Method for a single-line dispenser nozzle for positive-displacement piston and auger-style pumps

Disclosed is a method for a single-line dispenser nozzle for positive-displacement piston and auger-style pumps. Benefits include improved functionality, improved performance, improved reliability, improved throughput time, improved design flexibility, and improved cost effectiveness.

Background

Conventional epoxy nozzles have a single stainless-steel male luer needle. During dispensing, the dispenser head is moved in x/y/z-direction motions to deliver the underfill/adhesive. The needle is a consumable item that is typically 18 gauge but is available in gauges 10 to 28 (see Figure 1).

The conventional assembly can result in the following issues:

- Inaccurate dispensing pattern due to the required x/y motion
- Wear and tear on the dispenser head mechanics
- Temperature instability that results in epoxy stringers and wicking
- Excessive cost

The small thermal mass of the needle requires very stable and expensive heaters applied in a 360-degree envelopment of the needle to keep the temperature constant at all points. The moving needle is subject to mechanical vibrations, variations and inaccuracies in travel. Temperature control and stability is achieved through a constant air flow from a vortex cooling device. The added mechanics and synchronic motorization to control this style of needle, complicates maintenance, repair and programming complexity. The needle is considered a set-up disposable item.

General description

The disclosed method is a single-line dispenser nozzle for positive-displacement piston and auger-style pumps. The method uses a multiple-needle nozzle that deposits multiple overlapping epoxy dots to form a single line of capillary underfill or fillet epoxy (four-sided needle section). The disclosed method enables the development of multi-ganged dispensers that require no X/Y motion for dispensing.

The key elements of the disclosed method include:

- Internally configured reservoir shaped for the even flow of epoxy along the row of multiple needles
- Number of needles and their relative spacing tailored the die length, width of the epoxy line, and dot overlapping
- Shaped needles to 90° bends
- Smaller gauge needles

- Nozzle compatibility with existing valves and their direct needle heater assemblies
- Metal nozzle body with increased thermal mass that retains and stabilizes the epoxy temperature for a more consistent flow rate
- Hex screws that enable the nozzle to be cleaned and reused

Advantages

The disclosed method provides advantages, including:

- Improved functionality due to providing a single-line dispenser nozzle for positive-displacement piston and auger-style pumps
- Improved performance due to reducing epoxy drippage by using smaller gauge needles
- Improved performance due to increasing control of the flow temperature
- Improved performance due to increasing the accuracy of the epoxy delivery by eliminating x/y-direction motions
- Improved performance due to reducing epoxy stringers by controlling the delivery temperature
- Improved reliability due to reducing wicking by controlling the flow temperature
- Improved throughput time due to increasing the speed of the epoxy delivery by eliminating x/y-direction motions
- Improved design flexibility due to using multiple connector styles
- Improved cost effectiveness due to enabling the nozzle to be cleaned and reused
- Improved cost effectiveness due to reducing the wear and tear on the equipment dispenser head mechanics by eliminating x/y-direction motions

Detailed description

The disclosed method is a single-line dispenser nozzle for positive-displacement piston and auger style pumps. The nozzle is constructed to be split in half to facilitate cleaning and maintenance. One half is the fitting section, the other is the needle section. A luer male valve fits on one end with multiple needles on the opposite end. They clamp and seal together using hex-head 256 X 0.125-inch screws (see Figures 2 and 3).

The epoxy adhesive flow rate, flow uniformity and quantity are determined by the following:

- Mechanical pressure applied to the epoxy
- Needle gauge
- Shape of the internal cavity
- Quantity of needles

The part is machined in two parts and the needles are pressure fit inserted and cut to specified lengths, such as 0.25”. A specified amount of needle gap separation is required to reduce epoxy balling between needles. The needle holder can be replaced with interchangeable sections configured for different die sizes and shapes.

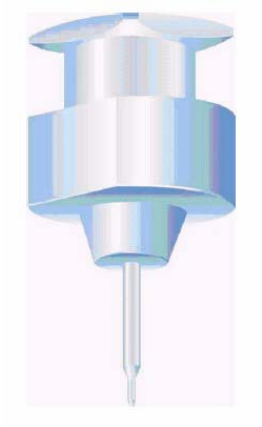

Fig. 1

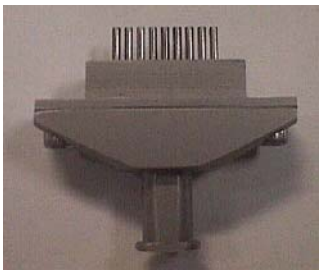

Fig. 2

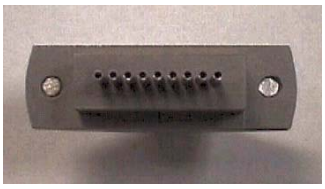

Fig. 3

Disclosed anonymously