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MODULAR COMPLIANT LINK SPLINT FOR FLEXIBLE TUBE KINK PREVENTION WITHOUT ROUTING PATH IMPACT

HP INC

Modular Compliant Link Splint for Flexible Tube Kink Prevention Without Routing Path Impact

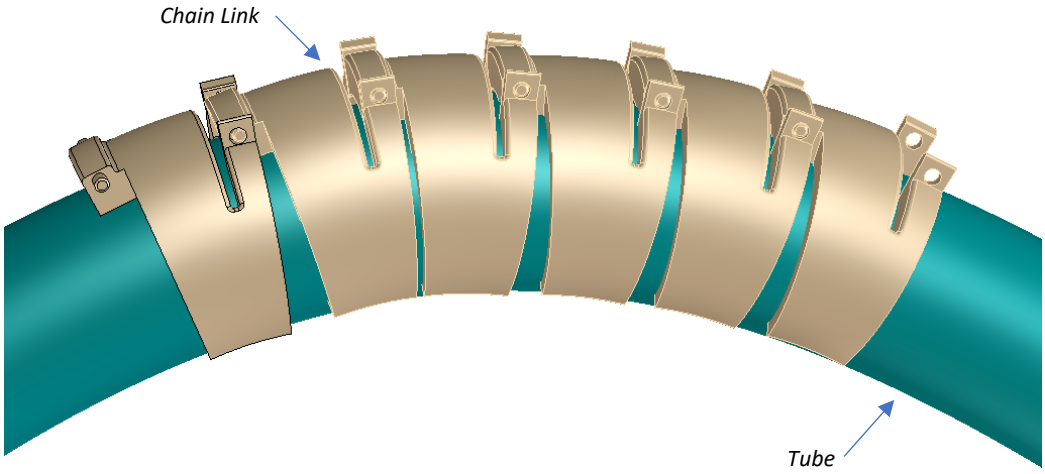
Described here is a device for preventing kink formation in flexible, non-wire bound tubing without adding pathing constraints to the tube. Flexible tubing tends to have minimum bend radii, below will kink in the material form and choke off the flow of material through the tube. Current kink prevention solutions either dictate a rigid path for the tube or impart some reaction force onto the tube. This invention prevents kinks and allows a tube to retain its natural minimum strain path with no additional force applied, and works for any number of different tube paths or bends. This is achieved by joining rotating links into a chain of segments that each prevent kinks in a small section and conforms to the tube path.

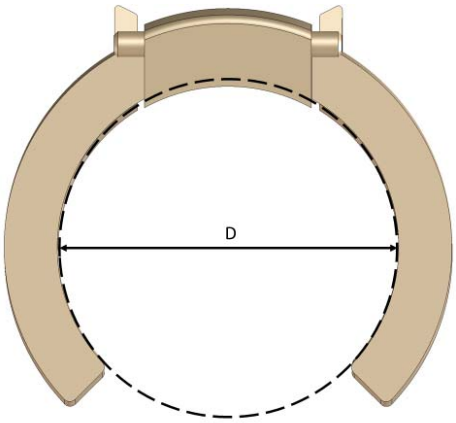
The development of kinks in flexible hose is widely solved using stiffening devices that prevent end stresses from forcing the tube into a low bend radius path. These stiffening devices often consist of springs through which the tube passes or a stiff wire bent around the tube. Kink resistant tubing solves the kink issue similarly, the stiffer tube tends to take a path with wider bend radii which is less prone to kinks. That kink resistance is generally achieved by embedding a weave of stiff material, usually metal, into the tube material. Kinks have also been eliminated using rigid supports that prevent the tube material from bulging outward as is required to form a kink. Such devices are usually a hard-plastic C-channel bent with the desired radius.

The device consists of a chain of any number of rotating rigid links. The links rotate relative to one another with up to two degrees of freedom to allow linear propagation of the chain along the tube by conforming to its path. The links are small angular sections of a torus or segments of a cylinder, resembling small partial rings. The diameter (D) and section angle (θ) of each ring can be selected for the proper tube size and minimum required bend radius (R).

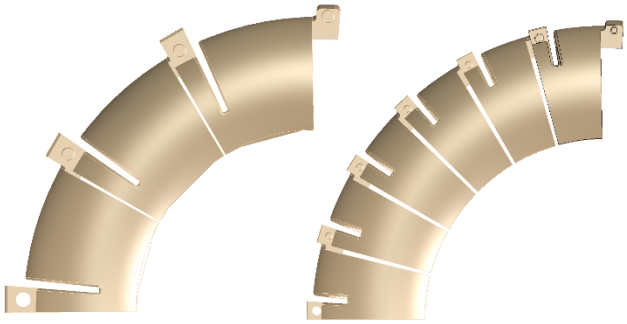
The advantages to this design over the widely used tube kink solutions are that it applies zero force to the tube, it is flexible in application, it is modular and universal, and it can conform to and reinforce highly constrained tube paths. Other stiffening devices by their nature impart a force on the tube with the intention of changing the path into one less kink-prone, which is not possible if the more kink-prone path is necessary due to other spatial constraints.

Disclosed by Theodore J Conley, Nicholas Wang and Tait A Regnier, HP Inc.

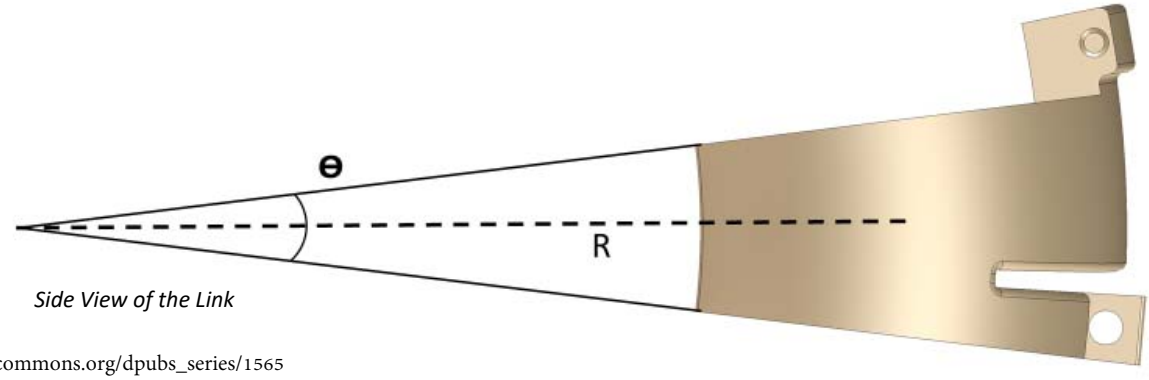




Front View of the Link



Comparison of different angles



Side View of the Link