SUMMARY

[0009] ~~One aspect of the present disclosure includes~~ According to a first aspect of the present invention, there is provided a tubing support device for tubing of a drug manufacturing system. The tubing support device comprises a body having a first end, a second end, and a plurality of projections. The plurality of projections includes a first projection disposed at the first end and a second projection disposed at the second end, each of the first and second projections including an aperture adapted to receive a fastener. A bore extends from the first end to the second end of the body, and the bore is adapted to receive tubing such that the body reinforces the tubing, allowing the tubing to contain fluids at high pressures and/or preventing kinking in the tubing.

[0010] ~~Another aspect of the present disclosure includes~~ According to a second aspect of the present invention, there is provided a drug manufacturing system. The drug manufacturing system comprises one or more manufacturing components and one or more fluid lines fluidly coupled to the one or more manufacturing components. The one or more fluid lines include tubing having a tubing support device. The tubing support device includes a body having a first end, a second end, and a plurality of projections. The plurality of projections includes a first projection disposed at the first end and a second projection disposed at the second end, each of the first and second projections including an aperture adapted to receive a fastener. A bore extends from the first end to the second end of the body, and the bore is adapted to receive tubing such that the body reinforces the tubing, allowing the tubing to contain fluids at high pressures and/or preventing kinking in the tubing.

[0011] ~~Another aspect of the present disclosure includes~~ According to a third aspect of the present invention, there is provided a method of manufacturing a tubing support device for a drug manufacturing system. The method comprises forming a body including a bore and a plurality of projections, the bore extending along a length of the body and adapted to receive tubing of a drug manufacturing system for reinforcing the tubing and/or preventing kinking of the tubing during high pressure operations. The method further comprises forming an aperture in at least one projection of the plurality of projections, the aperture adapted to receive a fastener.

[0012] Each of the foregoing exemplary ~~aspects~~ examples of the present disclosure may further include any one or more of the following features. For example, the body may further include a first body part and a second body part coupled to the first body part. Each of the first and second body parts may include a first end, a second end, a first projection disposed on the first end, and a second projection disposed on the second end. Each of the projections may include an aperture.

[0013] In some further ~~aspects~~examples, the second body part may be complementary in shape to the first body part, such that the apertures of the first and second projections of the second body part are aligned with the apertures of the first and second projections of the first body part when the first and second body parts are coupled together.

[0014] In some other ~~aspects~~examples, the body is a sheath and includes a C-shape. The first body part may include a first half of the sheath, and the second body part may include a second half of the sheath. Each of the first and second body parts may have the same shape and form the bore when coupled together.

[0015] In other ~~aspects~~examples, the body may further include a first tab disposed at the first end of the body and a second tab disposed at the second end of the body. Each of the first and second tabs may have a slot adapted to receive a fastener for hanging the body, elevating the tubing adapted to be received within the bore of the body and preventing kinking of the tubing.

[0016] In another ~~aspect~~example, the plurality of projections may further include a third projection upwardly extending from a center portion of the body. The third projection may also include an aperture adapted to receive a fastener.

[0017] According to other ~~aspects~~examples, the body may include a sleeve having a cylindrical shape. In addition, the body may include an inside surface having a gripping system adapted to contact the welded tubing for additional securement of the welded

tubing within the bore. The gripping system may include a first array of teeth disposed on the inside surface near the first end of the body and a second array of teeth disposed on the inside surface near the second end of the body.

[0018] In some ~~aspects~~examples, at least one tooth of the first and second arrays of teeth may include a base having a first side inwardly extending from the base and a second side inwardly extending from the base. The first and second sides may form an edge for gripping the welded tubing when the welded tubing is disposed within the bore.

[0019] In some other ~~aspects~~examples, the first and second arrays of teeth may each extend around the inside surface of the bore near each of the first and second ends of the body, forming an annular first array of teeth and an annular second array of teeth.

[0020] In still other ~~aspects~~examples, the body may include a sleeve and an inside surface having a plurality of ridges adapted to contact the tubing for additional securement of the tubing within the body. In addition, the inside surface may include a first plurality of ridges disposed on the inside surface near the first end of the body and a second plurality of ridges disposed on the inside surface near the second end of the body. Each of the first and second plurality of ridges may contact the tubing for additional securement of the tubing within the body.

[0021] In yet another ~~aspect~~example, the body may include a first plurality of ridges disposed near a first end of the body and a second plurality of ridges disposed near a second end of the body.

[0022] In other ~~aspects~~examples, the body may include an additively manufactured body comprising an additively manufactured first body part and an additively manufactured second body part coupled to the additively manufactured first body part.

[0023] In yet another ~~aspect~~example, forming a body including a bore and a plurality of projections may comprise forming a body including a bore and a plurality of projections using an additively manufacturing technique.

[0024] In another ~~aspect~~example, forming a body including a bore and a plurality of projections may comprise forming a first body part having a first end, a second end, a first projection disposed on the first end, and a second projection disposed on the second end, the first body part being a first half of the body. In addition, the method may further include forming a second body part having a first end, a second end, a first projection disposed on the first end, and a second projection disposed on the second end, the second body part being a second half of the body.

[0025] In yet another ~~aspect~~example, forming a body including a bore and a plurality of projections may further comprise forming a first tab disposed at a first end of the body and a second tab disposed at the second end of the body, and forming a slot in each of the first and second tabs, the slot for receiving a fastener for hanging the body.

[0026] In yet another ~~aspect~~example, forming the body including a bore and a plurality of projections may comprise forming a body having an inside surface with a gripping system having a first array of teeth disposed near a first end of the body and a second array of teeth disposed on the inside surface near the second end of the body, disposing each of the first and second arrays of ribs around the inside surface of the body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the several FIGS., in which:

[0028] FIG. 1A is a perspective view of a portion of a conventional drug substance manufacturing system having several nutritional feed lines going into a bioreactor;

[0029] FIG. 1B is another perspective view of additional lines of the conventional drug substance manufacturing system of FIG. 1A;