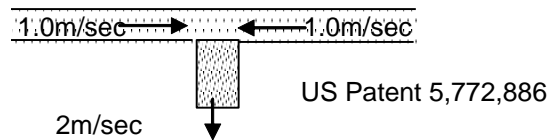
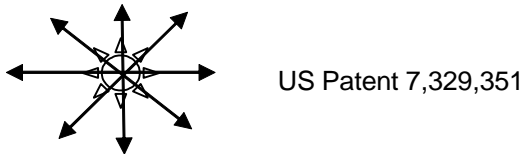


Blue Frog™ System: Impingement Mixing in Combination with Radial Circulation

- When two gas/liquid streams are directly impinged one to the other, the bubbles fractionate and do not float out of the water column rapidly. [The terminal velocity is tiny.]



- When fractionated bubbles are circulated radially from a central circulator, the diverging streamlines cause upwelling eddies which re-mix the fractionated bubbles



- The oxygen added from air (21%) is consumed almost immediately because of the huge increase in macro surface area (smaller bubbles have larger surface area per gram of gas); the residual nitrogen gas (79%) reduces the specific gravity to $\rho = .97$. Solids sink four times faster (Stokes Law).
 - Pathogens are solids and sink into the anaerobic lower zone where they are digested
- 35% of municipal waste is soluble and is evenly distributed throughout the water column. 65% is insoluble and sinks into the anaerobic lower zone. Energy-to-add-oxygen and to mix water is cut in half.
 - Sufficient oxygen is added to oxidize only the soluble demand (expensive). The insoluble demand is mitigated in the anaerobic zone (inexpensive).
 - Sludge produced in the top meter during soluble-oxidation sinks into the anaerobic zone
 - The top meter of water is mixed directly; the bottom several meters are virtually quiescent.
 - The top one meter of water is clarified.
 - Water is discharged from the clarified top meter
- Produced sludge is anaerobically digested in situ
 - The by-products are carbon dioxide, methane and a small amount of ash.
 - Pre-existing sludge is also digested; this increases ammonia temporarily until the pre-existing sludge inventory is digested completely.
- Nitrogen is removed at the end of the process by providing attached growth surface (a very special suspended plastic film) in the oxygenated top meter
 - Ammonia is oxidized and then reduced to water and nitrogen gas by indigenous synergistic microbes attached to the plastic film