CLAIMS

1. A method for increasing flow capacity of a fluid channel in a downstream direction, the fluid channel having a channel surface configured for liquid flow there along, the channel surface including a discontinuity, the method comprising:

disposing a fairing adjacent the discontinuity, the fairing defining a respective fairing surface absent convolutions transverse to the downstream direction, the fairing surface:

being located entirely in the fluid channel;

being configured for liquid flow there along; and

extending from a respective leading edge of the fairing surface located upstream of the discontinuity to a respective trailing edge of the fairing surface located downstream of the leading edge at least as far as the discontinuity; wherein:

at the leading edge, the fairing surface is tangent the channel surface;

at the trailing edge, the fairing surface is tangent the channel surface; and

the fairing surface follows a curve that smoothly transitions between the leading edge and the trailing edge.

2. A method according to claim 1, wherein the fairing surface follows a reverse curve that smoothly transitions between the leading edge and the trailing edge.

3. A method according to claim 1, wherein the trailing edge of the fairing surface is located no further downstream than the discontinuity.

4. A method according to claim 1, wherein the trailing edge of the fairing surface is located downstream of the discontinuity.

5. A method according to claim 3, wherein the fairing surface follows an at least two-cycle reverse curve.

6. A method according to claim 1, wherein the fluid channel defines a volume configured for liquid flow therethrough and disposing the fairing comprises disposing the fairing such that at least a portion of the fairing surface between the leading edge and the trailing edge is displaced a positive distance, measured perpendicular to the downstream direction, into the volume of the fluid channel from a hypothetical channel surface of the channel absent the fairing.

7. A method according to claim 1, wherein the fluid channel defines a volume configured for liquid flow therethrough and disposing the fairing comprises disposing the fairing such that, at each location along the downstream direction, between the leading edge and the trailing edge, the fairing surface is displaced a positive distance, measured perpendicular to the downstream direction, into the volume of the fluid channel from a hypothetical channel surface of the channel absent the fairing.

8. A method according to claim 1, wherein disposing the fairing comprises disposing the fairing such that, at each corresponding location along the downstream direction, between the leading edge and the trailing edge, a cross-sectional fluid flow area, measured perpendicular to the downstream direction and taking into account the fairing, of the fluid channel is no greater than a hypothetical cross-sectional fluid flow area absent the fairing.

9. A method according to claim 1, wherein the discontinuity is defined by a portion of the fluid channel: (a) having an elbow-shape, a T-shape or a Y-shape or (b) comprising an entrance region to a centrifugal pump or to a rotary valve.

10. A method according to claim 1, wherein disposing the fairing adjacent the discontinuity comprises temporarily installing the fairing in the fluid channel.

11. A method according to claim 1, wherein disposing the fairing adjacent the discontinuity comprises forming the fairing as an integral part of the fluid channel.

12. A method according to claim 1, wherein the fairing surface is smooth.

13. A device for increasing flow capacity of a fluid channel in a downstream direction, the fluid channel having a channel surface configured for liquid flow there along, the channel surface including a discontinuity, the device comprising:

a fairing defining a respective fairing surface, the fairing surface:

being located entirely in the fluid channel;

being configured for liquid flow there along; and

extending from a respective leading edge of the fairing surface located upstream of the discontinuity to a respective trailing edge of the fairing surface located downstream of the leading edge at least as far as the discontinuity; wherein:

at the leading edge, the fairing surface is tangent the channel surface;

at the trailing edge, the fairing surface is tangent the channel surface; and

the fairing surface follows a curve that smoothly transitions between the leading edge and the trailing edge, wherein the fairing surface is dimpled, rough or patterned.

14. A device according to claim 13, wherein the fairing surface defines a surface pattern configured to cause, in response to flow of liquid there along, emission of an acoustic signal indicative of a predetermined flow characteristic of the fluid.

15. A device for increasing flow capacity of a fluid channel in a downstream direction, the fluid channel having a channel surface configured for liquid flow there along, the channel surface including a discontinuity, the device comprising:

a fairing defining a respective fairing surface, the fairing surface:

being located entirely in the fluid channel;

being configured for liquid flow there along; and

extending from a respective leading edge of the fairing surface located upstream of the discontinuity to a respective trailing edge of the fairing surface located downstream of the leading edge at least as far as the discontinuity; wherein:

at the leading edge, the fairing surface is tangent the channel surface;

at the trailing edge, the fairing surface is tangent the channel surface; and

the fairing surface follows a curve that smoothly transitions between the leading edge and the trailing edge;

the fairing comprises a pin, and the fairing is configured to pivot about the pin.

16. A device for increasing flow capacity of a fluid channel in a downstream direction, the fluid channel having a channel surface configured for liquid flow there along, the channel surface including a discontinuity, the device comprising:

a fairing defining a respective fairing surface, the fairing surface:

being located entirely in the fluid channel;

being configured for liquid flow there along; and

extending from a respective leading edge of the fairing surface located upstream of the discontinuity to a respective trailing edge of the fairing surface located downstream of the leading edge at least as far as the discontinuity; wherein:

at the leading edge, the fairing surface is tangent the channel surface;

at the trailing edge, the fairing surface is tangent the channel surface; and

the fairing surface follows a curve that smoothly transitions between the leading edge and the trailing edge;

the fairing defines as hollow portion and an aperture between the hollow portion and the fluid channel, wherein the hollow portion and the aperture are configured to emit an oscillating acoustic signal in response to a fluid flow across the aperture.

17. A device for increasing flow capacity of a fluid channel in a downstream direction, the fluid channel having a channel surface configured for liquid flow there along, the channel surface including a discontinuity, the device comprising:

a fairing defining a respective fairing surface, the fairing surface:

being located entirely in the fluid channel;

being configured for liquid flow there along; and

extending from a respective leading edge of the fairing surface located upstream of the discontinuity to a respective trailing edge of the fairing surface located downstream of the leading edge at least as far as the discontinuity; wherein:

at the leading edge, the fairing surface is tangent the channel surface;

at the trailing edge, the fairing surface is tangent the channel surface; and

the fairing surface follows a curve that smoothly transitions between the leading edge and the trailing edge;

the fairing defines a bladder in fluid communication with a control port and configured to change the shape of the surface of the fairing in response to inflation of the bladder.

18. A device according to claim 17, wherein the fairing defines at least one pressure sensing port fluidically coupled to a respective gauge port.

19. A device according to claim 18, wherein the gauge port is fluidically coupled to the control port.

20. A method according to claim 1, wherein the fairing defines at least one passage through the fairing, each passage fluidically connecting a respective upstream portion to a respective downstream portion of the fairing, each passage defining a respective upstream opening and a respective downstream opening, each passage being configured to permit at least a portion of liquid flowing in the fluid channel to bypass full profile of the fairing.

21. A device for increasing flow capacity of a fluid channel in a downstream direction, the fluid channel having a channel surface configured for liquid flow there along, the channel surface including a discontinuity, the device comprising:

a fairing defining a respective fairing surface, the fairing surface:

being located entirely in the fluid channel;

being configured for liquid flow there along; and

extending from a respective leading edge of the fairing surface located upstream of the discontinuity to a respective trailing edge of the fairing surface located downstream of the leading edge at least as far as the discontinuity; wherein:

at the leading edge, the fairing surface is tangent the channel surface;

at the trailing edge, the fairing surface is tangent the channel surface; and

the fairing surface follows a curve that smoothly transitions between the leading edge and the trailing edge;

the fairing comprises an upstream portion and a downstream portion joined together by a pivot hinge, wherein an upstream end of the upstream portion is translatably attached to the channel surface, and the two portions and are configured to pivot in response to translation of the upstream end of the upstream portion and thereby extend the pivot hinge, the downstream end of the upstream portion and the upstream end of the downstream portion further into the fluid channel, the fairing further comprising a spring configured to urge the upstream end of the upstream portion to a neutral position.

22. A device for increasing flow capacity of a fluid channel in a downstream direction, the fluid channel having a channel surface configured for liquid flow there along, the channel surface including a discontinuity, the device comprising:

a fairing defining a respective fairing surface, the fairing surface:

being located entirely in the fluid channel;

being configured for liquid flow there along; and

extending from a respective leading edge of the fairing surface located upstream of the discontinuity to a respective trailing edge of the fairing surface located downstream of the leading edge at least as far as the discontinuity; wherein:

at the leading edge, the fairing surface is tangent the channel surface;

at the trailing edge, the fairing surface is tangent the channel surface; and

the fairing surface follows a curve that smoothly transitions between the leading edge and the trailing edge;

the fairing defines:

a first bladder in fluid communication with a port downstream of the fairing in the fluid channel; and

a second bladder in fluid communication with a port upstream of the fairing in the fluid channel;

wherein the first and second bladders are configured to automatically regulate shape of the fairing, based on respective pressures at the ports.

23. A method according to claim 1, wherein the channel surface includes a second discontinuity, the method further comprising:

disposing a second fairing defining a respective second fairing surface, the second fairing surface:

being located entirely in the fluid channel;

being configured for liquid flow there along; and

extending from a respective leading edge of the second fairing surface located upstream of the discontinuity to a respective trailing edge of the second fairing surface located downstream of the leading edge at least as far as the discontinuity; wherein:

at the leading edge, the second fairing surface is tangent the channel surface;

at the trailing edge, the second fairing surface is tangent the channel surface; and

the second fairing surface follows a curve that smoothly transitions between the leading edge and the trailing edge.

24. A method according to claim 1, wherein the fairing surface is dimpled, rough or patterned.

25. A method according to claim 24, wherein the fairing surface defines a surface pattern configured to cause, in response to flow of fluid there along, emission of an acoustic signal indicative of a predetermined flow characteristic of the fluid.

26. A method according to claim 1, wherein the fairing comprises a pin, and the fairing is configured to pivot about the pin.

27. A method according to claim 1, wherein the fairing defines as hollow portion and an aperture between the hollow portion and the fluid channel, wherein the hollow portion and the aperture are configured to emit an oscillating acoustic signal in response to a fluid flow across the aperture.

28. A method according to claim 1, wherein the fairing defines a bladder in fluid communication with a control port and configured to change the shape of the surface of the fairing in response to inflation of the bladder.

29. A method according to claim 28, wherein the fairing defines at least one pressure sensing port fluidically coupled to a respective gauge port.

30. A method according to claim 29, wherein the gauge port is fluidically coupled to the control port.

31. A method according to claim 1, wherein the fairing comprises an upstream portion and a downstream portion joined together by a pivot hinge, wherein an upstream end of the upstream portion is translatably attached to the channel surface, and the two portions and are configured to pivot in response to translation of the upstream end of the upstream portion and thereby extend the pivot hinge, the downstream end of the upstream portion and the upstream end of the downstream portion further into the fluid channel, the fairing further comprising a spring configured to urge the upstream end of the upstream portion to a neutral position.

32. A method according to claim 1, wherein the fairing defines:

a first bladder in fluid communication with a port downstream of the fairing in the fluid channel; and

a second bladder in fluid communication with a port upstream of the fairing in the fluid channel; wherein the first and second bladders are configured to automatically regulate shape of the fairing, based on respective pressures at the ports.