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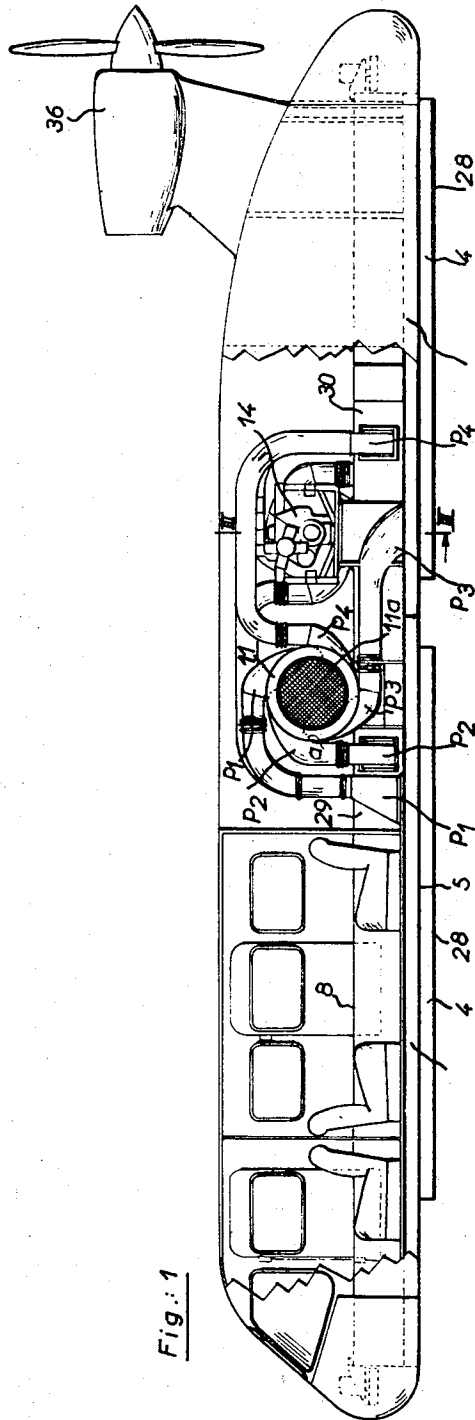
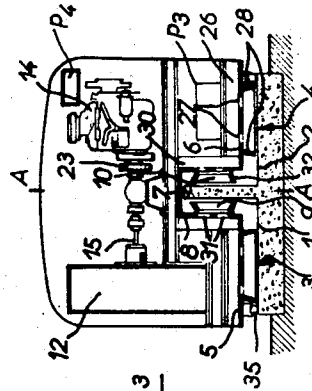
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3,417,709

AIR-CUSHION SUSTAINED VEHICLES

Filed May 31, 1966

2 Sheets-Sheet 1



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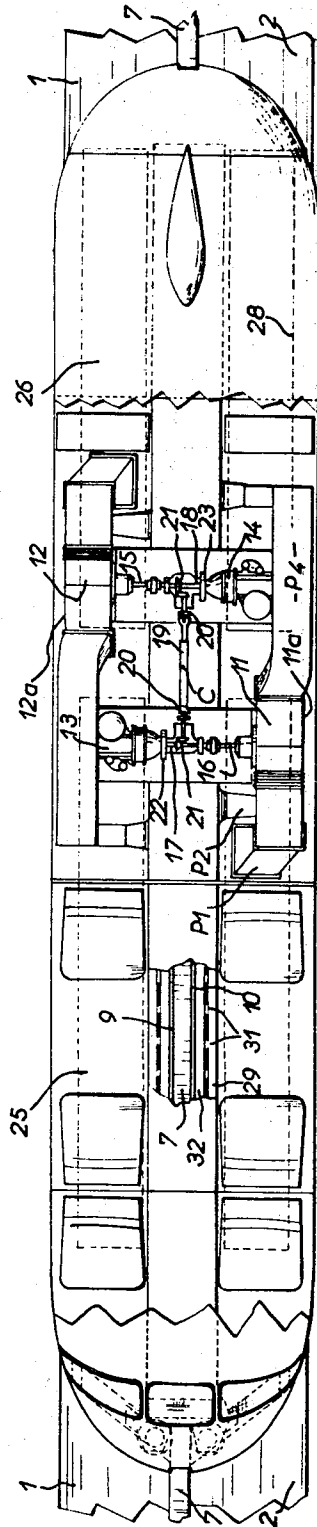
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AIR-CUSHION SUSTAINED VEHICLES

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Filed May 31, 1966, Ser. No. 553,738

Claims priority, application France, June 3, 1965, 19,438

9 Claims. (Cl. 104—23)

ABSTRACT OF THE DISCLOSURE

A multi-cushion, tracked ground effect machine having a cushion fluid supply plant which comprises centrifugal blowers or like shrouded fans so arranged with respect to the longitudinal medial plane of the machine that the impellers rotate, their intakes open, and their discharge ducts extend, in planes parallel to said longitudinal medial plane, thereby allowing for an overall design which is concentrated transversely of the machine and expanded longitudinally thereof.

Vehicles are known which are adapted to travel on a guide track and have means for producing air cushions at the places where the forces acting on the moving vehicle tend to produce friction between solids, the air cushions replacing the solid-to-solid friction by the much reduced friction of a solid on a gas, so that a relatively reduced propulsive power can provide very high speeds. The trend is to dispose the air cushions in at least two symmetrical rows on either side of the longitudinal plane of symmetry of the vehicle.

The problem is to supply the air cushions by so devising the system for producing the compressed air and distributing the same to the various cushions that such system takes up very little of the space bounded by the vehicle envelope or shell—for the vehicle loading gauge is of course limited—while ensuring that the supply of air to the cushions is very reliable and satisfactorily uniform.

The air cushion supply means according to this invention comprise at least two compressors or fans, to deliver the compressed air, and two motors, to drive the compressors, with provision for coupling such that either the two motors can drive the compressors or just one motor can drive both compressors in the event of the other motor failing.

Preferably, the compressors and the motors are disposed on either side of the longitudinal plane of symmetry of the vehicle so as to form a compact group which can be installed in the central part of the vehicle near the centre of the gravity thereof; preferably, the group is so devised that the compressors are symmetrical of the vertical axis of the group, and so are the motors, the overall arrangement ensuring that the vehicle is balanced satisfactorily.

Advantageously, the compressors and associated air outlets can be embodied by the means, comprising a centrifugal fan or compressor having air outlets distributed around the diffuser, which are described in French Patent No. 1,445,525 issued June 6, 1966. When such means are used, then, if the centrifugal fans are so positioned that their axis is horizontal, the air outlets of the single compressor can be distributed in a vertical plane, a feature further facilitating the contriving of the groups and of the supply piping for the various air cushions while helping to standardise air distribution conditions between the cushions.

In the drawings:

FIGURE 1 is a side view, in vertical elevation and with part of the outer shell or envelope broken away, of an

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embodiment of a vehicle according to the invention;

FIGURE 2 is a view in horizontal projection and corresponding to FIGURE 1; and

FIGURE 3 is a vertical section on the line III—III of FIGURE 1.

The drawings show a vehicle which is specially adapted for an inverted-T guide track, as can be seen clearly in FIGURE 3. Two bearing surfaces 1, 2 of the track (in FIGURE 3, the surfaces 1, 2 are shown as being horizontal but they can be inclined transversely to opposite hands) are adapted to bear the weight of the vehicle via air cushions produced at places 3, 4 between the surfaces 1, 2 and the vehicle body bottom walls 5, 6. The central vertical "stroke" or upright part 7 of the track guides the vehicle, the same being formed centrally with a deep inverted-U longitudinal groove 8 so as to straddle the upright part 7. Guidance is provided by vertical air cushions produced at places 9, 10 between the vehicle body vertical walls and the respective surfaces of the track part 7.

The invention is of course of use with other track guide systems, whatever guide system is used, the air cushions must be arranged in at least two rows disposed symmetrically of the longitudinal plane A—A of symmetry of the vehicle.

To produce compressed air for supplying the air cushions, the embodiment shown comprises two rotary compressors or ventilators 11, 12 associated with two driving motors 13, 14 shown as explosion or internal-combustion engines. One motor and one compressor are provided on each side of the plane A—A and, as FIGURE 2 shows, on the one hand the compressors, and, on the other hand, the engines are disposed symmetrically of the vertical axis, passing through a point C, of the assembly which they form, a factor helping in the vehicle balancing. Advantageously, the latter axis also passes through the centre of gravity of the vehicle.

The compressors shown are of the centrifugal kind and their shafts 15, 16 are horizontal, so that the air intakes 11a, 12a associated with each compressor can be disposed in substantially vertical planes on either side of the plane A—A, as the plan view in FIGURE 2 shows.

Output shafts 17, 18 of the engines 13, 14 are disposed in respective prolongation of the shafts 15, 16 of the compressors 11, 12 driven by the engines. The shafts of the two motor-compressor sets are interconnected by an intermediate shaft 19 which the drawing shows as being placed in the plane of symmetry of the vehicle and connected by universal joints 20 and gearing 21 to the compressor shafts. The output shaft of each engine comprises a free wheel 22, 23 respectively.

When both the engines are operating and running at the same speed, the shafts 17, 18 are driven by their respective engines via the respective free wheels 22, 23. If one engine operates incorrectly or fails completely, it is automatically disengaged, via the corresponding free wheel, and the two compressors are driven by the engine which remains in operation and whose power can be increased by the vehicle driver to maintain the supply of air to the air cushions.

Of course, modifications are possible. For instance, a normally disengaged coupling can be provided on the intermediate shaft 19 and normally engaged couplings can be provided on the shafts 17, 18, so that in the event of either motor failing in any way, the coupling of the failing or failed motor is disengaged simultaneously as the coupling of the shaft 19 is engaged.

The advantage of using centrifugal compressors is that the air delivery outlets associated with a single compressor can be devised simply and very symmetrically to supply various cushions. Referring, for instance to FIGURE 1, the compressor 11 delivers to four air outlets p^1 , p^2 , p^3 , p^4 , which follow the compressor diffuser and in shape resem-

ble a portion of a volute in prolongation of diffuser blading diagrammatically denoted in FIGURE 1 by chain lines *a*. The aforesaid French patent discloses this latter feature, which provides good separation between the various air flow components delivered by a single compressor, helps to make such components substantially independent of one another, and helps to divide the air flow uniformly.

Referring to FIGURES 1 and 3, the air outlets p^1 , p^3 , of the compressor 11 deliver to two elongated boxes 25, 26 disposed below the vehicle bottom wall 6. Through holes, as 27, the boxes 25, 26 supply two air cushions 4 and also act as reserves therefor. Each cushion is bounded laterally by a flexible wall or skirt 28 connected to the underside of the vehicle. The wall 28, which is impervious to air, is embodied, for instance, by a rubberized fabric.

Similarly, the air outlets p^2 , p^4 of the compressor 11 supply two boxes 29, 30 disposed vertically and consecutively along a vertical wall of the body parts straddling the central upright 7 of the track. Through holes, as 31, the boxes 29, 30 supply the air cushions 10 which help to provide guidance and which, like the air cushions just described, are bounded by a flexible wall or skirt 32 secured to the vehicle. A similar and symmetrical system associated with the fan 12 enable air to be supplied to the air cushions disposed on the other side of the plane A—A.

When the supply to the air cushions ceases, the vehicle can rest on the ground through the agency of skids or horizontal-axis rollers 35 mounted on the vehicle. Other vertical-axis rollers can be provided to bear against the central track upright 7, to take over in the event of accidental failure of the supply of air to the guiding cushions.

A variety of forms of propulsion can be considered, such as an engine driving an airscrew (denoted by the reference 36 in FIGURE 1); reaction jet and so on.

What is claimed is:

1. A ground effect machine movable along a track with the interposition of separate pressure fluid cushions formed against said track, said machine including a longitudinal medial plane and comprising shrouded fans having rotation axes substantially perpendicular to said longitudinal medial plane and pressure fluid discharge passages arcuately spaced about said axes, and pressure fluid supply ducts connecting each of said discharge passages to a respective one of said pressure fluid cushions, a substantial extent of the length of said supply ducts extending from said discharge passages in planes substantially parallel to said longitudinal medial plane, said fans comprising each a central fluid intake area extending in a plane substantially parallel to said longitudinal medial plane.

2. Ground effect machine as claimed in claim 1, wherein said shrouded fans are centrifugal blowers comprising each peripheral pressure fluid discharge passages distributed in a plane substantially parallel to said longitudinal medial plane.

3. Ground effect machine as claimed in claim 1, further comprising a motor for each fan, positioned opposite the same transversely of said machine, and a transverse drive shaft connecting each motor to the respective fan and extending substantially perpendicular to said longitudinal medial plane.

4. Ground effect machine as claimed in claim 3, wherein each motor driven fan is so arranged that the fan is positioned on one side of said longitudinal medial plane, the motor is positioned on the other side of said longitudinal medial plane, and the drive shaft extends across said longitudinal medial plane.

5. Ground effect machine as claimed in claim 4, comprising two longitudinally spaced motor driven fans in mutual head-to-tail arrangement, the fans being on opposite sides of said longitudinal medial plane and the motors being likewise on opposite sides of said longitudinal medial plane.

6. Ground effect machine as claimed in claim 5, further comprising a longitudinal auxiliary shaft extending substantially parallel to said longitudinal medial plane and interconnecting said transverse drive shafts.

7. Ground effect machine as claimed in claim 6, further comprising a free wheel system in each of said transverse drive shafts on the section thereof between the respective motor and the respective connection with said longitudinal auxiliary shaft.

8. Ground effect machine as claimed in claim 5, comprising a plurality of pressure fluid cushions on each side of said longitudinal medial plane, with the cushions positioned on one side of said longitudinal medial plane being supplied with pressure fluid from the fan position on the same side, and with the cushions positioned on the other side of said longitudinal medial plane being supplied with pressure fluid from the fan positioned on said other side.

9. Ground effect machine as claimed in claim 1, wherein said track has a cross section in inverted T shape with a central upright section which is straddled by said machine, and wherein said rotation axes extend above the upmost part of said upright section.

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U.S. Cl. X. R.

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