SUMMARY

[0005] In accordance with a first exemplary aspect, a method for producing sterile solution-filled containers may include positioning a cartridge onto a filling machine. The cartridge may include a plurality of containers, a filter assembly, a connection line in fluid communication with the filter assembly, and a reservoir coupled to the connection line, disposed upstream from the plurality of containers, and disposed downstream from the filter assembly. Each of the plurality of containers may include a volume and a stem having a first end in fluid communication with the volume and a second end in fluid communication with the connection line. The method may include coupling the cartridge to a feed line in fluid communication with a fluid source, and activating a pump coupled to the feed line. The method may include at least partially filling one or more of the volumes associated with the plurality of containers by pumping fluid through the feed line, the filter assembly, the reservoir, and the connection line, thereby creating one or more at least partially filled containers. After filling, the method may include sealing the stem of each of the at least partially filled containers at a location between the connection line and the volume of the at least partially filled containers, thereby creating one or more at least partially filled and sealed containers. Then, the method may include separating each of the at least partially filled and sealed containers from the connection line while maintaining at least a portion of the seal on the stem. Finally, the method may include purging air from at least one of the feed line or the connection line before at least partially filing the one or more of the volumes.

[0006] In accordance with a second exemplary aspect, a cartridge assembly for a filling machine may include a plurality of containers. Each container may include a volume and a stem connected to the volume. A connection line grid may be in fluid communication with each stem of the plurality of containers. The connection line grid may include a first row connected to one or more containers of the plurality of containers and a second row connected to one or more containers of the plurality of containers. A filter assembly may be coupled to the connection line grid.

[0007] In accordance with a third exemplary aspect, a machine for producing a plurality of solution-filled containers may include a seal and cut assembly including a sealer, a cutter, and a carriage carrying the sealer and the cutter. The seal and cut assembly may be movable in a lateral direction and in a longitudinal direction. A bracket may receive a cartridge of containers. The machine may include a first group of pinch valves that include a first column and a second

column spaced from the first column. A second group of pinch valves may be disposed between the first column and the second column. The second group of pinch valves may be movable in the longitudinal direction.

What is Claimed:

1. A method for producing sterile solution-filled containers, the method comprising:

positioning a cartridge onto a filling machine, the cartridge including a plurality of containers, a filter assembly, a connection line in fluid communication with the filter assembly, and an reservoir coupled to the connection line, disposed upstream from the plurality of containers, and disposed downstream from the filter assembly, wherein each of the plurality of containers includes a volume and a stem having a first end in fluid communication with the volume and a second end in fluid communication with the connection line;

coupling the cartridge to a feed line in fluid communication with a mix tank;

activating a pump coupled to the feed line;

at least partially filling one or more of the volumes associated with the plurality of containers by pumping fluid through the feed line, the filter assembly, the reservoir, and the connection line, thereby creating one or more at least partially filled product containers;

sealing the stem of each of the at least partially filled containers at a location between the connection line and the volume of the at least partially filled containers, thereby creating one or more at least partially filled and sealed containers;

separating each of the at least partially filled and sealed containers from the connection line; and

purging air from at least one of the feed line or the connection line before at least partially filing the one or more of the volumes.

2. The method of claim 1, further comprising at least partially filling the reservoir with a solution from the mix tank before at least partially filling one or more volumes.

3. The method of claim 2, further comprising activating a second pump coupled to the connection line, the second pump disposed downstream from the reservoir and upstream from the plurality of containers.

4. The method of claim 2 or 3, further comprising reversing the second pump after separating each of the at least partially filled and sealed containers from the connection line.

5. The method of any one of claims 1 through 4, wherein at least partially filling one or more of the volumes includes filling a first row of the connection line with a solution, the first row including one or more containers.

6. The method of claim 5, wherein filling a first container of the first row includes releasing a first valve coupled to the connection line of the first row.

7. The method of claim 6, wherein filling the first container of the first row includes releasing a second valve coupled to a stem of the first container.

8. The method of claim 7, further comprising filling a second container of the first row after opening a third valve coupled to a stem of the second container, and closing the second valve coupled to the stem of the first container.

9 The method of claim 8, further comprising moving a seal and cut assembly in a lateral direction from the first container of the first row to the second container of the first row.

10. The method of any one of claims 5 through 9, wherein at least partially filling one or more of the volumes includes filling a second row of the connection line with a solution after separating each of the at least partially filled and sealed containers from the first row of the connection line, the second row being parallel to the first row and including one or more containers.

11. The method of claim 10, further comprising moving a seal and cut assembly in a longitudinal direction from the first row toward the second row of the connection line before filling a second row of the connection line.

12. The method of any one of claims 1 through 11, further comprising purging air from the connection line of the cartridge before at least partially filling the one or more volumes.

13. The method of claim 12, wherein purging air from the connection line includes activating a second pump to deliver air from the connection line to a reservoir disposed above the connection line.

14. The method of claim 12 or 13 any one of claims, wherein purging air from the connection line includes purging a first row of the connection line by opening a first row supply valve and opening a first row return valve, the first row including a first end, a second end, and one or more containers disposed between the first and second ends, wherein the first end is coupled to the first row supply valve and the second end is coupled to the first row return valve.

15. The method of any one of claims 1 through 14, further comprising decoupling the cartridge from the filling machine and coupling a different cartridge to the filling machine, the different cartridge including a plurality of containers, a filter assembly, and a connection line in fluid communication with the filter assembly, wherein each of the plurality of containers includes a volume and a stem having a first end in fluid communication with the volume and a second end in fluid communication with the connection line.

16. The method of any one of claims 1 through 15, wherein sealing the stem comprises:

capturing the stem with a sealing device, and collecting sealing sensor data by a sensor associated with a seal of the stem;

analyzing, by one or more processors of a controller, the sensor data associated with the seal; and

identifying, by one or more processors, based on an analysis of the sensor data, a status or condition associated with the seal.

17. The method of claim 16, further comprising accepting the seal if an average weld power, analyzed by the one or more processors, is within a stored acceptable weld power range.

18. The method of claim 16 or 17, further comprising rejecting the seal if an average weld power, analyzed by the one or more processors, is less than a lower limit of a stored acceptable weld power range.

19. The method of any one of claims 16 through 18, further comprising rejecting the seal if a direct short is detected in the sealing device by the one or more processors.

20. The method of any one of claims 16 through 19, further comprising rejecting the seal if an average weld power, analyzed by the one or more processors, is greater than an upper limit of a stored acceptable weld power range.

21. The method of claim 19 or 20, further comprising re-sealing the stem.

22. The method of any one of claims 1 through 21, wherein positioning a cartridge onto a filling machine includes positioning a cartridge having a plurality of product bags as containers, each product bag including a bladder as a volume.

23. The method of any one of claims 1 through 21, wherein positioning a cartridge onto a filling machine includes positioning a cartridge having a plurality of vials as containers.

24. The method of any one of claims 1 through 21, wherein positioning a cartridge onto a filling machine includes positioning a cartridge having a plurality of syringes as containers.

25. The method of any one of claims 1 through 21, wherein the one or more containers includes one or more product bags, and wherein the volume is a bladder.