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Grant

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[54] **APPARATUS AND METHOD FOR COMPUTING UNSTEADY FLOWS BY DIRECT SOLUTION OF THE VORTICITY EQUATION**

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[52] **U.S. Cl.** **73/147**

[58] **Field of Search** ..... 73/147, 178 R, 73/178 T, 861.22, 861.23, 861.24, 195, 196; 137/804; 346/1, 107, 135

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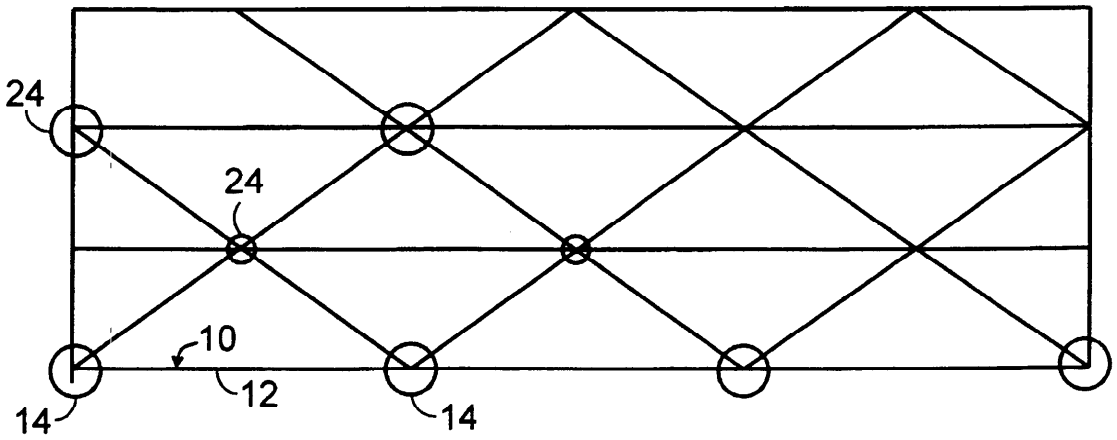
[57] **ABSTRACT**

Fluid flow characteristics are calculated directly from a two dimensional surface model of the object. A plurality of surface nodes with defined boundary conditions are established on the surface model. Consecutive layers of nodes are created a preset distance outward from said surface model. Curved panels are defined passing through three nodes at a layer, and a surface shape function is established for each panel from previous panels or from the boundary conditions. The fluid flow velocity for the next layer is developed from the velocities calculated at the previous layer and the shape function. Triangular elements are created by connecting a node on the next layer with two nodes from the previous layer to form an element. First and second vorticity gradients can be calculated for the current node at a time segment from the parameters associated with the previous layer of interest nodes at that time increment. This can be combined with the calculated diffusion velocity for the node to produce a rate of change of vorticity with respect to time which can be used to calculate the velocity of the fluid at the node.

9 Claims, 4 Drawing Sheets