CLAIMS

1. A fluid mixer (101) comprising:

- a frame structure (201, 202) defining a mixing chamber (203, 303, 403) and at least one first inlet (204, 205, 304, 404) for conducting first fluid to the mixing chamber from above the mixing chamber, the mixing chamber being substantially cylindrical and the first inlet being shaped to conduct the first fluid along a side wall of the mixing chamber to produce a spiral stream in the mixing chamber,

- at least one second inlet (206, 207, 306, 406) for conducting second fluid tangentially into the spiral stream, each opening (216, 316) of the second inlet being inside the mixing chamber and a distance away from the side wall of the mixing chamber to reduce concentration of the second fluid at the side wall of the mixing chamber, and

- an outlet channel (208, 308, 408, 508a-508c) for conducting the first and second fluids downwards out from the mixing chamber, the outlet channel being concentric to the mixing chamber,

wherein the outlet channel comprises a mixing structure (209, 309, 409, 509a-509c) for producing turbulence in a stream of the first and second fluids flowing in the outlet channel, at least a part of the mixing structure being located below an upper edge of the outlet channel, wherein the mixing structure (209, 309, 409, 509a-509c) is configured to implement one or more stepwise reductions of a cross-sectional flow area of the outlet channel, **characterized** in that a wall of the outlet channel (208, 308, 408, 508a, 508b) is shaped to implement at least one of the one or more stepwise reductions of the cross-sectional flow area of the outlet channel.

2. A fluid mixer according to claim 1, wherein the mixing structure (209, 409, 509a-509c) is located below a bottom of the mixing chamber (203, 403).

3. A fluid mixer according to claim 1, wherein the mixing structure (509a) comprises a loop-shaped mixing ridge (514) on an upwards facing surface (515) of

the outlet channel, the upwards facing surface implementing the stepwise reduction of the cross-sectional flow area of the outlet channel.

4. A fluid mixer according to any of claims 1-3, wherein the mixing structure (509c) comprises a mixing element (512) mechanically supported inside the outlet channel and shaped to produce turbulence in the stream of the first and second fluids flowing in the outlet channel.

5. A fluid mixer according to any of claims 1-4, wherein the outlet channel (308) comprises a loop-shaped ridge (310) on a bottom of the mixing chamber, the loop-shaped ridge constituting an upper portion of the outlet channel, and an upper rim of the loop-shaped ridge constituting the upper edge of the outlet channel.

6. A fluid mixer according to any of claims 1-5, wherein the outlet channel (208, 308) is substantially circularly symmetric with respect to a vertical geometric line.

7. A fluid mixer according to any of claims 1-6, wherein the first inlet (204, 205, 304) is shaped to descend to the mixing chamber in a form of a curved ramp.

8. A fluid mixer according to any of claims 1-7, wherein the second inlet (206, 207, 306) comprises a tube protruding radially from the side wall of the mixing chamber towards a center of the mixing chamber and having one or more openings (216, 316) for passing the second fluid tangentially into the spiral stream.

9. A fluid mixer according to claim 8, wherein the tube is curved so that an end of the tube is tangential for passing the second fluid tangentially into the spiral stream.

10. A fluid mixer according to claim 8, wherein the tube has a closed end and a side wall of the tube has the one or more openings (216) for passing the second fluid tangentially into the spiral stream.

11. A fluid mixer according to any of claims 1-10, wherein the second inlet (406) comprises one or more protrusions located on a bottom of the mixing chamber and each being provided with an opening for passing the second fluid tangentially into the spiral stream.

12. A fluid mixer according to claim 11, wherein the one or more protrusions are located at a place of the bottom of the mixing chamber (403) where the first inlet (404) is configured to join the mixing chamber.

13. A fluid mixer according to any of claims 1-12, wherein the first inlet is one of at least two first inlets (204, 205) placed substantially equidistantly on a periphery of the mixing chamber.

14. A fluid mixer according to any of claims 1-13, wherein the second inlet is one of at least two second inlets (206, 207) placed substantially equidistantly on a periphery of the mixing chamber.

15. A reactor for a hydrocarbon processing plant, the reactor comprising:

- a reactor vessel (117),
- catalytic beds (118, 119) inside the reactor vessel, and
- at least one fluid mixer (101) according to any of claims 1-14 inside the reactor vessel and between successive ones of the catalytic beds.

16. A reactor according to claim 15, wherein the reactor is a hydrodeoxygenation reactor.

17. A method comprising:

- conducting (601) first fluid, via at least one first inlet, to a mixing chamber from above the mixing chamber, the mixing chamber being substantially cylindrical and the first fluid being conducted along a side wall of the mixing chamber to produce a spiral stream in the mixing chamber,
- conducting (602) second fluid, via at least one second inlet, tangentially into the spiral stream, each opening of the second inlet being inside the mixing chamber and a distance away from the side wall of the mixing chamber to reduce concentration of the second fluid at the side wall of the mixing chamber, and

- conducting (603), via an outlet channel concentric to the mixing chamber, the first and second fluids downwards out from the mixing chamber,

wherein the outlet channel comprises a mixing structure located at least partly below an upper edge of the outlet channel and producing turbulence in a stream of the first and second fluids flowing in the outlet channel, wherein the mixing structure is configured to implement one or more stepwise reductions of a cross-sectional flow area of the outlet channel, **characterized** in that a wall of the outlet channel is shaped to implement at least one of the one or more stepwise reductions of the cross-sectional flow area of the outlet channel.

18. A method according to claim 17, wherein the first fluid flows to the mixing chamber from a bottom of a first catalytic bed of a reactor and a mixture of the first and second fluids is conducted to a top of a second catalytic bed of the reactor.