CLAIMS

1. A cross-flow fan comprising a plurality of vane portions (21) provided to be circumferentially spaced apart from each other, each having an inner edge portion (26) arranged on a radially inner side to/from which air flows in/out and an outer edge portion (27) arranged on a radially outer side to/from which air flows in/out, wherein

said vane portion (21) has a blade surface (23) extending between said inner edge portion (26) and said outer edge portion (27) and including a pressure surface (25) arranged on a rotation direction side of the cross-flow fan and a suction surface (24) arranged on a back side of said pressure surface (25),

said vane portion (21) has such a blade cross-sectional shape that a concave portion (56, 57, 76, 77) is formed at said pressure surface (25) and said suction surface (24) when said vane portion (21) is cut along a plane orthogonal to a rotation axis of the cross-flow fan, and

a plurality of said concave portions are formed at at least one of said pressure surface (25) and said suction surface (24).

2. The cross-flow fan according to claim 1, wherein

said vane portion (21) has a flection portion (41) formed by flexing a center line (106) of said blade cross-sectional shape extending between said inner edge portion (26) and said outer edge portion (27), at a plurality of points, and

said concave portion (56, 57) is formed by said flection portion (41).

3. The cross-flow fan according to claim 2, wherein said flection portion (41) is flexed such that a depth of said concave portion (56, 57) is larger than a thickness of said vane portion (21) at at least one point.

4. The cross-flow fan according to claim 1, wherein said concave portion (57)

is formed in the proximity of said inner edge portion (26) and said outer edge portion (27).

5. The cross-flow fan according to claim 1, wherein said concave portion (56) is formed at a blade central portion between said inner edge portion (26) and said outer edge portion (27).

6. The cross-flow fan according to claim 1, wherein said concave portion (56, 57, 76, 77) is formed to extend from one end to the other end of said blade surface (23) in a rotation axis direction of the cross-flow fan.

7. The cross-flow fan according to claim 1, wherein said concave portion (76, 77) is formed at said pressure surface (25) and said suction surface (24) to repeatedly appear in a direction in which said inner edge portion (26) is connected with said outer edge portion (27).

8. The cross-flow fan according to claim 1, wherein said concave portion (57, 77) formed at said pressure surface (25) forms a convex portion (51, 71) at said suction surface (24), and said concave portion (56, 76) formed at said suction surface (24) forms a convex portion (52, 72) at said pressure surface (25).

9. The cross-flow fan according to claim 1, wherein

in said blade cross-sectional shape, said concave portion (56, 57, 76, 77) is formed between convex portions (51, 52, 71, 72) appearing at said blade surface (23), and

said concave portion (56, 57, 76, 77) and said convex portions (51, 52, 71, 72) are formed to be alternately aligned in a direction in which said inner edge portion (26) is connected with said outer edge portion (27).

10. The cross-flow fan according to claim 1, wherein said vane portion (21) has said blade cross-sectional shape having a generally constant thickness between said inner edge portion (26) and said outer edge portion (27).

11. The cross-flow fan according to claim 1, wherein said blade cross-sectional shape is approximately W-shaped.

12. The cross-flow fan according to claim 1, wherein the cross-flow fan is formed from resin.

13. A molding die for use to mold the cross-flow fan of claim 12.

14. A fluid feeder comprising a blower (115) configured to include the cross-flow fan of claim 1 and a driving motor coupled to said cross-flow fan to rotate a plurality of said vane portions (21).

CLAIMS

1. A cross-flow fan comprising a plurality of vane portions provided to be circumferentially spaced apart from each other, each having an inner edge portion arranged on a radially inner side to/from which air flows in/out and an outer edge portion arranged on a radially outer side to/from which air flows in/out, wherein

said vane portion has a blade surface extending between said inner edge portion and said outer edge portion and including a pressure surface arranged on a rotation direction side of the cross-flow fan and a suction surface arranged on a back side of said pressure surface,

said vane portion has such a blade cross-sectional shape that a concave portion is formed at said pressure surface and said suction surface when said vane portion is cut along a plane orthogonal to a rotation axis of the cross-flow fan,

a plurality of said concave portions are formed at at least one of said pressure surface and said suction surface, and

the number of said concave portion(s) formed at said pressure surface is greater than the number of said concave portion(s) formed at said suction surface.

2. The cross-flow fan according to claim 1, wherein

said concave portion has a groove cross section extending along a rotation axis of the cross-flow fan, and

side surfaces of said groove cross section are formed to rise from a deepest point of said concave portion to both sides thereof.

3. The cross-flow fan according to claim 1 or 2, wherein

said vane portion has a flection portion formed by flexing a center line of said blade cross-sectional shape extending between said inner edge portion and said outer edge portion, at a plurality of points, and

said concave portion is formed by said flection portion.

4. The cross-flow fan according to claim 3, wherein said flection portion is flexed such that a depth of said concave portion is larger than a thickness of said vane portion at at least one point.

5. The cross-flow fan according to any one of claims 1 to 4, wherein said concave portion is formed in the proximity of said inner edge portion and said outer edge portion.

6. The cross-flow fan according to any one of claims 1 to 5, wherein said concave portion is formed at a blade central portion between said inner edge portion and said outer edge portion.

7. The cross-flow fan according to any one of claims 1 to 6, wherein said concave portion is formed at said pressure surface and said suction surface to repeatedly appear in a direction in which said inner edge portion is connected with said outer edge portion.

8. The cross-flow fan according to any one of claims 1 to 7, wherein said concave portion formed at said pressure surface forms a convex portion at said suction surface, and said concave portion formed at said suction surface forms a convex portion at said pressure surface.

9. The cross-flow fan according to any one of claims 1 to 8, wherein

in said blade cross-sectional shape, said concave portion is formed between convex portions appearing at said blade surface, and

said concave portion and said convex portions are formed to be alternately aligned in a direction in which said inner edge portion is connected with said outer edge portion.

10. The cross-flow fan according to any one of claims 1 to 9, wherein said vane portion has said blade cross-sectional shape having a generally constant thickness between said inner edge portion and said outer edge portion.

11. The cross-flow fan according to any one of claims 1 to 10, wherein said blade cross-sectional shape is approximately W-shaped.

12. The cross-flow fan according to any one of claims 1 to 11, wherein the cross-flow fan is formed from resin.

13. A molding die for use to mold the cross-flow fan of claim 12.

14. A fluid feeder comprising a blower configured to include the cross-flow fan of any one of claims 1 to 12 and a driving motor coupled to said cross-flow fan to rotate a plurality of said vane portions.