

[72] Inventor **Marc Henri Jean Faure**
Saint-Maur-des-Fosses, France

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[73] Assignee **Bertin & Cie**
Plaisir, France
a company of France

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[33] **France**

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Pat. 1,442,532

[54] **SIDEWALL DEVICE FOR FLUID CUSHION**
SYSTEM OF SURFACE EFFECT MACHINE
3 Claims, 2 Drawing Figs.

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

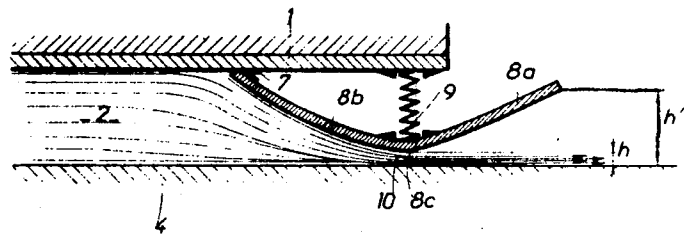
[51] Int. Cl. **B60v 1/00**

[50] Field of Search **180/127,**
128, 116—121

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Primary Examiner—A. Harry Levy
Attorney—Stevens, Davis, Miller and Mosher

ABSTRACT: A ground effect machine movable along a surface with the interposition of a pressure fluid cushion formed against said surface and laterally bounded by a sidewall which is carried by the machine structure and which defines, with said surface, a daylight clearance, said sidewall having an inner portion exposed to cushion fluid and converging from said structure towards said surface, and an outer extension connected to said inner portion in the region of said daylight clearance and diverging therefrom away from said surface, a cusp or like discontinuity in outline being provided at the connection of said inner portion and outer extension to ensure flow separation from the latter of the fluid issuing from said clearance.



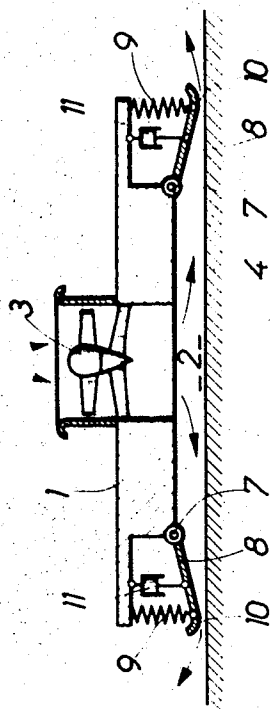


FIG. 1

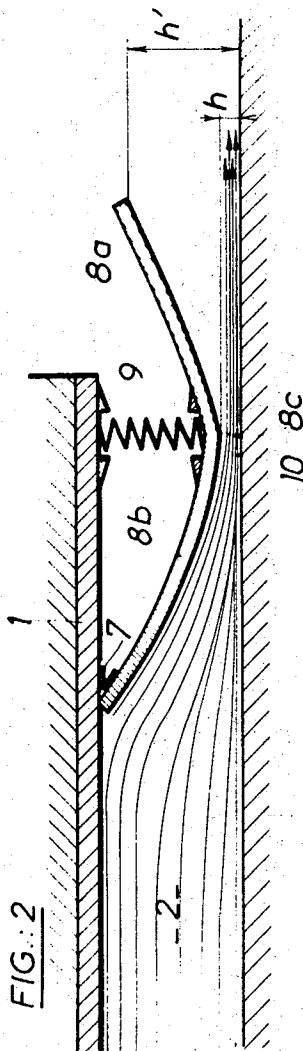


FIG. 2

SIDEWALL DEVICE FOR FLUID CUSHION SYSTEM OF SURFACE EFFECT MACHINE

This is a continuation-in-part of my copending application Ser. No. 498,258 filed Oct. 20, 1965 and since abandoned.

The present invention relates to surface effect machines and more particularly to tracked air cushion vehicles equipped with cushion-bounding sidewalls which are made of solid fluidtight material but are nevertheless yieldable at least in their part adjacent the track or other surface along which the machine is movable.

An object of this invention is to design such a sidewall so that it forms in outline, with said surface, a generally convergent-divergent passage, the throat of which being the so-called "daylight clearance" of the cushion system. The convergent portion flaring out toward the surface and being exposed to cushion pressure the latter urges it away from said surface, so that resilient return means are required to counteract this tendency.

Another object of the present invention is to provide a cusp or like discontinuity in said sidewall outline at or slightly beyond said throat in order to ensure flow separation from the diverging sidewall portion of the cushion fluid issuing from said daylight clearance.

A further object of this invention is to hinge said sidewall to the structure of the ground effect machine thereby allowing overall angular displacement of the sidewall and corresponding deformation of the convergent-divergent passage and displacement of the location of the daylight clearance.

Other objects and advantages of the present invention will appear in the following description given with reference to the accompanying drawings in which:

FIG. 1 is a diagrammatic vertical section of an air cushion vehicle having sidewalls designed in accordance with the present invention;

FIG. 2 is a partial section on a larger scale.

As illustrated in the drawings, the ground effect machine comprises basically a platform or body structure 1 on the underface of which a pressure fluid cushion 2 is formed by means of a fan 3 and bears the machine upon a surface 4 which may be a track. This cushion is laterally confined by means of sidewalls 8 connected at 7 to the platform underface.

In accordance with the present invention, the sidewall 8 is formed of rigid material of curved outline with an inner portion 8b exposed to cushion fluid and an outer extension 8a exposed to ambient air. The inner portion 8b flares downwardly and converges toward surface 4 whereas the outer extension 8a flares upwardly and diverges from said surface 4. A cuspidal edge 8c is formed at the junction of the inner portion 8b and outer extension 8a, that is at or near the lowermost point of the sidewall 8 or in other words its closest point with respect to surface 4, thereby defining a daylight clearance 10 for the cushion 2.

The rigid sidewall 8 is hinged at 7 to the platform structure 1. The cushion pressure exerted on the downwardly flaring portion 8b, urges it upwardly, that is counterclockwise about hinge 7 when viewing figure 2. To counteract this action, a spring 9 is inserted between the sidewall 8 and the platform structure 1. Any oscillations resulting from casual pressure variations are damped by means of dampers 11 extending also between the sidewalls 8 and the platform structure 1.

When encountering an obstacle on surface 4, the upwardly

flaring outer extension 8a is first to engage this obstacle and constitutes a sort of ramp or cam which raises the sidewall 8, helping negotiation of the obstacle. When the latter has passed beyond the lowermost point of the sidewall, the spring 9 returns the latter towards its original angular position. Of course, the obstacle being now inside cushion 2, it will be next engaged by the inner portion 8b of the opposite sidewall and this portion will in its turn play the part of a ramp or cam raising the latter sidewall against its spring 9.

With regard now to normal cushion operation, owing to the flaring outwardly and downwardly of inner portion 8b from the sidewall hinge 7, the fluid streamlines from inside the cushion 2 which flow towards the daylight clearance 8 along this portion 8b, have an increasing velocity and therefore exert a decreasing static pressure, which improves stability of the platform and in particular sidewise stability. Moreover, again owing to the above flared shape, any increase in cushion pressure causes a decrease in cushion volume since sidewalls 8 are urged closer to the platform 1 and, as the daylight clearance varies very little, this amounts to saying that platform 1 moves toward surface 4; opposite variations of cushion pressure and volume are a prerequisite of dynamic stability for the platform.

In order to ensure that the effective gap width be at the small value h of the throat or daylight clearance 10, care must be taken to prevent the convergent-divergent passage between sidewall 8 and surface 4 to operate as a Venturi or otherwise the effective width would be $h' > h$, h' being the distance of the free end of extension 8a above surface 4. That is why a cuspidal edge 8c or like outline discontinuity is provided at or immediately beyond throat 10 in order to ensure flow separation from extension 8a and to render the divergent passage 8a-4 ineffective aerodynamically speaking as a diffuser, thus restricting the real flow passage to a convergent nozzle 8b-4 ending at a section 10 of minimum area.

I claim:

1. A fluid cushion system for a surface effect machine having a structure movable along a surface in spaced relationship therewith with the interposition of a pressure fluid cushion formed against said surface, said system comprising a sidewall for said cushion which is carried by said structure and which defines with said surface a daylight clearance, said sidewall having in outline a curved convex side generally facing said surface, with an outwardly inclined inner portion exposed to cushion fluid and extending from said structure towards said surface, an intermediate section closest to said surface and defining said daylight clearance, and a turned-up, outwardly projecting extension diverging away from said surface, whereby said sidewall defines with said surface a generally convergent-divergent passage with said intermediate section defining a throat, said intermediate section including means for causing flow separation of fluid issuing through said clearance from said outwardly projecting extension has been inserted after "throat".

2. A fluid cushion system as claimed in claim 1, further comprising spring means extending between said structure and a side of said sidewall opposite said convex side thereof, said spring means urging said sidewall towards said surface.

3. A fluid cushion system as claimed in claim 2, further comprising oscillation damping means extending between said structure and said opposite side of said sidewall.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,536,154 Dated October 27, 1970

Inventor(s) Marc Henri Jean Faure

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, lines 53 and 54, cancel "has been inserted after "throat" ".

Signed and sealed this 13th day of April 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents