PROTECTIVE SYRINGE SLEEVE

BACKGROUND OF THE INVENTION

Field of the Invention

The present application relates to sleeves that protect the operation of syringes.

Background Information

Syringes are typically cylindrical in shape and equipped with an internally encased piston or piston assembly that pushes a substance within the cylinder and delivers the substance to an output port that is typically a hollow needle. Hereinafter the phrase "piston assembly" is defined to include a single piston and/or a piston assembly made from component parts. The piston is withdrawn from within the cylinder and the cylinder is filled with a substance. The piston is repositioned within the cylinder and pushed towards the output port ejecting the substance through the hollow needle to some desired location.

In applications where the substance is potentially harmful or detrimental, such as cyanoacrilate adhesives or solder paste, or where precise metering of the substance is desired, it is prudent to prevent the substance from leaking around the piston. The piston typically has a seal meant to prevent substances from passing between the piston and the inner cylinder wall, however in some cases, particularly with very viscous substances, the seal may fail and allow leakage of the substance to an area behind the piston.

In some applications, the piston may be operated by a human and leakage around the piston seal may contact the human with potentially harmful results. In other applications the piston-may be pushed via computer controlled device, e.g. a motor and lead screw. In these other applications, however, preventing leakage remains important since the substance within the cylinder may contact the piston advancing means of the computer controlled device and the resulting contamination may then be returned to the computer controlled device itself, potentially causing the device to fail.

SUMMARY OF THE INVENTION

The present disclosure describes a protective sleeve that is installed within a syringe cylinder. The sleeve is positioned with one end at the piston assembly and the other end at the far end of the cylinder. The sleeve is specially formed with two ends, one end is attached or fixed to on end of the cylinder and the sleeve's second end is attached to and moves with the piston. Any substance in the cylinder that may leak by the piston at the cylinder wall will be prevented protective sleeve from reaching the piston, the drive shaft and the motor or computer electronics driving the piston.

The protective sleeve has a tubular shape that is collapsible along the long axis of the tube and the axis of the cylinder. The sleeve may be made from of a resilient material. Illustrative, one collapsible shape is a bellows that extends and compresses easily, however other shapes may function similarly. The end of the sleeve attached to a piston or piston assembly moves with the piston or piston assembly while the other end remains fixed in place.

The sleeve may have a first lip or ridge that engages the piston assembly, wherein the first lip moves with the piston assembly; and a second lip that is retained at the far end of the syringe. The first lip may engage a recess in the piston or be bonded or otherwise fixed to the piston assembly. The second lip may be retained at the other end of the syringe by a plate or it also may be bonded or fixed to the other end of the syringe. The sleeve extends and collapses as the piston assembly moves in both directions along the long axis of the cylinder.

In one application the sleeve's tubular shape includes a bellows along at least a portion of the sleeve.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention description below refers to the accompanying drawings, of which:

FIG. 1 is a sectioned drawing of a fully extended protective sleeve installed in a syringe;

FIG. 2A is the partially sectioned view of FIG. 1, with the protective sleeve is fully compressed;

FIG. 2B and 2C illustrate the lips on either end of the sleeve that lock and seal the sleeve.

FIG. 3 is a side drawing of a fully extended sleeve; and;

FIG. 4 is a side view of a fully compressed sleeve.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

FIG. 1 illustrates a syringe 2 with a piston 4 that is attached to and being pushed by a shaft 6 controlled by a computer controlled device. In this example, the shaft 6 is an extendable and retractable leadscrew driven by a motor (not shown). The syringe has an outlet 8 and a protective sleeve 20 that is compressed. In FIG. 1, a substance that is contained in the volume 10 may be delivered via the outlet 8 by the shaft 6 pushing the piston assembly 4 that in turn expels the substance. The piston assembly may include a hub and seal, as would be known to those skilled in the art.

The substance in the volume 10 may leak where the outer edge seal of the piston assembly10 meets the inner surface 12 of the syringe cylinder 14.

FIG. 2A shows the piston assembly after expelling most of the contents of the volume 10 and the protective sleeve is fully extended. Comparing FIG. 1 and FIG. 2, if some of the contents of the volume 10 leaked by the piston and remained on the cylinder wall and if the protective sleeve 20 were not in place, the contents might contact the shaft 6, and, as mentioned above, the contents may be returned to the computer controlled device and cause damage, malfunction, or failure.

FIG. 2B shows a functional detail where a lip 24 of the sleeve 20 is secured between a retention plate18 at the end 13 of the cylinder 14. FIG. 2C illustrates the sleeve attachment at the outlet of the syringe. Here the lip 22 of the sleeve 20 is secured between an extension 9 of the piston assembly 14 and a shoulder 7 of the shaft 6.

FIG. 3 is a sectioned view of the sleeve 20 illustrating the lip 24 and the lip 22 at distal ends of the sleeve.

As is evident from all the drawings in this particular example, the sleeve has a tubular shape with a "bellows" or "accordion" configuration 26 to accommodate a full compression when the syringe is full and a full extension when the syringe has emptied

its contents. Thinner sleeve material is advantageous as it will allow for more volume of material to be loaded within the syringe, due to reduced full compression height of the sleeve. The sleeve will easily extend along the long axis of the tubular shape and the cylinder of the syringe and will move back up the cylinder as the shaft 6 pulls the piston back. A pull back may be used to prevent leaking at the outlet 8 by creating a vacuum that holds the contents within the syringe. The sleeve, with this configuration, is designed to minimally, if at all, increase the dynamic load on the computer controlled device. The depth 28 of the protective sleeve is arranged to allow the shaft entry without interference.

The sleeve may be made from low density resilient polyethylene, or other resilient materials, with a very thin wall, perhaps only 0.015" thick. Other wall thicknesses, however, may be employed depending on the configuration of the syringe into which the protective sleeve is installed. It may be fabricated by a blow molding process, but other processes may be used as known to those in the art. The thickness limits the range of the travel from full compression to full extension, as shown in FIG. 1 and full extension in FIG. 2A.

The bellows shape is illustrative, and other configurations may be used. For example, screw shaped ridges that compress or tube sections of different diameters where on section telescopes into another section may be used.

In some applications the sleeve is installed in pre-filled syringes, and is meant as a single use device that is discarded with the syringe after use. Since syringes are manufactured in different sizes and configuration, the subject protective sleeve may be made in many different sizes, thicknesses and configurations.

What is claimed is:

CLAIMS

1. A protective sleeve (20) for use in a syringe (2) having a cylinder (14) with a first and second (13) ends, a piston assembly (4), an output (8) at the first end and an opening for a shaft (6) at the second end of the cylinder (14), the protective sleeve (20) being

a tube made of a resilient material and having a first end and a second end, the second end opposing the first end, the tube configured to extend and collapse along a longitudinal axis of the tube, and located within the cylinder (14) behind the piston assembly (4), with

a first lip (22) formed at one end of the tube that is configured to engage the piston assembly (4), and to move with the piston assembly (4) and

a second lip (24) formed at the second end of the tube that is configured to be retained at the second end of the cylinder (14), wherein the tube is configured to extend and collapse as the piston assembly (4) moves,

characterized by:

(a) the first lip (22) having a first lip longitudinal portion extending from the sleeve (20) along a direction substantially parallel to the longitudinal axis of the tube, and a first lip radial portion extending from the first lip longitudinal portion along a direction that is substantially perpendicular to the longitudinal axis of the tube, where the first lip radial portion is secured between a shoulder (7) of the shaft (6) and an extension portion (9) of the piston assembly (4); and

(b) the second lip (24) having a second lip longitudinal portion extending from the sleeve (20) along a direction substantially parallel to the

longitudinal axis of the tube, and a second lip radial portion extending from the second lip longitudinal portion along a direction that is substantially perpendicular to the longitudinal axis of the tube, where the second lip radial portion is secured between a retention plate (18) at the end (13) of the cylinder (14) and the second end (13) of the cylinder (14).

2. The protective sleeve of claim 1 wherein the tube comprises a bellows or accordion configuration (26) along at least a portion of the sleeve (20).

3. The protective sleeve of any preceding claim wherein the sleeve (20) is made from polyethylene, or other resilient material of a thickness of less than 3.81mm (0.15 inches).

4. The protective sleeve of any preceding claim, wherein the second lip radial portion is configured to be disposed external to the second end (13) of the cylinder (14) between the retention plate (18) and a handle of the cylinder (14).

5. The protective sleeve of any preceding claim, wherein the second lip radial portion extends radially outwardly away from a central axis of the tube.

6. The protective sleeve of any preceding claim, wherein the first lip radial portion extends radially inwardly toward a central axis of the tube.

7. A syringe comprising:

a cylinder (14) with two ends, a first end defining an output (8) and a second end defining an opening for a shaft (6);

a piston assembly (4); and

a tubular-shaped protective sleeve (20) made to extend and collapse along a longitudinal axis of the tube, the protective sleeve (20) according to claim 1 made of a resilient material that is placed within the cylinder (14) behind the piston.

8. The syringe of claim 7 wherein the tube comprises a bellows or accordion configuration (26) along at least a portion of the sleeve (20).

9. The syringe of claim 8 wherein the sleeve (20) is made from polyethylene, or other resilient material of a thickness of less than 3.81 mm (0.15 inches).

10. The syringe of claim 8, wherein the second lip radial portion is configured to be disposed external to the second end (13) of the cylinder (14) between the retention plate (18) and a handle of the cylinder (14).

11. The syringe of claim 8, wherein the second lip radial portion extends radially outwardly away from a central axis of the tube.

12. The syringe of claim 11, wherein the first lip radial portion extends radially inwardly toward a central axis of the tube.