CLAIMS

1. A heat exchanger comprising:

a flow passage unit

arranged with a plurality of planar flow passage bodies each arranged with two flow passages that are curved and bent and adjacent to each other in a same plane, the plurality of the planar flow passage bodies being layered in an intersecting direction that intersects with the plane, and

in two of the planar flow passage bodies adjacent in the intersecting direction of the plurality of the layered planar flow passage bodies, each one of two flow passage ports in both ends of each of the flow passages of one of the planar flow passage bodies is connected to each one of two flow passage ports in both ends of each of the flow passages of another of the planar flow passage bodies; and

a high-pressure pipe that covers an outside of the flow passage unit, wherein

the planar flow passage body is a spiral flow passage body arranged alternately with the two flow passages in a diameter direction of a spiral formed with the two flow passages, the two flow passages spreading from a center side to an outer circumference side and curving spirally in a same direction shifted in phase by halfway from each other, and

the flow passage unit is arranged with a plurality of the spiral flow passage bodies layered in the intersecting direction that intersects the plane, and the flow passage ports to the center side of the two spiral flow passage bodies adjacent in the intersecting direction are connected to each other or the flow passage ports to the outer circumference side of the two spiral flow passage bodies adjacent in the intersecting direction are connected to each other to form two continuous flow passages, wherein

in the flow passage unit, the spiral flow passage bodies are layered such that a winding direction of the adjacent spiral flow passage bodies are the same.

2. A heat exchanger comprising:

a flow passage unit

arranged with a plurality of planar flow passage bodies each arranged with two flow passages that are curved and bent and adjacent to each other in a same plane, the plurality of the planar flow passage bodies being layered in an intersecting direction that intersects with the plane, and

in two of the planar flow passage bodies adjacent in the intersecting direction of the plurality of the layered planar flow passage bodies, each one of two flow passage ports in both ends of each of the flow passages of one of the planar flow passage bodies is connected to each one of two flow passage ports in both ends of each of the flow passages of another of the planar flow passage bodies; and

a high-pressure pipe that covers an outside of the flow passage unit, wherein

the planar flow passage body is a spiral flow passage body arranged alternately with the two flow passages in a diameter direction of a spiral formed with the two flow passages, the two flow passages spreading from a center side to an outer circumference side and curving spirally in a same direction shifted in phase by halfway from each other, and

the flow passage unit is arranged with a plurality of the spiral flow passage bodies layered in the intersecting direction that intersects the plane, and the flow passage ports to the center side of the two spiral flow passage bodies adjacent in the intersecting direction are connected to each other or the flow passage ports to the outer circumference side of the two spiral flow passage bodies adjacent in the intersecting direction are connected to each other to form two continuous flow passages, wherein

in the flow passage unit, the spiral flow passage bodies are layered such that winding directions of the adjacent spiral flow passage bodies are opposite to each other.

3. A method to manufacture a heat exchanger comprising:

partition material forming to form a plurality of partition materials forming a partition of a recess that is connected and formed to both surfaces of a metallic plate material, the plurality of the

partition materials including an opening in one end part of the recess;

plate material forming to form a plurality of metallic plate materials, the plurality of the metallic plate materials including a plane that opposes the partition material, the plurality of the metallic plate materials forming a flow passage by covering the recess of the partition material, the plurality of the metallic plate materials including an opening in an end part to an opposite side of an end part provided with the opening of the formed flow passage;

flow passage unit forming to form a flow passage unit by

arranging alternately the partition material and the plate material,

adjusting and integrally fixing positions of the openings provided in the partition material and the plate material such that flow passages provided in one side of the partition material are connected to each other and flow passages provided in another side of the partition material are connected to each other; and

integrating to integrate by inserting the flow passage unit along the intersecting direction in a high-pressure pipe and covering an outside of the flow passage unit with the high-pressure pipe.

4. The method to manufacture a heat exchanger according to claim 3, wherein

the partition material and the plate material are formed by a drawing process,

an outer circumferential part of the partition material and the plate material, which are adjacent to each other, are bent in a direction that intersects with the plane, and

the partition material and the plate material are layered and joined in a section where the partition material and the plate material are bent in the direction that intersects with the plane.