Claims

1. Flexible assembly line ~~(30, 200, 220, 230)~~ for cutlery packaging comprising:
a cutlery assembly line ~~(34)~~ for receiving and dispensing cutlery items ~~(31)~~,
wherein the cutlery assembly line ~~(34)~~ further comprises an automatic organizer ~~(36, 38, 40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240)~~ for picking the cutlery items ~~(31)~~ in forming at least one set of eating utensils, and
the automatic organizer additionally comprises an industrial robot being configured to recognize and choose different types of cutlery items in forming the at least one set of eating utensils ~~(31)~~.

2. Flexible assembly line ~~(30, 200, 220, 230)~~ of Claim 1 further comprising
a toothpick and tissue assembly line ~~(32, 202, 204)~~ for providing serviettes ~~(37)~~ and/or sachets of toothpicks ~~(33)~~ in forming the at least one set of eating utensils ~~(31)~~.

3. Flexible assembly line ~~(30, 200, 220, 230)~~ of Claim 1 or 2 further comprising
a cutlery packaging machine ~~(42)~~ coupled to both the cutlery assembly line ~~(34)~~ and the toothpick and tissue assembly line ~~(32, 202, 204)~~ for wrapping selected cutlery items ~~(31)~~, a serviette ~~(37)~~ and a sachet of toothpick ~~(33)~~ together in forming the at least one set of eating utensils ~~(31)~~.

~~4. Flexible assembly line (30, 200, 220, 230) of Claim 1, wherein the automatic organizer (36, 38, 40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240) comprises an industrial robot (40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240) that is configured to recognize and choose different types of cutlery items (31) in forming the at least one set of eating utensils (31).~~

~~5~~4. Flexible assembly line ~~(30, 200, 220, 230)~~ of Claim 1 ~~or 4~~, wherein
the industrial robot ~~(40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240)~~ has machine vision capability in order to pick or check the cutlery items ~~(31)~~, the serviette ~~(37)~~ or the sachet of toothpick ~~(33)~~ for providing quality compliant eating utensils ~~(31)~~.

56. Flexible assembly line (30, 200, 220, 230) of Claim 51 or 4, wherein the industrial robot (40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240) is configured to scan profiles of the cutlery items (31) for recognizing different patterns of the cutlery items (31).

76. Flexible assembly line (30, 200, 220, 230) of Claim 51, 4 or 65, wherein the industrial robot (40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240) is figured to scan surface texture of the cutlery items (31) for quality inspection.

87. Flexible assembly line (30, 200, 220, 230) of any of the preceding Claims, wherein the cutlery assembly line (34) further comprises a spreader (54) for scattering the cutlery items (31).

98. Flexible assembly line (30, 200, 220, 230) of any of the preceding Claims, wherein the toothpick and tissue assembly line (32) further comprises a sorter (36, 38, 41, 206, 214) for disseminating sachets of toothpicks (33), serviettes (37) or both.

109. Flexible assembly line (30, 200, 220, 230) of any of the preceding Claims further comprising a transporting line (32, 34) connected to the spreader (54), the sorter (36, 38, 41, 206, 214) or both to the cutlery packaging machine (42).

1110. Flexible assembly line (30, 200, 220, 230) of Claim 1, wherein the automatic organizer (36, 38, 40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240) comprises a vision inspector (40, 56, 60, 62, 64, 66, 240) for recognizing patterns, surface texture or quantity of the cutlery items (31), the serviettes and the toothpicks before their packaging.

~~12~~11. Flexible assembly line ~~(30, 200, 220, 230)~~ of Claim 1 or ~~11~~10, wherein the automatic organizer ~~(36, 38, 40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240)~~ further comprises a blower ~~(222)~~ next to the vision inspector ~~(40, 56, 60, 62, 64, 66, 240)~~ for discharging air onto the cutlery items ~~(31)~~.

~~13~~12. Flexible assembly line ~~(30, 200, 220, 230)~~ of any of the Claims ~~4~~ 1, 4, 5 ~~to~~r~~o~~ ~~7~~6, wherein the industrial robot ~~(40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240)~~ comprises a buffer station ~~(75, 77, 79)~~ for storing cutlery items ~~(31)~~.

~~14~~13. Flexible assembly line ~~(30, 200, 220, 230)~~ of any of the Claims ~~4~~ 1, 4, 5, 6 ~~to~~or ~~7 and 13~~12, wherein an end effector ~~(243)~~ of the industrial robot ~~(40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240)~~ comprises a suction cup ~~(243)~~ for grabbing a cutlery item ~~(31)~~.

~~15~~14. Flexible assembly line ~~(30, 200, 220, 230)~~ of any of the preceding Claims, wherein the automatic organizer ~~(36, 38, 40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240)~~ comprises an auto tissue dispenser ~~(36)~~ for laying folded tissue paper ~~(37)~~ onto a toothpick conveyor ~~(48, 70, 208, 216)~~ in an orderly manner.

~~16~~15. Flexible assembly line ~~(30, 200, 220, 230)~~ of any of the preceding Claims, wherein the cutlery assembly line ~~(34)~~ comprises an upstream conveyor belt ~~(70a)~~, an inspection station ~~(240)~~ and a downstream conveyor belt ~~(70b)~~ that are sequentially laid out following a process flow direction ~~(127) (in a longitudinal direction)~~, the inspection station ~~(240)~~ further comprising a top vision camera ~~(244)~~ at the upstream conveyor belt ~~(70a)~~ and a bottom vision camera ~~(246)~~ at the downstream conveyor belt ~~(70b)~~ for checking opposite surfaces of a cutlery item ~~(31)~~.

~~17~~16. Flexible assembly line ~~(30, 200, 220, 230)~~ of any of the preceding Claims ~~16~~, wherein

the cutlery assembly line ~~(34)~~ further comprises a reject bin ~~(248)~~ between the upstream conveyor belt ~~(70a)~~ and the downstream conveyor belt ~~(70b)~~ for collecting quality non-complaint cutlery items ~~(31)~~.

~~18~~17. Flexible assembly line ~~(30, 200, 220, 230)~~ of any of the preceding claims, wherein

machine stations ~~(36, 38, 40, 41, 42, 44, 46, 54, 56, 58, 60, 62, 64, 66, 69, 224, 240)~~ of the automatic organizer ~~(36, 38, 40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240)~~ and the vision inspection station ~~(36, 40, 44, 54, 56, 224, 240)~~ are connected in forming an artificial neural network for adaptive control.

~~19~~18. Flexible assembly line ~~(30, 200, 220, 230)~~ of any of the preceding claims further comprising

a flip over machine ~~(58)~~ for turning over an cutlery item ~~(31)~~ before or after vision inspection.

~~20~~19. Flexible assembly line ~~(30, 200, 220, 230)~~ of any of the preceding Claims further comprises

an Automatically Guided Vehicle ~~(231)~~ for transporting packaged cutlery items ~~(31)~~ to or from the flexible assembly line ~~(30, 200, 220, 230)~~.

~~21~~20. Method for packaging cutlery items comprising:

- dispensing ~~(126)~~ cutlery items ~~(31)~~ onto a cutlery conveyor belt ~~(70)~~,
- recognizing different types of cutlery items, and
- picking up ~~(130)~~ the cutlery items ~~(31)~~ in forming at least one eating utensil set by an industrial robot ~~(31)~~.

21~~22~~. Method of Claim ~~21~~20 further comprising

inspecting ~~(128, 146)~~ the cutlery items ~~(31)~~ by machine vision for picking quality complaint cutlery items ~~(31)~~.

~~23~~22. Method of Claim ~~21~~20 or ~~22~~21 further comprising automatically packaging ~~(166)~~ quality compliant cutlery items ~~(31)~~ in forming sets of eating utensils ~~(31)~~.

~~24~~23. Method for making or installing a flexible assembly line ~~(30, 200, 220, 230)~~ comprising

- providing a cutlery assembly line ~~(34)~~,
- presenting a toothpick and tissue assembly line ~~(32, 202, 204), and~~
- connecting the cutlery assembly line ~~(34)~~ and the toothpick and tissue assembly line ~~(32, 202, 204)~~ together for packaging sets of eating utensils, and
- installing at least one industrial robot at the flexible assembly line for picking or moving various types or shapes of cutlery items adaptably ~~(31)~~.

~~25. Method of Claim 24 further comprising installing at least one industrial robot (36, 38, 40, 41, 54, 56, 58, 60, 62, 64, 66, 224, 240) at the flexible assembly line (30, 200, 220, 230) for picking or moving various types or shapes of cutlery items (31) adaptably.~~