of the peripheral wall or skirt and extending downwardly approximately to the lower edge of the wall or skirt. The brushes are sufficiently stiff so that they are capable of supporting the vehicle while at rest without substantial deformation of the peripheral wall or skirt. However, inasmuch as the bristles of the brushes are elastic, if the brushes strike projections or obstacles in normal operation of the vehicle, the bristles bend or part so as to pass over or around the obstacle without injury, and without impairing the operation of the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of an air-cushion vehicle showing a suitable positioning of the brushes;

FIG. 2 is a side view of the vehicle of FIG. 1, with parts of the peripheral wall broken away to show the brushes;

FIG. 3 is a cross-section along the line 3—3 of FIG. 1;

FIG. 4 shows a modification of the brush;

FIG. 5 illustrates a rippled bristle which may be used in the brush; and

FIG. 6 is a cross-section along the line 6—6 of FIG. 5.

DESCRIPTION OF THE SPECIFIC EMBODIMENT

Referring to the figures, an air-cushion vehicle is shown of the type described in detail in application Ser. No. 2,810, filed

Jan. 14, 1970 by Hugo S. Ferguson for "Air Cushion Vehicles", assigned to the same assignee as the present application. A body platform **10** has an air propeller **11** driven by motor **12**. Front and rear sets of steering vanes **14** and **15** are controlled by a steering wheel **16**. The downstream flow of air from the propeller, under the control of the front steering vanes **14**, passes through air channels on either side of the operator position (behind steering wheel **16**) to the rear steering vanes.

The body platform **10** is provided with a downwardly extending peripheral wall or skirt **21** which forms an open plenum chamber **22** beneath the vehicle. As described in the above-identified application, air from the lower portion of the propeller is admitted to the plenum chamber through an opening in the body platform **10** (not shown).

Advantageously, the body platform **10** is molded of foamed, closed-cell, rigid polyurethane with a tough skin, and the peripheral wall or skirt **21** is formed of foamed, closed-cell, semi-rigid polyethylene. The semi-rigid wall has sufficient flexibility to avoid serious damage when traveling over rough terrain.

Although the semi-rigid skirt **21** has sufficient elasticity to return to its original condition after being deformed in normal operation, if the weight of the vehicle rests on the skirt for a considerable length of time the skirt will be more or less permanently deformed or "set". This will result in changing the clearance of the vehicle from the ground or other supporting surface. Further, if chambers or slots are formed in the skirt, the resulting deformation may seriously affect subsequent performance.

Accordingly, brushes **23** are attached to the vehicle body in a suitable configuration to provide stable support when the vehicle is at rest. The use of three round brushes, as shown, has been found satisfactory, but the number and shape of the brushes may be selected as meets the requirements of a particular vehicle. The brushes may be attached to the body of the vehicle in any suitable manner. The brushes project approximately to the lower edge of skirt **21**. If they project slightly below the lower edge, when the vehicle is on level ground the skirt will be slightly above the surface. If the brushes do not extend quite to the lower edge, the wall need give only a little bit and the vehicle will then be resting on the brushes. This may be satisfactory in particular applications.

In the specific embodiment shown, a perforated plate **25** with threaded cylinder **26** welded thereto is inserted in the body platform **10** during the molding operation. The head **24** of the brush has a central hole therethrough, and a bolt **27** and washer secure the brush in a recess **28** in the body of the vehicle.

The brushes **23** are designed to have sufficient stiffness to support the weight of the vehicle. Bristles of nylon and polypropylene have been employed with success, and bristles of wire, such as stainless steel, may be employed if desired. The size of the brush, diameter and length of the bristles, and the bristle material may be selected as meets the requirements of a particular application.

In one brush which has been used with success, approximately 90 tufts of bristles were set in ½ inch holes in a plywood back **24** about 8 inches in diameter and 1 inch thick. Nylon bristles about 55 mils (thousandths of an inch) in diameter were used. Each tuft had about 56 bristles and the length of the tufts was 4¼ inches from the back. Three of these brushes provided satisfactory support for a 250 pound vehicle. The brushes were mounted so that the bristles extended about one-quarter inch below the level of the skirt.

Similar brushes having ripple polypropylene bristles have also been used with success. A ripple bristle is shown in FIG. **5**. As indicated in FIG. **6**, the filament forming the bristle may be somewhat fluted. With such bristles, the ripples tend to insure contact between adjacent bristles so as to increase the overall stiffness of the brush without reducing the flexibility of the individual bristles.

It is possible for the bristles of the brushes to acquire a set if the vehicle is left standing for a long time with the bristles somewhat bent. This might occur, for example, if the vehicle were dragged along the ground to its resting place, and left standing without raising it to allow the bristles to resume their normal straight condition. Although such bending may not be serious, the bending may be reduced or avoided by strengthening the brush as a whole.

FIG. 4 shows an elastic band 29 encircling the brush near the base of the bristles, so as to strengthen the bristles as an aggregate against bending, while still allowing individual bending of the bristles as may be required to enable them to pass over obstacles, or to part so as to allow smaller obstacles to pass therethrough.

If desired, the bristle diameter may be increased, say to ⅛ inch diameter or more, particularly with longer bristles, to form a stiffer brush while still retaining adequate flexibility to pass over or around obstacles.

I claim

1. An air-cushion vehicle including a body having a deformable peripheral wall or skirt of impermeable material extending downwardly therefrom and means for producing an air cushion beneath said body within the confines of said peripheral wall or skirt for raising the vehicle above a supporting surface, in which the improvement comprises a plurality of discrete separated support brushes fixedly mounted on the under side of said body a substantial distance inwardly of the boundary of said peripheral wall or skirt and spaced therefrom, said brushes extending downwardly and terminating in a plane at a level below the major portion of said peripheral wall or skirt and approximately at the level of the lower edge of said peripheral wall or skirt for supporting said vehicle in the absence of said air cushion, each said brush comprising a plurality of individually flexible bristles, the aggregate of said bristles providing stiff brushes for the said support of said vehicle.

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