

Claims

1. Apparatus for inspecting components (C) having at least one top surface, a plurality of lateral surfaces (a, b, ...) to be inspected and/or edges of the lateral surfaces (a, b, ...),
 - the apparatus has at least one pick-up tool arranged on a turning device for one of the components (C) in each case, which tool is intended and set up to receive the respective component (C) on its top surface,
 - the turning device is intended and set up for this purpose,
 - using the pick-up tool to rotate the component (C) in a turning plane (WE) along a transport path (WB) about a turning axis (WA), and
 - thereby conveying a component (C) located on the pick-up tool and oriented at an angle to the transport path (WB) or the turning plane (WE) into an inspection position, and
 - in the inspection position, as optical component inspection devices, a first and a second imaging device are arranged at an angle to one another in such a way that a first lateral surface or edge of the component (C) located in the inspection position is to be inspected with the first imaging device, and a second lateral surface or edge, adjacent to the first, of the component (C) located in the inspection position is to be inspected with the second imaging device, wherein the component (C) is to be inspected in transmitted light and/or with reflected light, in that an infrared (IR) transmitted light and/or reflected light illumination device (306, 308) is associated with each of the imaging devices (302, 304) as illumination devices, each of which is oriented to the location at which the lateral surfaces (a, b, c, d) to be inspected are located in the respective inspection position (26, 28).
2. Apparatus for inspecting components (C) according to the preceding claim, wherein along the transport path (WB) of the component (C) two pairs of optical component inspection device are arranged, each in an angular arrangement outside transport path (WB) of the component (C) along the circumference of the turning device, wherein the transport path (WB) of the component (C) is substantially circular segment-shaped.
3. Apparatus for inspecting components (C) according to one of the preceding claims, wherein as illuminating devices for infrared transmitted-light inspection there is associated with the imaging devices in each case an infrared (IR) illuminating device opposite them, wherein each illuminating device is to be activated by a control arrangement when the pick-up tool with the component is located in the detection

range of the respective imaging device, or the illuminating devices are permanently activated.

4. Apparatus for inspecting components (C) according to one of the preceding claims, wherein at two successive inspection positions (26, 28) in each case two inspection devices (302A, 302B, 304A, 304B) and their illumination devices (306A, 306B, 308A, 308B) are arranged with their optical paths in an X arrangement for transmitted-light inspection, wherein in the first inspection position (26) a first illumination device (306A) is directed onto a first imaging device (304A) and a second illumination means (308A) is directed to a second imaging means (302A), and in the second inspection position (28) a second illumination means (306B) is directed to a first imaging means (304B) and a second illumination device (308B) is directed towards a second imaging device (302B), and the pick-up tool is arranged to convey the component (C) into a region of the respective inspection position (26, 28) in which in each case two of the optical paths cross or intersect.

5. Apparatus for inspecting components (C) according to one of the preceding claims, wherein in each of the inspection positions two lateral surfaces are to be inspected optically at the same time when the component (C) is located at the corresponding position without the imaging devices and/or their illumination devices entering the transport path of the component (C), or the component (C) is to be moved radially outwardly or inwardly on the pick-up tool in order to enter the optical path of the imaging devices and their illumination devices.

6. Apparatus for inspecting components (C) according to one of the preceding claims, wherein the pick-up tool (160) on the turning device (150) is set up and intended to pick up the component (C) and convey it with its lateral surfaces (a, b, c, d) to be inspected optically along the transport path (WB) of the component (C) through at least one or two of the pairs of optical component inspection devices which are set up and intended to inspect in each case two adjoining lateral surfaces (a, b, c, d).

7. Apparatus for inspecting components (C) according to any one of the preceding claims, wherein the component (C) is to be inspected with incident light by directing four imaging devices (302A, 304 A, 302B, 304B) in an X arrangement at a single inspection position (26) onto four lateral surfaces (a, b, c, d) of the same component (C) to be inspected, and wherein the imaging devices (302A, 304 A, 302B, 304B) are each assigned illumination devices (306A, 306 A, 308B, 308B) which are set up to

inspect the respective lateral surface (a, b, c, d) of the component (C) to be inspected in the X-arrangement.

8. Apparatus for inspecting components (C) according to one of the preceding claims, wherein the component (C) is to be conveyed in an angular orientation relative to the transport path (WB), wherein two respective imaging devices (600) and their illumination devices (610) are provided at the inspection positions (26, 28), a respective deflection device (420, 430) for the optical beam path being associated with each of said imaging devices (600), wherein the imaging devices (600) associated with the first and/or second inspection position (26, 28), their illumination devices (610) and/or the deflection devices (440, 450) are to be moved into and out of the transport path (WB) of the component (C) by means of corresponding linear drives, and/or the deflection devices (440, 450) are designed to be completely or partially deflecting/reflecting.

9. Apparatus for inspecting components (C) according to any one of the preceding claims, wherein an illumination device is provided for an incident light imaging device for inspecting the lateral surfaces or edges of the component (C), on the side of the imaging device. 10. Apparatus for inspecting components (C) according to any one of the preceding claims, wherein in an X arrangement at a single inspection position (26) four imaging devices (302A, 304 A, 302B, 304B) are directed onto the four lateral surfaces (a, b, c, d) of the same component (C) to be inspected, the imaging devices (302A, 304 A, 302B, 304B) are each assigned illumination devices (306A, 306 A, 308B, 308B) which illuminate the respective lateral surface (a, b, c, d) of the component (C) to be inspected in reflected light.

10. Apparatus for inspecting components (C) according to any one of the preceding claims, wherein for a reflected light image pickup for inspecting the components picked up by the pick-up tool, and/or the position/orientation of the component (C) on the pick-up tool (160), the imaging device (700) has illumination devices with different wavelengths and a partially transparent deflection device for the optical beam path from the imaging device to the end face of the component (C) and/or further illumination devices, which are arranged surrounding the deflection device, and/or wherein the imaging device (700), the illumination devices and/or the deflection device are to be moved relative to the component by means of corresponding linear drives.

11. Apparatus for inspecting components (C) according to one of the preceding claims, wherein one of the holding and feeding devices is intended and set up to align a component stock (BV) with component (C) to be dispensed relative to the pick-up tool located in the receiving position in such a way that, at least for the component (C) to be dispensed from the component stock (BV) in each case

- a lateral surface of the component (C) which encloses an acute angle with the turning plane (WE) encloses an angle of 30° to 60° with the turning plane (WE), or
- a lateral surface of the component (C), which encloses an obtuse angle with the turning plane (WE), encloses an angle of 120° to 150° with the turning plane (WE).

12. Method for inspecting components (C) having at least one top surface, a plurality of lateral surfaces (a, b, ...) to be inspected and/or edges of the lateral surfaces (a, b, ...),

- providing a pick-up tool arranged on a turning device for one of the components (C) in each case;
- picking up a component (C) at its top surface by means of the pick-up tool in an angled orientation to a transport path (WB) or turning plane (WE) to convey the component (C) to at least one inspection position, and
- rotating the turning device with the pick-up tool to convey the component (C) in the turning plane (WE) along the transport path (WB) to the inspection position, and
- providing, in the inspection position, as optical component inspection device, first and second imaging means arranged at an angle to each other, and
- inspecting a first lateral surface or edge of the component (C) located in the inspection position with the first imaging device,
- inspecting a second lateral surface or edge, adjacent to the first, of the component (C) located in the inspection position with the second imaging device, wherein the component (C) is to be inspected in transmitted light and/or with reflected light, in that an infrared (IR) transmitted light and/or reflected light illumination device (306, 308) is associated with each of the imaging devices (302, 304) as illumination devices, each of which is oriented to the location at which the lateral surfaces (a, b, c, d) to be inspected are located in the respective inspection position (26, 28).