Vorsana

RADIAL COUNTERFLOW SOLUTIONS

The McCutchen Processor

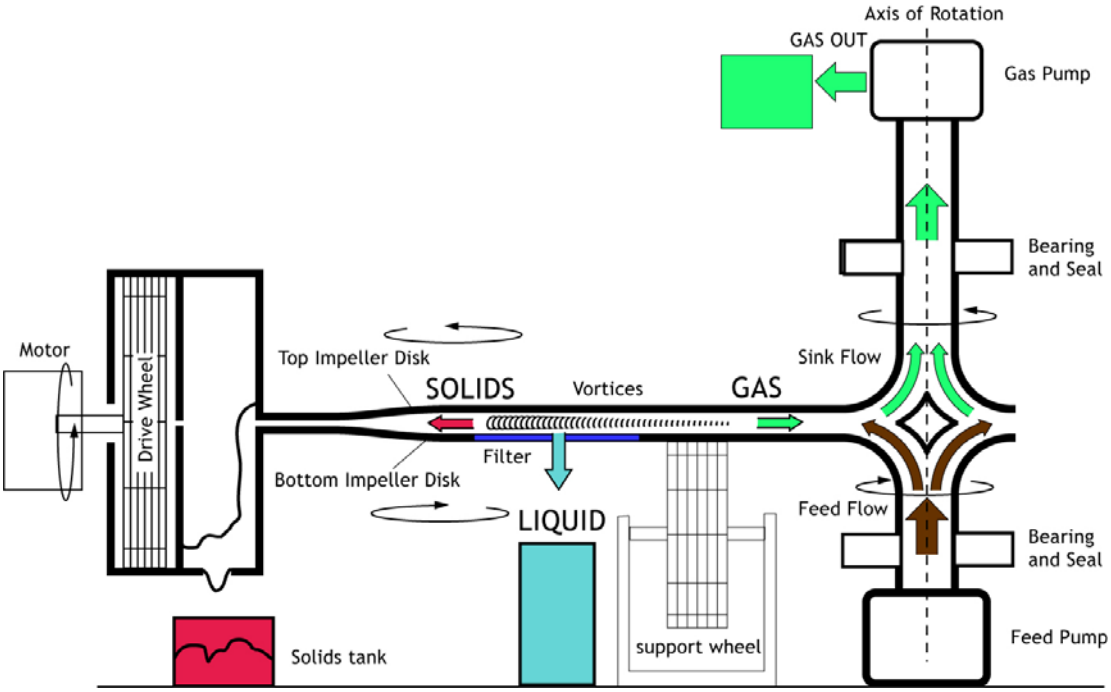
The McCutchen Process™, developed by Wilmot H. McCutchen, centrifugally separates a fluid mixture using vortices created in high shear between axially fed counter-rotating disk impellers. Numerous patent-pending uses of the McCutchen Processor™ include mechanical desalination, oil processing, wastewater treatment, separation of gases, liquids and solids, and mechanical carbon capture and scrubbing of flue gas. The device is simple, inexpensive and scalable, and is being offered through Vorsana, Inc.

The McCutchen Processor makes use of radial counterflow. The fluid mixture feed comes in continuously at the axis of rotation, and divergent heavy and light fraction streams emerge from the space between the disks, separated by a myriad of vortices induced by the disk impellers. The vortices, both large and small, form in the shear layer between the disks in a branching, radial tree of organized turbulence. The g force for separation is extremely high because the vortex radii are small, and for each rotation of the impellers, the vortices rotate many times. As the fluid mixture is spun at high speed in the vortices, centrifugal force moves heavy fractions toward the outside of the vortices and away from the axis of rotation, while light fractions remain inside the vortices, and are sucked inward by an axial pump. Vortex axis stretching, due to the axial pump, tightens the vortices, increases the g force, and maintains the coherence of the radial tree of low pressure gradients. The separation effects of even the tiniest vortices flow inward along the radial tree, to be gathered together in the central axial pump.

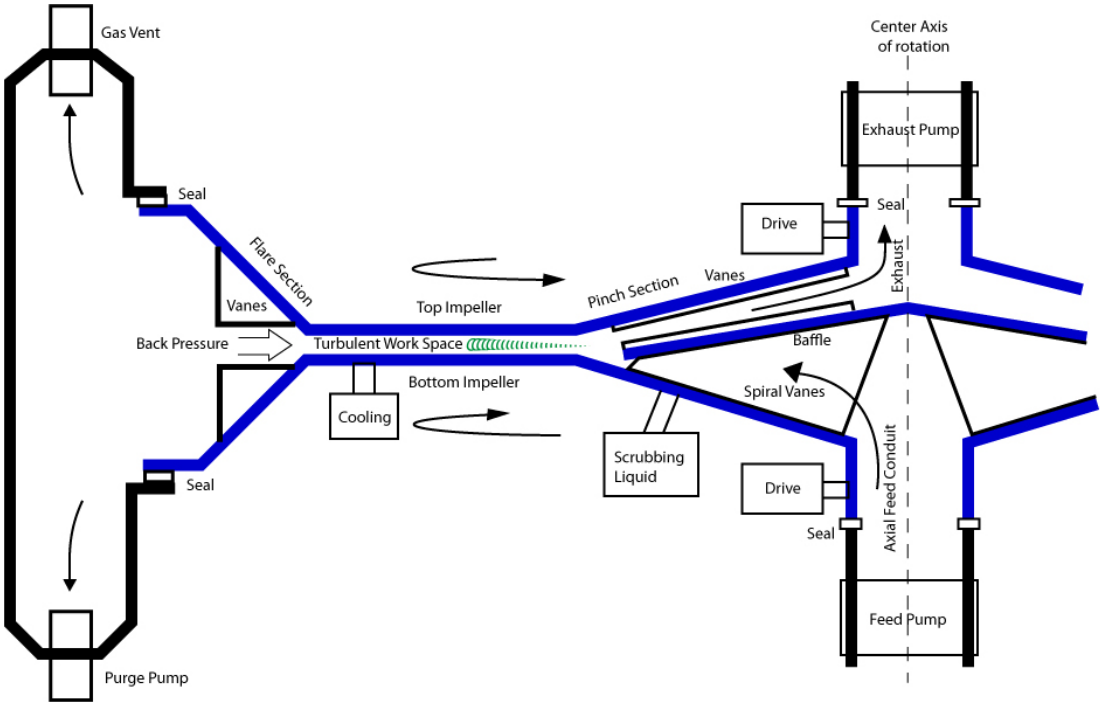
A shrouding tank at the periphery of the disks collects the heavy fractions that remain. The shrouding tank also causes back pressure, impeding the outward centrifugal flow of the feed, and providing a long residence time for centrifugal separation and scrubbing in high turbulence between the disks. This back pressure also helps drive the radial inward flow of light fractions through the vortex cores toward the axis of rotation. If the radial vortices meet impedance at the periphery, rebound jets also push back through the vortex cores due to the so-called vortex-wall interaction. The feed mixture is thus made to be essentially porous, because of the high shear vortices in combination with axial suction and back pressure, and pulled apart into its constituent parts without the use of added heat, chemicals, or dead-end filters.

Light fractions (such as nitrogen in flue gas, fresh water in desalination, light oil in oil processing) go radially inward to the axial pump, and heavy fractions (such as carbon dioxide and sulfur dioxide in flue gas, concentrated brine in desalination, or solids in wastewater cleanup) go radially outward to the tank. A shear filter inset into the bottom impeller can let liquid through without being clogged, enabling simultaneous separation of gases, liquids and solids in a continuous stream by purely mechanical means.

Vorsana
RADIAL COUNTERFLOW SOLUTIONS



McCutchen Processor for separation of Gases, Solids and Liquids



McCutchen Processor for Flue Gas Scrubbing