CLAIMS

1. A double tube that is a heat exchanger of a supercritical solid-liquid mixture fluid comprising:

a cylindrical outer tube;

an inner tube including a helical protrusion in an outer circumference, the inner tube forming a flow passage connected helically with a groove shaped section between the helical protrusion and the outer tube adjacent to each other, the inner tube being provided inside the outer tube; and

a helical flow passage forming member that forms a helical flow passage inside the inner tube, the helical flow passage forming member being provided inside the inner tube.

2. The double tube according to claim 1, wherein

the helical protrusion is a thread that is formed in an outer circumference of a cylindrical tube material forming the inner tube.

3. The double tube according to claim 1, wherein

the helical protrusion is a fin provided helically in an outer circumference of a cylindrical tube material configuring the inner tube.

4. The double tube according to any one of claims 1 to 3, wherein

the helical flow passage forming member is a helical plate having a curved surface formed helically.

5. A heat exchanger comprising:

an inner tube of a double tube according to any one of claims 1 to 4, the inner tube being formed of a metal that is heat-conductive and is heat-resistant,

the heat exchanger conducting heat exchange between a fluid that flows through a helical flow passage in an outer side of the inner tube of the double tube and a fluid that flows through a helical flow passage in an inner side of the inner tube.

6. A method to manufacture a double tube including an inner tube and an outer tube, the double tube being a heat exchanger of a supercritical

solid-liquid mixture fluid, comprising:

forming the inner tube provided with a helical protrusion in an outer circumference;

forming a helical flow passage forming member that forms a helical flow passage inside the inner tube; and

fixing in an integral manner

the protrusion to an inner circumferential surface of the outer tube by arranging the protrusion to contact the inner circumferential surface of the outer tube, and

the helical flow passage forming member to an inner circumferential surface of the inner tube by arranging the helical flow passage forming member to contact or be near to the inner circumferential surface of the inner tube,

wherein one flow passage is formed connected helically with a groove shaped section partitioned with the helical protrusion and the inner circumferential surface of the outer tube adjacent to each other, between the inner tube and the outer tube.

7. The method to manufacture a double tube according to claim 6, wherein a thread, as the helical protrusion, is formed in an outer circumference of a tube material that forms the inner tube.

8. The method to manufacture a double tube according to claim 6, wherein a helical fin, as the helical protrusion, is welded to an outer circumferential surface of a tube material that configures the inner tube.