

Abstract of the Disclosure

A heat transfer apparatus for processing a liquid (II, 41) continuously has a positive mechanical drive for a set of vertical whip rods (14) each disposed in a vertical heat transfer tube (2). Each whip rod (14) is free-standing on its lower end and is sufficiently flexible to conform closely to the inner surface of the tube as it orbits. The orbital drive propels the whip rod directly through a pair of horizontal, vertically spaced plates (11, 12) that engage the rods (14) in loose openings (27, 27') that serve as fluid inlets from the drive plate. A motor (18) rotates a drive shaft (17) coupled to at least one of the drive plates (11, 12) through at least one eccentric crank (16, 16'). Each plate (11, 12) can be an opposed pair of plates (11, 11') with a separate eccentric drives 180° out of phase with one another for a self balancing. Another form of drive plate uses a rigid circular ring (11a) that mounts rod-engaging sleeves (27) via a network of wires (11b) supported by the ring (11a). Fluid distribution can also be from a water supply (24) held between a fixed plate (3) and the upper drive plate (11) with gravity feed to each tube (2) through a properly sized inlet (25) opening in the upper tube end. To isolate the heat transfer process, various seals (52, 57) are used to transmit rotary power through a housing (1) without conventional rotary seals.

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