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FLEXIBLE SKIRTING SYSTEM FOR SURFACE EFFECT MACHINES

Filed April 19, 1965 4 Sheets-Sheet 1

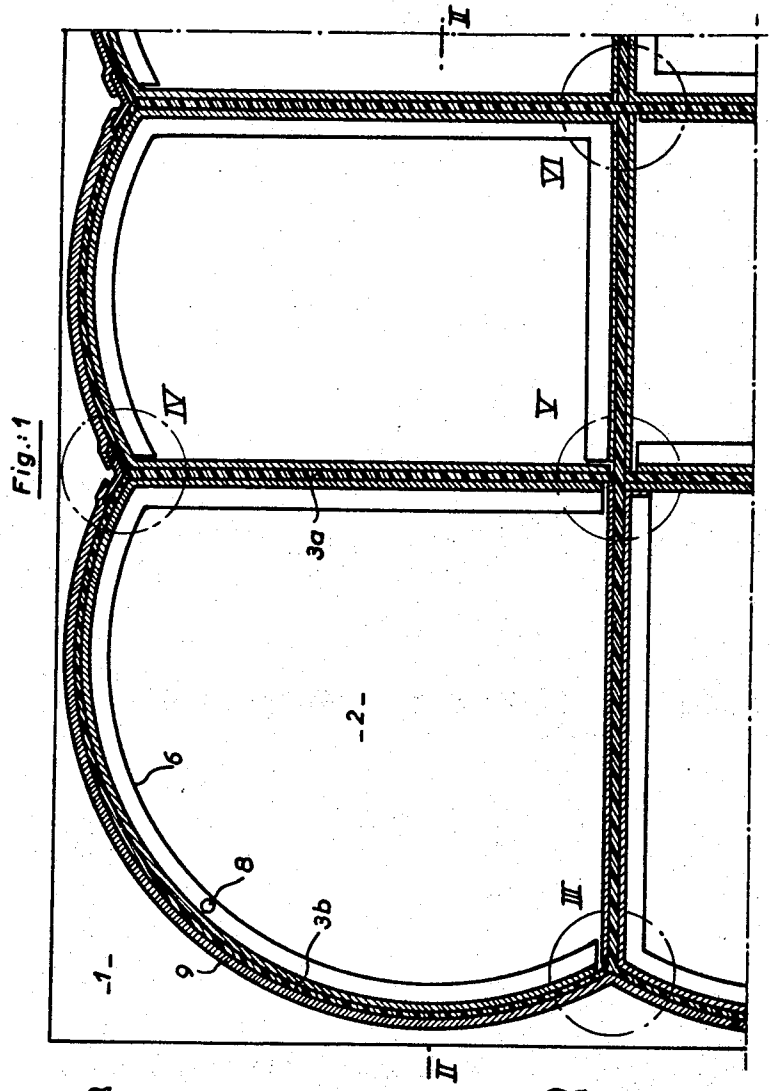

Fig. 1

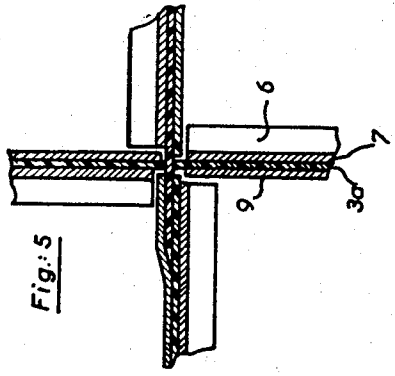

Fig. 5

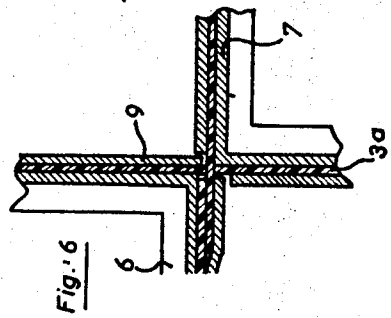

Fig. 6

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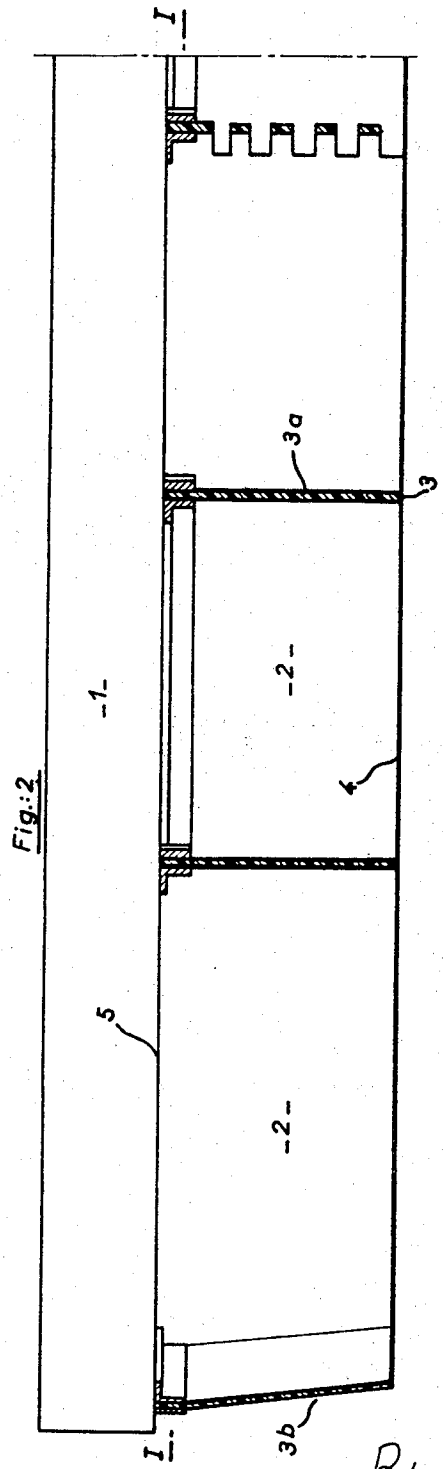

Fig.:2

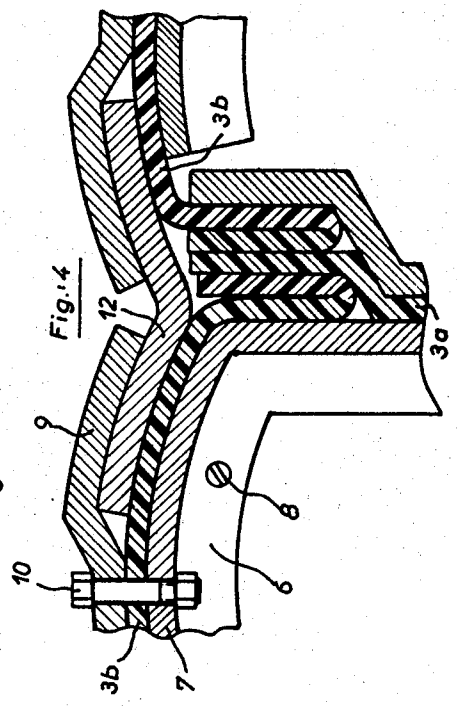

Fig.:4

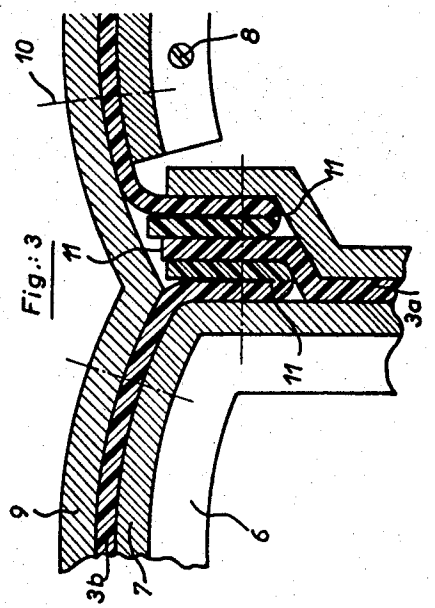

Fig.:3

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FLEXIBLE SKIRTING SYSTEM FOR SURFACE EFFECT MACHINES

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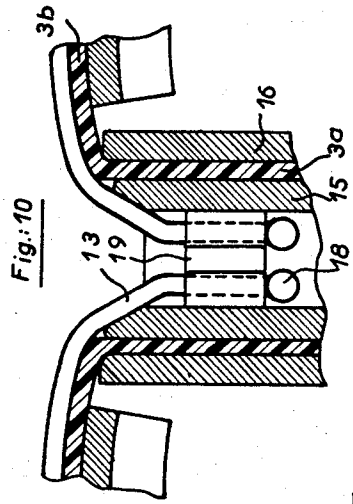


Fig.: 10

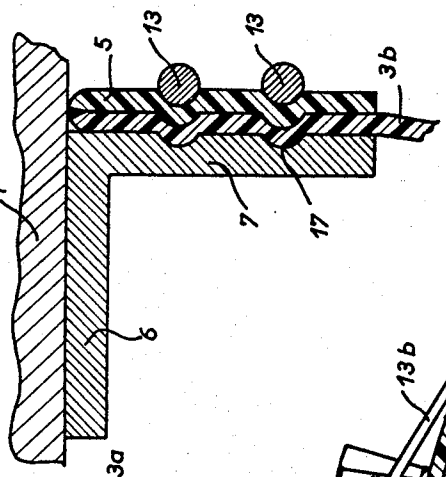
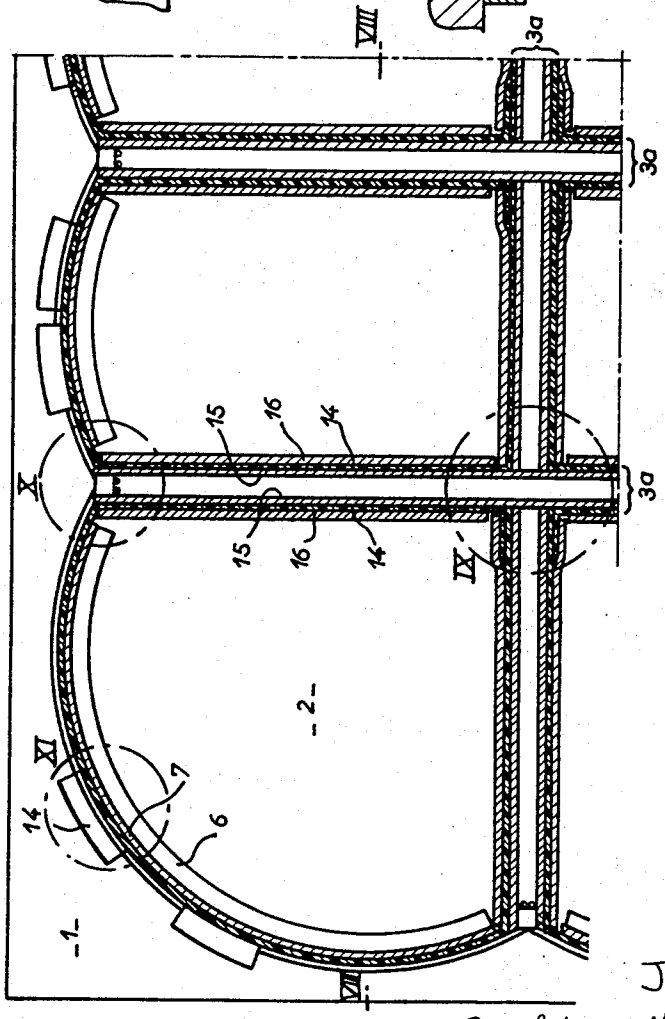


Fig.: 12



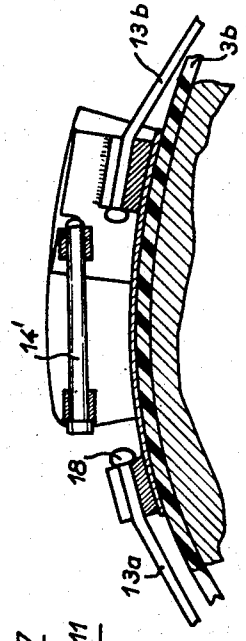


Fig.: 7

Fig.: 11

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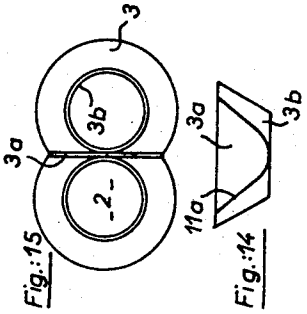
FLEXIBLE SKIRTING SYSTEM FOR SURFACE EFFECT MACHINES

Filed April 19, 1965 4 Sheets-Sheet 4



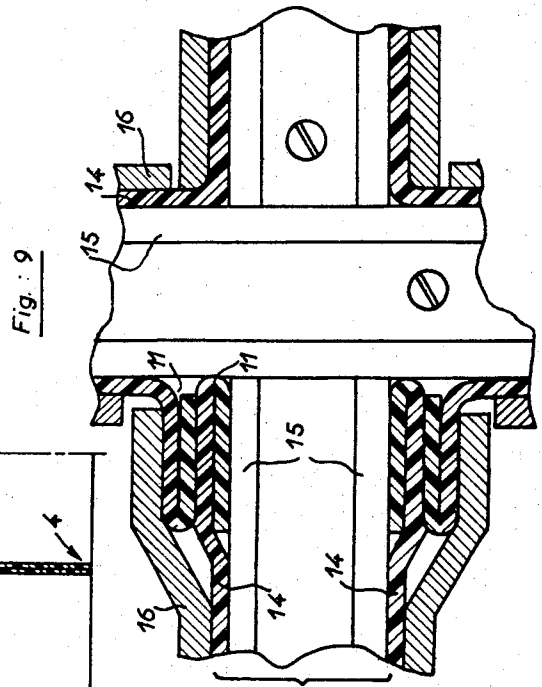


Fig: 9

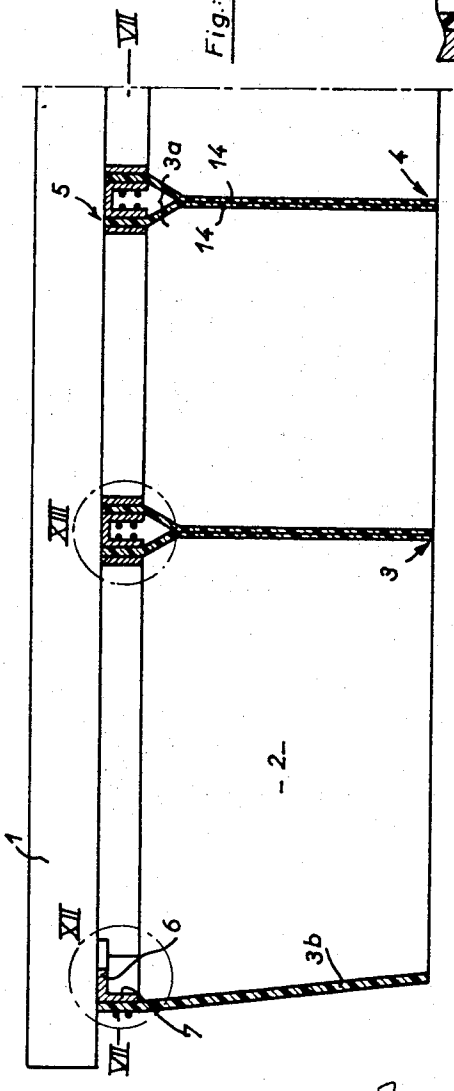


Fig:8

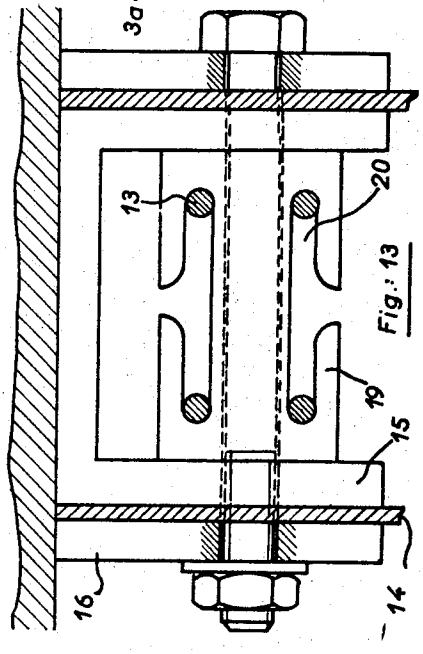


Fig: 13

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United States Patent Office 3,414,075 Patented Dec. 3, 1968

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FLEXIBLE SKIRTING SYSTEM FOR SURFACE EFFECT MACHINES

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Continuation-in-part of application Ser. No. 165,634, Jan. 11, 1962. This application Apr. 19, 1965, Ser. No. 449,009

Claims priority, application France, June 30, 1961, 866,604, add. application 80,047; Apr. 20, 1964, 971,607, Patent 1,421,301

8 Claims. (Cl. 180—121)

ABSTRACT OF THE DISCLOSURE

A surface effect machine of the multi-cushion kind operable with distinct pressure fluid cushions positioned next to each other and surrounded by a yieldable skirting system which comprises a peripheral wall lobated in plan and formed by a succession of outwardly-convex arcuate flexible skirt portions connected to form said wall at cuspidal edges thereof, and inner lobe separating means formed by one or more substantially planar flexible partitions extending substantially rectilinearly from said cuspidal edges inwardly of said peripheral wall and forming therewith junctions which are generally Y-shaped in plan with each partition being the leg of the Y.

This is a continuation-in-part of my application, Ser. No. 165,634 filed Jan. 11, 1962, now Patent No. 3,263,764 granted Aug. 2, 1966.

FIGURES 10 and 10A in the above-mentioned application relate to a surface effect machine of the multi-cushion type with distinct pressure fluid cushions positioned next to each other and surrounded by a skirting system made of flexible material adapted to yield when engaged by an obstacle or the crest of a wave.

Said figures in the parent application show such a machine with a skirting system designed and arranged to have a succession of two outwardly-convex arcuate flexible skirt portions connected to each other through cuspidal edges, whereby said skirting system is lobated in planform.

An object of the invention as disclosed in said figures of the parent application is to design and arrange said skirt portions to be part frustoconical and taper toward a free edge which extends along a circular arc.

An object of the present application invention is to provide an improvement over the parent application wherein said lobated skirting system is formed with lobe separating means extending rectilinearly between the cuspidal edges thereof and forms therewith a Y-shaped junction in planform with said lobe separating means being the leg of the Y.

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

FIGURE 1 is a fragmentary plan view along line I—I of FIGURE 2 of a ground effect machine embodying the invention;

FIGURE 2 is a corresponding sectional elevation along line II—II of FIGURE 1;

FIGURES 3 to 6 show on a larger scale details of the junctions of two contiguous flexible skirts, these figures corresponding to respective reference numerals III to VI of FIGURE 1;

FIGURES 7 and 8 correspond to FIGURES 1 and 2 respectively but show an alternative embodiment of a ground effect machine;

FIGURES 9 to 11 are views on a larger scale corresponding to details which bear the respective reference numerals IX to XI of FIGURE 7;

FIGURES 12 and 13 show details which correspond to respective reference numerals XII and XIII of FIGURE 8; and,

FIGURES 14 and 15 are respectively a partial perpendicular elevation and a view from below, on a smaller scale, of a further embodiment of a ground effect machine similar in certain respects to that of FIGURES 7 to 13.

Reference is here made to said copending application for a complete description of aforesaid FIGURES 10 and 10A and the advantages ascribed thereto which, by said reference thereto, is incorporated herein as part of the instant disclosure.

Referring to FIGURES 1 to 6, **1** designates a platform which during its operation is supported by several fluid cushions **2** each of which is bounded laterally by a flexible skirt **3** and is supplied, preferably independently of the other cushions, with fluids under pressure.

In order to best utilize the whole of the lower surface of the platform **1** for lift, the fluid cushions **2** are juxtaposed so as to form a compact group and the flexible skirts **3** which bound them laterally and include on the one hand substantially planar partition portions **3***a* separating two contiguous cushions without substantial pressure difference and on the other hand peripheral portions **3***b* forming the outer boundary of the group of cushions, to which the excess pressure of said cushions over that of the ambient medium imparts a planform at least approximately circular. These peripheral portions **3***b* are situated near the edges of the platform **1**.

In fact, the skirt configuration is such that the arcuate, peripheral portions **3***b* are outwardly-convex and together form a peripheral wall which is lobated in plan, being connected to form said wall at generally cuspidal edges thereof. Moreover, the planar portions **3***a* extend substantially rectilinearly from such cuspidal edges inwardly of the peripheral wall to define and separate the cushion "lobes" and form with such wall junctions which are generally Y-shaped in plan with the portions **3***a* being the leg of such Y.

The plan configuration of the lower edges of the skirts depends solely upon the "excess" pressure in the cushions and the internal tensile stresses to which the skirts are subjected. The skirts are made of any flexible and, if desired, tension-resistant material, especially a synthetic fabric made fluid-tight by means of a rubber coating.

The plan configuration of the upper edge **5** of each skirt **3** is determined by the means for securing the skirts to the underside of the frame **1**. Such securing is, for example, obtained by means of angle section members **6**, one flange of which is made fast with the platform **1** by any conventional securing means, for instance screws **8**, and the other perpendicular flange **7** of which is made fast with the upper edge **5** of a skirt **3**. This edge is for instance clamped between the flange **7** and a metal band **9** by means of bolts **10**.

All the members just mentioned may be seen in FIGURES 3 to 6. The junction of at least two peripheral skirt portions **3***b* and an inner skirt portion **3***a* is performed by any conventional assembling means, especially by stitching or gluing, the substantially vertical edge **11** of at least one of said portions being preferably doubled up and a butt-strap **12** being added if desired. It is also possible to carve strips out of the edge of a skirt portion and to rivet these strips as shown in FIGURE 2.

The description of this first embodiment of the invention shows that the substantially rectilinear portions **3***a* of the skirts form walls common to two contiguous skirts and are supported by one angle-bar only, relating to one or the other of said skirts. Moreover, the skirt portions **3***a*

form a crossed network inside the lobated peripheral wall.

FIGURES 7 to 13 show a modification according to which the portions 3*b* of the skirts are still supported by angle-bars **6**, their clamping against the flange **7** of said angle-bars being performed however, by means of tightening bands **13** in the state of tension. Moreover the common rectilinear portions 3*a* which separate two contiguous fluid cushions in fact consist of the juxtaposition of two sheets **14** respectively belonging to the skirts which surround said cushions and are therefore distinct.

It is apparent, especially on FIGURES 9 and 13, that two sheets **14** which constitute a common rectilinear partition portion 3*a* are supported by the two flanges **15** of a channel bar the web of which is secured to the platform **1** of the ground effect machine. The upper edges **5** of the sheets **14** are clamped by bolts or in any equivalent manner, between one of said flanges **15** and a metal band **6**. The internal pressure of the contiguous fluid cushions **2** maintains the sheets **14** in contact with each other apart from a region thereof adjacent the platform **1** which is somewhat greater than the height of the flanges **15**. This arrangement renders easier the deflection of the portions of common partitions portions 3*a* when the platform passes above an obstacle and reduces the loss of cushion fluid. Each skirt is deformed independently of the others, and therefore also the sheets **14** which constitute a portion 3*a* are deformed independently.

FIGURES 10 to 13 show how the upper edge **5** of the peripheral, curvilinear skirt portions 3*b* which bound the group of cushions is secured to the angle-bars **6** by means of the tightening bands **13**. The flanges **7** of the angle-bars **6** are preferably provided with grooves **17** which cooperate with said tightening bands in order to deform the edge **5** of said skirt portion 3*b*, which is conveniently doubled up (FIGURE 12). The end of the tightening bands **13**, which is provided with a shoulder **18**, is secured to a channel piece by a stop **19** bolted on to the flanges **15** of this member and having suitable slots **20** (FIGURES 10 and 13). Screw-stretchers **14'** connect two portions **13***a*, **13***b* of the same tightening band and enable the overall length of said band to be adjusted (FIGURE 11).

FIGURES 14 and 15 show a limit case of the second modification in which the skirts **3**, which are independent but form a compact group under the influence of the pressure forces, are only two in number and further the partition 3*a* which separates the two fluid cushions **2** has a width reduced practically to nothing at the lower edge

4 of the skirts. The edge **11***a* of this partition 3*a* has in elevation a hyperbolic form (FIGURE 14).

What is claimed is:

1. A surface effect machine of the multi-cushion kind operable with distinct pressure fluid cushions positioned next to each other, comprising a yieldable skirting system which surrounds said cushions and which includes a peripheral wall lobated in plan and formed by a succession of at least two outwardly-convex arcuate flexible skirt portions connected to form said wall at generally cuspidal edges thereof.

2. Machine as claimed in claim **1**, wherein each of said flexible skirt portions ends with a substantially part circular free edge.

3. Machine as claimed in claim **2**, wherein each of said flexible skirt portions is substantially part frustoconical and tapers toward said free edge thereof.

4. Machine as claimed in claim **1**, including a cuspidal edge interconnecting means comprising a plurality of substantially planar flexible partitions extending in either one of two substantially orthogonal directions and forming a crossed network inside said peripheral wall.

5. Machine as claimed in claim **1**, comprising a cuspidal edge interconnecting means including two flexible sheets respectively exposed to the pressure fluid of adjacent cushions and in mutual overlapping relation, whereby said sheets are urged against each other by the pressure of said respective cushions.

6. Machine as claimed in claim **5**, wherein said sheets are substantially coextensive and parallel with each other.

7. Machine as claimed in claim **6**, wherein said sheets are positively applied by said cushion pressure against each other in mutual engagement.

8. Machine as claimed in claim **7**, wherein said sheets are spaced from each other along an edge thereof remote from the surface over which said machine is operable.

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