Claims

1. Flexible Vision Inspector ~~(30, 200, 230)~~ comprising
   - a first type of illuminator ~~(52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~ for illuminating an object ~~(80, 250)~~,
   - a second type of illuminator for projecting light onto the object,
   - at least one type of camera ~~(48, 50, 74)~~ for capturing an image of the object ~~(80, 250)~~, and
   - an unitary framework ~~(46, 60, 62, 64, 66, 68, 70, 222~232)~~ that is connected to the first type of illuminator ~~(52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~ and the at least one type of camera ~~(48, 50, 74)~~ for holding the first type of illuminator ~~(52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~ and the least one type of camera ~~(48, 50, 74)~~ together at predetermined positions.

~~2. Flexible Vision Inspector (30, 200, 230) of Claim 1 further comprising a second type of illuminator (52, 54, 56, 58, 78, 240, 242, 244, 246, 248) for projecting light onto the object (80, 82, 250).~~

~~3~~2. Flexible Vision Inspector ~~(30, 200, 230)~~ of Claim 1 ~~or 2~~, wherein the unitary framework ~~(46, 60, 62, 64, 66, 68, 70, 222~232)~~ comprises a housing ~~(46)~~ that encloses the first type of illuminator ~~(52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~, the second type of illuminator ~~(52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~, the at least one type of camera ~~(48, 50)~~ or a combination of any of these types of illuminators or camera for preventing interference of illumination to the object ~~(80, 82, 250)~~.

~~4~~3. Flexible Vision Inspector ~~(30, 200, 230)~~ of ~~any of preceding Claims~~ Claim 1 or 2, wherein the unitary framework ~~(46, 60, 62, 64, 66, 68, 70, 222~232)~~ further comprises at least one panel ~~(222~232)~~ for preventing external light from interfering illumination of the object ~~(80, 82, 250)~~.

~~5~~4. Flexible Vision Inspector ~~(30, 200, 230)~~ of Claim ~~4~~3, wherein

the at least one panel ~~(222~232)~~ comprises a light absorber, a light reflector, a light refractor, a light diffuser ~~(222)~~, a light polarizer, a lens or a combination of any of these.

~~65~~5. Flexible Vision Inspector ~~(30, 200, 230)~~ of Claim ~~43~~ or ~~54~~, wherein the at least one panel ~~(222~232)~~ comprises a front panel ~~(222)~~ that is in the form of ground glass diffuser ~~(222)~~.

~~76~~6. Flexible Vision Inspector ~~(30, 200, 230)~~ of Claim ~~65~~5, wherein the front panel ~~(222)~~ comprises a clear portion for exposing lens of the at least one type of camera ~~(48, 50, 74)~~.

~~87~~7. Flexible Vision Inspector ~~(30, 200, 230)~~ of any of the preceding Claims, wherein the unitary framework ~~(46, 60, 62, 64, 66, 68, 70, 222~232)~~ comprises at least one rail ~~(60, 62, 252, 254)~~ for mounting at least one of these types of illuminators ~~(52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~, the at least one camera ~~(48, 50)~~ or both.

~~98~~8. Flexible Vision Inspector ~~(30, 200, 230)~~ of Claim ~~87~~7, wherein the at least one rail ~~(60, 62, 252, 254)~~ comprises a first rail ~~(60)~~ and a second rail ~~(62)~~ for mounting the at least one of the cameras ~~(48, 50)~~ and any of these types of illuminators ~~(52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~ separately.

~~109~~9. Flexible Vision Inspector ~~(30, 200, 230)~~ of Claim ~~87~~7 or ~~98~~8, wherein the at least one rail ~~(60, 62, 252, 254)~~ comprises a first rail ~~(60)~~ and a third rail ~~(252)~~ that are joined together for moving the at least one of the cameras ~~(48, 50)~~, the types of the illuminators ~~(52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~ or both one the two rails ~~(60, 252)~~.

~~11~~10. Flexible Vision Inspector ~~(30, 200, 230)~~ of ~~any of the preceding Claims~~ any of the preceding claims 2 to 9, wherein the unitary framework ~~(46, 60, 62, 64, 66, 68, 70, 222~232)~~ comprises a hub connector ~~(256, 258)~~ on the housing ~~(46)~~ for bundling electrical connections.

~~12~~11. Flexible Vision Inspector ~~(30, 200, 230)~~ of Claim ~~11~~10, wherein
the hub connector ~~(256, 258)~~ comprises a signal wire connector ~~(256)~~, a power cable connector ~~(258)~~ or both for providing detachable electrical connectors.

~~13~~12. ~~Flexible Vision Inspector (30, 200, 230) of any of the preceding Claims 3 to 12, wherein~~
~~the housing (46) comprises at least one opening (88, 90) for receiving the object (80, 82, 250) into the housing (46).~~

~~14.~~ Flexible Vision Inspector ~~(30, 200, 230)~~ of Claim ~~13~~2 or 10, wherein
~~the at least one opening~~the housing ~~(88, 90)~~ comprises a first opening ~~(88)~~ and a second opening ~~(90)~~ such that the object ~~(80, 82, 250)~~ can be transferred between two robotic arms ~~(32, 34)~~ by accessing through the two openings ~~(88, 90)~~.

~~15~~13. Flexible Vision Inspector ~~(30, 200, 230)~~ of ~~any of the preceding Claims 1 to 14~~ Claim 2, 10 or 12, wherein
the housing further ~~(46)~~ comprises a layer of anti-fogging coating for resisting moisture.

~~16~~14. Flexible Vision Inspector ~~(30, 200, 230)~~ of any of the preceding Claims 1 to ~~15~~13 further comprising
a wiper for preventing fluid accumulation on the flexible vision inspector intermittently, continuously, periodically or on-demand.

~~17~~15. Flexible Vision Inspector ~~(30, 200, 230)~~ of any of the preceding Claims further comprising:
a fan mounted onto the unitary framework ~~(46, 60, 62, 64, 66, 68, 70, 222~232)~~ for cooling components of the flexible vision inspector ~~(30, 200, 230)~~.

~~18~~16. Flexible Vision Inspector ~~(30, 200, 230)~~ of any of the preceding Claims further comprising:

a distance sensor connected to the at least one type of camera ~~(48, 50, 74)~~ for detecting distance between the object ~~(80, 82, 250)~~ and a lens of the at least one type of camera ~~(48, 50, 74)~~.

~~19~~17. Vision inspection station ~~(86, 236)~~ comprising

the flexible vision inspector ~~(30, 200, 230)~~ of any of the preceding claims, and at least one robotic arm ~~(32, 34)~~ for fetching the object ~~(80, 82, 250)~~ to the at least one type of camera ~~(48, 50, 74)~~.

~~20~~18. Vision inspection station ~~(86, 236)~~ of Claim ~~19~~17, wherein

the at least one robotic arm ~~(32, 34)~~ comprises a first robotic arm ~~(32)~~ and second robotic arm ~~(34)~~ that are positioned next to the flexible vision inspector ~~(30, 200, 230)~~ for transferring the object ~~(80, 82, 250)~~.

~~21~~19. Vision inspection station ~~(86, 236)~~ of Claim ~~19~~17 or ~~20~~18 further comprising

a belt conveyor ~~(202)~~ for transporting the object ~~(80, 82, 250)~~.

~~21~~20. Method for inspecting an object ~~(80, 82, 250)~~ by machine or computer vision, the method comprising:

- providing a robotic arm ~~(32, 34)~~, a first type of illuminator, a second type of illuminator~~at least one type of illuminator (52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~, a camera ~~(48, 50, 74)~~ and an object ~~(80, 82, 250)~~ for examination,
- moving the object ~~(80, 82, 250)~~ to the at least one type of illuminator ~~(52, 54, 56, 58, 78, 240, 242, 244, 246, 248)~~ and the camera ~~(48, 50, 74)~~ by the robotic arm ~~(32, 34)~~,
- projecting light onto the object from the first type of illuminator or the second type of illuminator ~~(80, 82, 250)~~ for vision inspection by the camera. ~~(48, 50, 74)~~

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

receiving the object ~~(80, 82, 250)~~ by another robotic arm via ~~(32, 34)~~ vision inspection by the camera ~~(48, 50, 74)~~ or another camera ~~(48, 50, 74)~~.