RECTANGULAR AIRLIFT PUMP DESIGN

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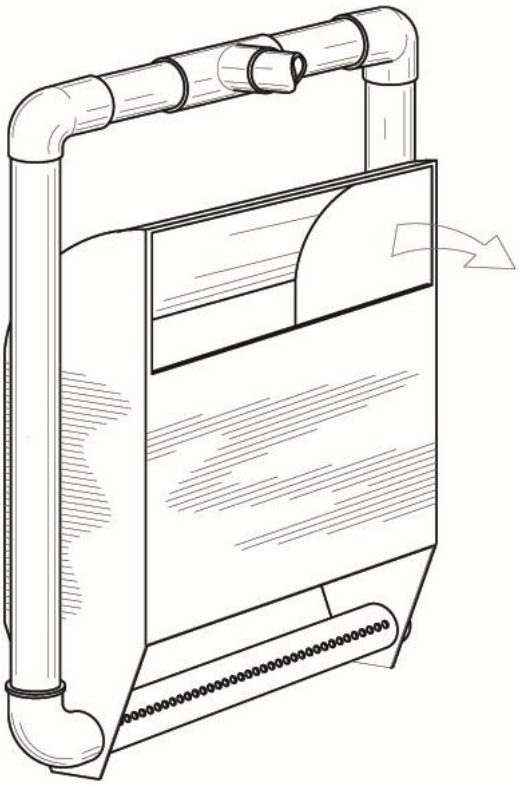
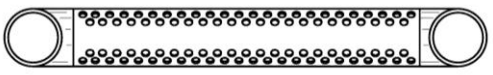
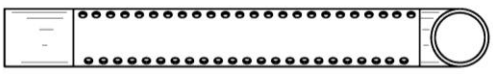
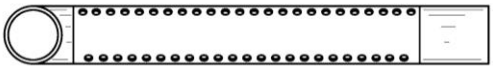
Documented examples of rectangular airlift pumps appeared in the early 1970s (e.g. Salser and Mock, 1973). These designs used single horizontal air injectors: either air stones/diffusers or a cylinder with perforations around the perimeter. Recent rectangular airlifts have used injection grids fabricated with fine-pore diffusers or cylinders with multiple perforations. Shortcomings of these grids are air-flow limitations and injector spacing constraints. System air pressures must be increased to deliver high volumes of air flow. Fine-pore diffuser fouling with bacteria, fungi and other micro-organisms also limits air flow.



In late 2006 and early 2007, Wurts designed and Herron built a prototype rectangular airlift pump. It was submitted to the USPTO as a provisional patent (Wurts and Herron, 2008) and again as a non-provisional patent application with new design elements/improvements added by Wurts (Wurts and Herron, 2009). The designs employed either single- or dual-cylinder, horizontal air injector elements. Air was injected through portals (circular apertures) in the cylinder walls. Unlike earlier documented designs, the air-injector portals were placed in bilateral single or double rows, just above the mid-lines of the injector cylinder. The lower-most air portals were tangential to the top of the injection cylinder's mid-lines. The bilateral configuration of air portals provided symmetrical airstream distribution, more precise injection depths and air-stream exposures to equal volumes of water – both sides of the air streams.



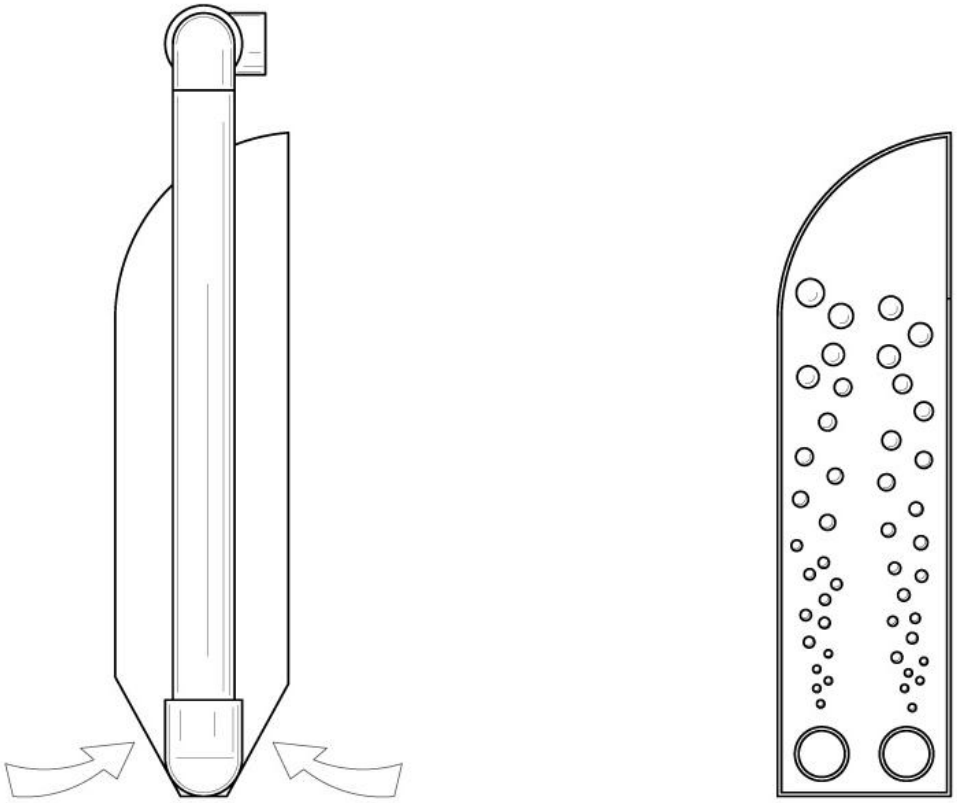




Rectangular airlifts can be substantially more compact and space efficient than single or multiple configurations of cylindrical airlifts. A single, compact rectangular airlift (Wurts and Herron, 2008 and 2009) can handle the total air output of one or two regenerative/centrifugal

blowers. The rectangular airlift pump can generate high volume water-flow rates at relatively low static air pressures. *Air Pump* software (Reinemann and Timmons, 1988) indicates a single rectangular airlift should pump water volumes of 9538-11960 Lpm/kw, with an air flow of 2284 Lpm/kw and riser volume from 0.18-0.21 cubic meters (1890-2370 gpm/hp, air flow 60.5 cfm/hp and riser volume from 6.38-7.35 cubic feet). *A picture of the Wurts-Herron prototype operating can be found on page 78.*

Side view of single and dual-cylinder air injector configurations for rectangular airlifts.



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Pond test of the Wurts-Herron rectangular airlift prototype in April 2007.