

CARRIER AND DETECTION APPARATUS

TECHNICAL FIELD

[0001] The present application relates to the technical field of detection apparatuses, and in particular to a carrier and an detection apparatus.

BACKGROUND

[0002] Currently, for frame-type product structures with a middle plate, there is often a need to detect both inner features and outer features of the product. For outer features, an detection device can be directly used for detection, whereas for inner features, it is usually necessary to adjust an optical path with the aid of a prism to achieve detection of the inner features.

[0003] However, existing solutions generally employ two stations, one of which is used for detecting outer features and the other for detecting inner features, and both stations require a carrier, resulting in a large equipment footprint.

SUMMARY

[0004] Based on this, in view of the problem of a large footprint in existing solutions where two stations are designed to respectively detect outer features and inner features, it is necessary to provide a carrier and an detection apparatus capable of detecting both outer features and inner features at a single station, thereby making the structure more compact.

[0005] The present application provides a carrier for carrying a product, the product having an inner cavity and a mounting hole in communication with the inner cavity, the mounting hole being located in a side wall of the inner cavity. The carrier comprises:

[0006] a mounting base;
a support assembly provided on the mounting base and configured to support the product;
and
a drive assembly and an optical path adjustment assembly, the drive assembly being provided on the mounting base and connected to the optical path adjustment assembly to

drive the optical path adjustment assembly to reciprocate in a first direction; wherein the optical path adjustment assembly, during movement in the first direction, is capable of extending into the inner cavity and opposing the mounting hole, so that light entering through the mounting hole is capable of being reflected, under the action of the optical path adjustment assembly, to the side wall of the inner cavity.

[0007] With the above carrier, when inspecting an outer side of the product and the side wall of the inner cavity, the product is supported on the support assembly such that the side of the product having the inner cavity faces the mounting base, and then the drive assembly drives the optical path adjustment assembly to move toward the product until the optical path adjustment assembly extends into the inner cavity and opposes the mounting hole, so that light is capable of being directed onto the side wall of the inner cavity, enabling an detection device to detect the outer side of the product and the side wall of the inner cavity.

[0008] When detecting a bottom wall of the inner cavity of the product, it is only necessary for the drive assembly to drive the optical path adjustment assembly away from the product, and then the product is turned over and placed on the support assembly, after which the detection device can detect the bottom wall of the inner cavity of the product. In this way, the carrier can be used for detecting both the outer side and the inner side of the product, without the need to provide two stations and two carriers, thereby making the structure of an detection apparatus more compact and also reducing equipment cost.

[0009] In one embodiment, the drive assembly comprises a guide module and a drive module, the guide module being reciprocally movably connected to the mounting base in the first direction, the optical path adjustment assembly being connected to the guide module, and the drive module being configured to drive the guide module to reciprocate in the first direction.

[0010] In one embodiment, the drive module comprises an adjustment driving member, a wedge block, and a return elastic member, the adjustment driving member being connected to the wedge block to drive the wedge block to reciprocate in a direction angled with respect to the first direction, the wedge block being capable of abutting against the

guide module during movement of the wedge block to push the guide module to drive the optical path adjustment assembly to move toward the product, and the return elastic member being connected between the optical path adjustment assembly and the mounting base and configured to provide an acting force for moving the optical path adjustment assembly away from the product.

[0011] In one embodiment, the guide module comprises a guide member and a roller, the guide member being reciprocally movably connected to the mounting base in the first direction and extending through the mounting base in the first direction, the optical path adjustment assembly and the roller being respectively connected to two ends of the guide member in the first direction, and the roller being rotatably provided, the wedge block being capable of abutting against the roller during movement of the wedge block.

[0012] In one embodiment, the drive assembly further comprises a limiting block provided on the mounting base;

during a process in which the guide module drives the optical path adjustment assembly to move toward the product, the limiting block is capable of abutting against the optical path adjustment assembly to limit the optical path adjustment assembly from continuing to move toward the product.

[0013] In one embodiment, the drive module is a pneumatic cylinder.

[0014] In one embodiment, the drive module comprises an adjustment driving member and a return elastic member, the adjustment driving member being provided on the mounting base, and a driving end of the adjustment driving member being capable of abutting against the optical path adjustment assembly to drive the optical path adjustment assembly to move in the first direction away from the mounting base toward the product, and the return elastic member being connected between the mounting base and the optical path adjustment assembly and configured to provide an acting force for moving the optical path adjustment assembly in the first direction toward the mounting base.

[0015] In one embodiment, the optical path adjustment assembly comprises a mounting frame and a prism, the drive assembly being connected to the mounting frame to drive the mounting frame to reciprocate in the first direction, the prism being provided on

the mounting frame, and the prism being capable of extending into the inner cavity and opposing the mounting hole during movement in the first direction.

[0016] In one embodiment, the optical path adjustment assembly comprises a plurality of prisms provided on the mounting frame, and when the plurality of prisms extend into the inner cavity, each of the prisms is capable of opposing one side wall of the inner cavity.

[0017] In one embodiment, an angle of the prism relative to the mounting frame is adjustable.

[0018] In one embodiment, the carrier further comprises a positioning assembly, the positioning assembly comprising two first positioning modules and two second positioning modules, the two first positioning modules being spaced apart on the mounting base in a second direction and configured to position the product on the support assembly in the second direction, and the two second positioning modules being spaced apart on the mounting base in a third direction and configured to position the product on the support assembly in the third direction;

wherein each of the second direction and the third direction is perpendicular to the first direction, and the second direction and the third direction are angled with respect to each other.

[0019] In one embodiment, each of the first positioning modules comprises a first positioning driving member, a first connection plate, and a first positioning post, the first positioning driving member being connected to the first connection plate to drive the first connection plate to reciprocate in the second direction, the first positioning post being provided on the first connection plate, and the two first positioning posts of the two first positioning modules being movable toward or away from each other to clamp the product on the support assembly during movement toward each other;

each of the second positioning modules comprises a second positioning driving member, a second connection plate, and a second positioning post, the second positioning driving member being connected to the second connection plate to drive the second connection plate to reciprocate in the third direction, the second positioning post being provided on the

second connection plate, and the two second positioning posts of the two second positioning modules being movable toward or away from each other to clamp the product on the support assembly during movement toward each other.

[0020] In one embodiment, the positioning assembly further comprises a third positioning module provided on one of the first connection plates or one of the second connection plates;

when the two first positioning posts or the two second positioning posts clamp the product, the third positioning module is capable of pressing the product against the support assembly.

[0021] In one embodiment, the carrier further comprises a base and a rotary connection seat, the rotary connection seat being rotatably connected to the base about an axis parallel to the first direction, and the mounting base being connected to the rotary connection seat.

[0022] The present application further provides an detection apparatus, comprising an detection device and the carrier according to any one of the above embodiments, wherein the detection device is configured to detect the product on the carrier.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] In order to more clearly illustrate the technical solutions in the embodiments of the present application or in the prior art, the drawings required for use in the description of the embodiments or the prior art will be briefly introduced below. Obviously, the drawings in the following description are merely some embodiments of the present application, and for a person of ordinary skill in the art, other drawings can be obtained based on these drawings without creative effort.

[0024] FIG. 1 is a schematic structural view of the product;

[0025] FIG. 2 is a schematic structural view of the product from another perspective;

[0026] FIG. 3 is a schematic structural view of a carrier according to an embodiment of the present application;

[0027] FIG. 4 is a schematic structural view of a drive assembly and an optical path adjustment assembly of the carrier according to a first embodiment;

[0028] FIG. 5 is a schematic cross-sectional structural view of the drive assembly and the optical path adjustment assembly shown in FIG. 4;

[0029] FIG. 6 is a schematic diagram illustrating the operating principle of a prism of the optical path adjustment assembly shown in FIG. 5;

[0030] FIG. 7 is a schematic structural view of a drive module of the drive assembly of the carrier according to a second embodiment;

[0031] FIG. 8 is a schematic structural view of a guide module of the drive assembly and the mounting base of the carrier according to the second embodiment;

[0032] FIG. 9 is a schematic structural view of the guide module and the mounting base shown in FIG. 8 from another perspective;

[0033] FIG. 10 is an enlarged schematic structural view of the guide module and the mounting base in FIG. 8;

[0034] FIG. 11 is a schematic structural view of a first positioning module and a third positioning module of the carrier shown in FIG. 3;

[0035] FIG. 12 is a schematic structural view of the first positioning module and the third positioning module shown in FIG. 11 from another perspective; and

[0036] FIG. 13 is a schematic structural view of a second positioning module of the carrier shown in FIG. 3.

DETAILED DESCRIPTION

[0037] For the above objects, features, and advantages of the present application to become more apparent and understandable, the specific embodiments of the present application will be described in detail below with reference to the accompanying drawings. In the following description, numerous specific details are set forth in order to facilitate a full understanding of the present application. However, the present application can be implemented in many other ways different from those described herein, and those skilled in the art can devise similar modifications without departing from the connotation of the present application. Therefore, the present application is not limited to the specific embodiments disclosed below.

[0038]

In the description of the present application, it should be understood that the terms indicating orientation or positional relationships, such as "center," "longitudinal," "lateral," "length," "width," "thickness," "upper," "lower," "front," "rear," "left," "right," "vertical," "horizontal," "top," "bottom," "inner," "outer," "clockwise," "counterclockwise," "axial," "radial," and "circumferential," are based on the orientations or positional relationships shown in the drawings, and are merely for convenience of describing the present application and simplifying the description, rather than indicating or implying that the device or element referred to must have a particular orientation or be constructed and operated in a particular orientation, and therefore should not be construed as limiting the present application.

[0039]

In addition, the terms "first" and "second" are used merely for descriptive purposes and should not be construed as indicating or implying relative importance or implicitly indicating the number of the indicated technical features. Thus, a feature defined with "first" or "second" may explicitly or implicitly include at least one such feature. In the description of the present application, "a plurality of" means at least two, for example two, three, etc., unless otherwise expressly and specifically defined.

[0040]

In the present application, unless otherwise expressly specified and limited, terms such as "mounted," "connected," "coupled," and "fixed" should be understood in a broad sense. For example, they may be fixed connections, detachable connections, or integral formations; they may be mechanical connections or electrical connections; they may be direct connections or indirect connections through intervening media; or they may be internal communications between two elements or interactive relationships between two elements, unless otherwise expressly limited. For a person of ordinary skill in the art, the specific meanings of the above terms in the present application can be understood according to specific circumstances.

[0041]

In the present application, unless otherwise expressly specified and limited, a first feature being "on" or "below" a second feature may mean that the first and second features are in direct contact, or that the first and second features are in indirect contact

through an intervening medium. Moreover, a first feature being "above," "over," or "on top of" a second feature may mean that the first feature is directly above or obliquely above the second feature, or merely that the first feature has a higher horizontal level than the second feature. A first feature being "below," "under," or "beneath" a second feature may mean that the first feature is directly below or obliquely below the second feature, or merely that the first feature has a lower horizontal level than the second feature.

[0042] It should be noted that when an element is referred to as being "fixed to" or "provided on" another element, it can be directly on the other element or an intervening element may also be present. When an element is referred to as being "connected to" another element, it can be directly connected to the other element or an intervening element may also be present. The terms "vertical," "horizontal," "upper," "lower," "left," "right," and similar expressions used herein are for illustrative purposes only and do not indicate that they are the only manner of implementation.

[0043] To facilitate understanding of the technical solution of the present application, the structure of the product 100 will be described herein with reference to FIGS. 1 and 2: the product 100 has an inner cavity 110 and a mounting hole 120 in communication with the inner cavity 110, and the mounting hole 120 is located in a side wall 130 of the inner cavity 110.

[0044] Specifically, in the embodiment shown in FIGS. 1 and 2, the product 100 is a middle frame of a mobile phone. In other embodiments, the product 100 may also be other products, which is not limited herein.

[0045] The present application provides an detection apparatus including an detection device and a carrier 200 (see FIG. 3), the carrier being configured to carry the product 100 to facilitate detection of the product 100 on the carrier by the detection device.

[0046] It should be explained that in this embodiment, the inner side of the product 100 refers to the side of the product 100 having the inner cavity 110, and detecting the inner side refers to detecting the side wall 130 and the bottom wall 140 of the inner cavity 110.

[0047] In addition, the detection device includes at least two detection mechanisms. One portion of the detection mechanisms is located above the carrier and is configured to

detect a surface of the product 100 on a side facing away from the mounting base 211, i.e., the outer top surface 150 or the bottom wall 140 of the inner cavity 110. Another portion of the detection mechanisms is located at a peripheral side of the carrier and is configured to detect an outer wall of the product 100, or in cooperation with the carrier 200, to detect the side wall 130 of the inner cavity 110 of the product 100. Since the detection mechanisms are located above or at the peripheral side of the carrier, and the product 100 is supported on the carrier, detection from below the product 100 is not possible.

[0048] Referring to FIGS. 3 to 5, the carrier includes a mounting base 211, a support assembly 220, a drive assembly 230, and an optical path adjustment assembly 240.

[0049] The support assembly 220 and the drive assembly 230 are both provided on the mounting base 211. The support assembly 220 is configured to support the product 100. The drive assembly 230 is connected to the optical path adjustment assembly 240 to drive the optical path adjustment assembly 240 to reciprocate in a first direction.

[0050] The optical path adjustment assembly 240 is capable of extending into the inner cavity 110 and opposing the mounting hole 120 during movement in the first direction, so that light entering through the mounting hole 120 is capable of being reflected, under the action of the optical path adjustment assembly 240, to the side wall 130 of the inner cavity 110.

[0051] An edge of the product 100 is supported on the support assembly 220, such that the inner side of the product 100 faces the mounting base 211. Then, the drive assembly 230 drives the optical path adjustment assembly 240 to move toward the product 100 until the optical path adjustment assembly 240 extends into the inner cavity 110 of the product 100 and opposes the mounting hole 120. Subsequently, the detection device detects the outer side of the product 100, and at the same time, since light entering through the mounting hole 120 can be reflected by the optical path adjustment assembly 240 onto the side wall 130 of the inner cavity 110, the detection device can also detect the side wall 130 of the inner cavity 110.

[0052] After the detection is completed, the drive assembly 230 drives the optical path adjustment assembly 240 away from the product 100, and then the product 100 is

turned over and re-supported on the support assembly 220, at which time the inner cavity 110 of the product 100 faces away from the optical path adjustment assembly 240 and is in an exposed state. Subsequently, the detection device can detect the bottom wall 140 of the inner cavity 110.

[0053] It can be understood that the optical path adjustment assembly 240 is mainly used to enable the detection device to detect the side wall 130 of the inner cavity 110 of the product 100.

[0054] In addition, it should be explained that since the edge of the product 100 is supported on the support assembly 220, when the inner side of the product 100 faces the mounting base 211, the bottom wall 140 of the inner cavity 110 is at a relatively high level; when the outer side of the product 100 faces the mounting base 211, the outer top surface 150 of the product 100 faces the mounting base 211, and the outer top surface 150 is at a relatively low level. Therefore, to avoid contact between the optical path adjustment assembly 240 and the outer top surface 150, when the outer top surface 150 of the product 100 faces the mounting base 211, the drive assembly 230 drives the optical path adjustment assembly 240 downward to move away from the product 100.

[0055] With the above carrier, when detecting the outer side of the product 100 and the side wall 130 of the inner cavity 110, the product 100 is supported on the support assembly 220 such that the side of the product 100 having the inner cavity 110 faces the mounting base 211, and then the drive assembly 230 drives the optical path adjustment assembly 240 to move toward the product 100 until the optical path adjustment assembly 240 extends into the inner cavity 110 and opposes the mounting hole 120, so that light is capable of being directed onto the side wall 130 of the inner cavity 110, enabling the detection device to detect the outer side of the product 100 and the side wall 130 of the inner cavity 110.

[0056] When detecting the bottom wall 140 of the inner cavity 110 of the product 100, it is only necessary for the drive assembly 230 to drive the optical path adjustment assembly 240 away from the product 100, and then the product is turned over and placed on the support assembly 220, after which the detection device can detect the bottom wall 140 of

the inner cavity 110 of the product 100. In this way, the carrier can be used for detecting both the outer side and the inner side of the product 100, without the need to provide two stations and two carriers, thereby making the structure of the detection apparatus more compact and also reducing equipment cost.

[0057] It should be explained that the above-mentioned detection of the inner side of the product 100 refers to detection of the bottom wall 140 and the side wall 130 of the inner cavity 110 of the product 100.

[0058] Referring to FIG. 3, in one embodiment, the carrier further includes a base 212 and a rotary connection seat 213. The rotary connection seat 213 is rotatably connected to the base 212 about an axis parallel to the first direction, and the mounting base 211 is connected to a side of the rotary connection seat 213 facing away from the base 212. In this way, by rotation, the detection device can detect the periphery of the product 100, making the detection more comprehensive.

[0059] Referring to FIG. 4, in one embodiment, the optical path adjustment assembly 240 includes a mounting frame 241 and a prism 242. The drive assembly 230 is connected to the mounting frame 241 to drive the mounting frame 241 to reciprocate in the first direction, and the prism 242 is provided on the mounting frame 241. The prism 242 is capable of extending into the inner cavity 110 and opposing the mounting hole 120 during movement in the first direction, so as to reflect light entering through the mounting hole 120 to the side wall 130 of the inner cavity 110, thereby enabling detection of the side wall 130 of the inner cavity 110.

[0060] As shown in FIG. 6, light is reflected by the prism 242 and can be directed onto the side wall 130 of the inner cavity 110.

[0061] Further, the optical path adjustment assembly 240 includes a plurality of prisms 242, and the plurality of prisms 242 are all provided on the mounting frame 241. When the plurality of prisms 242 extend into the inner cavity 110, each prism 242 is capable of opposing one side wall 130 of the inner cavity 110. In this way, regardless of how the product 100 is placed, there will always be a prism 242 opposing each side wall 130 of the inner cavity 110, thereby ensuring that light is reflected to the side wall 130 of the inner

cavity 110 of the product 100 to enable detection of the side wall 130, without restricting the placement of the product 100, which is more convenient.

[0062] Specifically, in the embodiment shown in FIG. 4, the product 100 is rectangular, and correspondingly, the optical path adjustment assembly 240 includes four prisms 242, which are arranged in a rectangular configuration to oppose the four side walls 130 of the inner cavity 110 of the product 100.

[0063] In one embodiment, the angle of the prism 242 relative to the mounting frame 241 is adjustable, so as to adjust the angle of the optical path and ensure that the prism 242 reflects light entering through the mounting hole 120 to the side wall 130 of the inner cavity 110.

[0064] It should be noted that the angle of the prism 242 being adjustable means, in FIG. 6, that the prism 242 is rotatable about an axis perpendicular to the plane of the drawing.

[0065] Referring to FIGS. 4 and 5, in one embodiment, the drive assembly 230 includes a guide module 231 and a drive module 232. The guide module 231 is reciprocally movably connected to the mounting base 211 in the first direction, the optical path adjustment assembly 240 is connected to the guide module 231, and the drive module 232 is configured to drive the guide module 231 to reciprocate in the first direction.

[0066] Optionally, the drive module 232 is a pneumatic cylinder, and the drive module 232 is connected to the guide module 231 to drive the guide module 231 to reciprocate in the first direction. Of course, the drive module 232 may also be other driving structures, which is not limited herein.

[0067] In a first embodiment, the drive module 232 includes an adjustment driving member 233 and a return elastic member 234. The adjustment driving member 233 is provided on the mounting base 211 or the rotary connection seat 213, and a driving end of the adjustment driving member 233 is capable of abutting against the mounting frame 241 to drive the mounting frame 241 to move in the first direction away from the mounting base 211 toward the product 100. The return elastic member 234 is connected between the mounting base 211 and the mounting frame 241 and is configured to provide an acting force

for moving the mounting frame 241 in the first direction toward the mounting base 211.

[0068] In this way, the driving end of the adjustment driving member 233 extends out and abuts against the mounting frame 241 to drive the mounting frame 241 to move the prism 242 toward the product 100. After the detection is completed, the driving end of the adjustment driving member 233 retracts, and the mounting frame 241 moves away from the product 100 under the action of the return elastic member 234.

[0069] Optionally, the adjustment driving member 233 is a pneumatic cylinder. Of course, the adjustment driving member 233 may also be other driving structures, which is not limited herein.

[0070] Referring to FIGS. 7 and 9, in a second embodiment, the drive module 232 includes an adjustment driving member 233, a wedge block 235, and a return elastic member 234. The adjustment driving member 233 is provided on the rotary connection seat 213 and connected to the wedge block 235 to drive the wedge block 235 to reciprocate in a direction angled with respect to the first direction. The wedge block 235 is capable of abutting against the guide module 231 during movement of the wedge block 235 to push the guide module 231 to drive the optical path adjustment assembly 240 to move toward the product 100. The return elastic member 234 is connected between the mounting frame 241 and the mounting base 211 and is configured to provide an acting force for moving the mounting frame 241 toward the mounting base 211 and away from the product 100.

[0071] Referring also to FIG. 10, further, the guide module 231 includes a guide member 236 and a roller 237. The guide member 236 is reciprocally movably connected to the mounting base 211 in the first direction, and the optical path adjustment assembly 240 and the roller 237 are both connected to the guide member 236. The roller 237 is rotatably provided. The wedge block 235 is capable of abutting against the roller 237 during movement of the wedge block 235, thereby cooperating with the return elastic member 234 to drive the optical path adjustment assembly 240 to reciprocate in the first direction.

[0072] It can be understood that the wedge block 235 has a wedge surface, and the roller 237 is pressed against the wedge surface under the action of the return elastic member 234. As the wedge block 235 moves, the roller 237 rolls on the wedge surface, thereby

driving the guide member 236 and the mounting frame 241 to reciprocate in the first direction. In addition, in a preferred embodiment, the adjustment driving member 233 drives the wedge block 235 to reciprocate in a direction perpendicular to the first direction.

[0073] Optionally, the adjustment driving member 233 is a pneumatic cylinder. Of course, the adjustment driving member 233 may also be other driving structures, which is not limited herein.

[0074] In addition, the structures of the guide module 231 in the first embodiment and the second embodiment are substantially the same, but the guide module 231 in the second embodiment further includes the roller 237 to facilitate contact with the wedge block 235 and respond to movement of the wedge block 235.

[0075] Specifically, in the embodiment shown in FIG. 10, the guide member 236 is connected to the mounting base 211 via a slider-rail arrangement. A slider is fixedly connected to the mounting base 211, a rail is fixedly connected to the guide member 236, and the slider and the rail are slidably connected to each other, thereby enabling the guide member 236 to be reciprocally movably connected to the mounting base 211 in the first direction.

[0076] Referring to FIGS. 7 and 8, in one embodiment, the optical path adjustment assembly 240 includes a plurality of mounting frames 241 and a plurality of prisms 242, and the drive assembly 230 includes a plurality of guide modules 231 and a plurality of drive modules 232. The plurality of mounting frames 241 correspond one-to-one to the plurality of prisms 242, and the plurality of drive modules 232, the plurality of guide modules 231, and the plurality of mounting frames 241 correspond one-to-one. In this way, a corresponding prism 242 can be driven to move toward the product 100 according to detection requirements.

[0077] It should be noted that in the second embodiment, when the number of prisms 242 is four, the number of corresponding drive modules 232 is also four. Two of the drive modules 232 may share one adjustment driving member 233, i.e., a pneumatic gripper cylinder is used to simultaneously drive two opposing wedge blocks 235 to move, and the other two drive modules 232 each use a pneumatic cylinder to drive the corresponding

wedge block 235 to move.

[0078] Referring to FIG. 5, in one embodiment, the drive assembly 230 further includes a limiting block 238. The limiting block 238 is provided on the mounting base 211.

[0079] During the process in which the guide module 231 drives the optical path adjustment assembly 240 to move toward the product 100, the limiting block 238 is capable of abutting against the optical path adjustment assembly 240 to limit the optical path adjustment assembly 240 from continuing to move toward the product 100. In this way, it can be ensured that the optical path adjustment assembly 240 rises to the same height each time, ensuring that after the optical path adjustment assembly 240 extends into the inner cavity 110 of the product 100, it can oppose the mounting hole 120. At the same time, it can also prevent the optical path adjustment assembly 240 from rising too high and contacting the product 100.

[0080] It should be noted that in the second embodiment, the stroke of the guide module 231 reciprocating in the first direction, i.e., the lifting height, is limited by the undulation height of the wedge surface, so the limiting block 238 may not be provided.

[0081] Specifically, in the embodiment shown in FIG. 5, the limiting block 238 is Z-shaped, and one end of the limiting block 238 is connected to the mounting base 211, and the other end is capable of abutting against the mounting frame 241 to limit the height to which the mounting frame 241 rises.

[0082] Referring to FIG. 3, in one embodiment, the carrier further includes a positioning assembly 250. The positioning assembly 250 is configured to position the product 100 on the support assembly 220 to prevent the product 100 from shaking during rotation of the rotary connection seat 213, thereby ensuring detection accuracy.

[0083] The detection steps for the product 100 based on the above embodiment are described below:

[0084] An edge of the product 100 is supported on the support assembly 220, such that the inner side of the product 100 faces the mounting base 211, and the product 100 is positioned by the positioning assembly 250. Then, the drive assembly 230 drives the optical path adjustment assembly 240 to move toward the product 100 until the optical path

adjustment assembly 240 extends into the inner cavity 110 of the product 100 and opposes the mounting hole 120. Subsequently, the detection device detects the outer side of the product 100. At the same time, since light entering through the mounting hole 120 can be reflected by the optical path adjustment assembly 240 onto the side wall 130 of the inner cavity 110, the detection device can also detect the side wall 130 of the inner cavity 110.

[0085] After detection of the outer side of the product 100 and the side wall 130 of the inner cavity 110 is completed, the drive assembly 230 drives the optical path adjustment assembly 240 away from the product 100, and then the positioning assembly 250 releases the positioning of the product 100. Subsequently, the product 100 is turned over and re-supported on the support assembly 220, and then the product 100 is repositioned by the positioning assembly 250. At this time, the inner cavity 110 of the product 100 faces away from the optical path adjustment assembly 240 and is in an exposed state. Next, the detection device detects the bottom wall 140 of the inner cavity 110.

[0086] In one embodiment, the positioning assembly 250 includes two first positioning modules 251 and two second positioning modules 252. The two first positioning modules 251 are spaced apart on the mounting base 211 in a second direction and are configured to position the product 100 on the support assembly 220 in the second direction. The two second positioning modules 252 are spaced apart on the mounting base 211 in a third direction and are configured to position the product 100 on the support assembly 220 in the third direction.

[0087] Each of the second direction and the third direction is perpendicular to the first direction, and the second direction and the third direction are angled with respect to each other. Specifically, in the embodiment shown in FIG. 4, the second direction and the third direction are perpendicular.

[0088] Referring to FIGS. 11 and 12, in one embodiment, each first positioning module 251 includes a first positioning driving member 2511, a first connection plate 2512, and a first positioning post 2513. The first positioning driving member 2511 is connected to the first connection plate 2512 to drive the first connection plate 2512 to reciprocate in the second direction. The first positioning post 2513 is provided on the first connection plate

2512. The two first positioning posts 2513 of the two first positioning modules 251 are movable toward or away from each other to clamp the product 100 on the support assembly 220 during movement toward each other, thereby positioning the product 100 in the second direction.

[0089] Referring also to FIG. 13, further, each second positioning module 252 includes a second positioning driving member 2521, a second connection plate 2522, and a second positioning post 2523. The second positioning driving member 2521 is connected to the second connection plate 2522 to drive the second connection plate 2522 to reciprocate in the third direction. The second positioning post 2523 is provided on the second connection plate 2522. The two second positioning posts 2523 of the two second positioning modules 252 are movable toward or away from each other to clamp the product 100 on the support assembly 220 during movement toward each other, thereby positioning the product 100 in the third direction.

[0090] It should be noted that in other embodiments, one of the positioning modules (the first positioning modules 251 and the second positioning modules 252) may be as described above, including a positioning driving member (the first positioning driving member 2511 and the second positioning driving member 2521), a connection plate (the first connection plate 2512 and the second connection plate 2522), and a positioning post (the first positioning post 2513 and the second positioning post 2523), while the other positioning module may include a positioning block fixedly connected to the mounting base 211, and the positioning post is movable toward or away from the corresponding positioning block to press the product 100 on the support assembly 220 against the positioning block during movement toward the positioning block, thereby positioning the product 100.

[0091] Referring to FIGS. 11 and 12, in one embodiment, the positioning assembly 250 further includes a third positioning module 253, and the third positioning module 253 is provided on one of the first connection plates 2512 or one of the second connection plates 2522.

[0092] When the two first positioning posts 2513 or the two second positioning posts 2523 clamp the product 100, the third positioning module 253 is capable of pressing the

product 100 against the support assembly 220.

[0093] Further, the third positioning module 253 includes a third positioning driving member 2531, a third connection plate 2532, and a third positioning post 2533. The third positioning driving member 2531 is connected to the third connection plate 2532 to drive the third connection plate 2532 to reciprocate in the first direction. The third positioning post 2533 is provided on the third connection plate 2532. The third positioning post 2533 is capable of pressing the product 100 against the support assembly 220 during movement in the first direction.

[0094] It can be understood that, taking the third positioning module 253 being provided on the first connection plate 2512 as an example, after the first positioning modules 251 clamp and position the product 100, the third positioning post 2533 is located above the product 100. Then, the third positioning driving member 2531 drives the third positioning post 2533 to move toward the product 100 until the product 100 is pressed and fixed on the support assembly 220. When the product 100 needs to be released, the third positioning driving member 2531 first drives the third positioning post 2533 away from the product 100, and then the first positioning modules 251 and the second positioning modules 252 release the product 100.

[0095] In one embodiment, each of the positioning driving members (the first positioning driving member 2511, the second positioning driving member 2521, and the third positioning driving member 2531) includes a pneumatic positioning cylinder 254 and a positioning elastic member 255. A driving end of the pneumatic positioning cylinder 254 is capable of abutting against the connection plate (the first connection plate 2512, the second connection plate 2522, or the third connection plate 2532) to push the connection plate to drive the positioning post (the first positioning post 2513, the second positioning post 2523, or the third positioning post 2533) away from the product 100 on the support assembly 220, thereby releasing the product 100. The positioning elastic member 255 is configured to provide an acting force for moving the positioning post toward the product 100 on the support assembly 220 to clamp and position the product 100.

[0096] It can be understood that, in the first positioning driving member 2511 and the

second positioning driving member 2521, the positioning elastic member 255 is connected between the mounting base 211 and the corresponding connection plate, or between the rotary connection seat 213 and the corresponding connection plate, while in the third positioning driving member 2531, the positioning elastic member 255 is connected between the first connection plate 2512 and the third connection plate 2532, or between the second connection plate 2522 and the third connection plate 2532.

[0097] In other embodiments, the pneumatic positioning cylinder 254 may also drive the positioning post to move toward and clamp the product 100, and the positioning elastic member 255 may drive the positioning post to move away from and release the product 100. Of course, it is preferable that the positioning elastic member 255 drives the positioning post to move toward and clamp the product 100, so as to prevent the positioning post from crushing the product 100.

[0098] To facilitate understanding of the technical solution of the present application, the working process of the carrier in the above embodiments will be described herein with reference to FIGS. 3 and 4:

[0099] Initially, the positioning posts in the first positioning modules 251, the second positioning modules 252, and the third positioning module 253 are moved away from each other under the action of the positioning pneumatic cylinders 254. Then, the product 100 is placed on the support assembly 220, such that the inner side of the product 100 faces the mounting base 211, and then the positioning driving members are actuated to position the product 100 through the first positioning modules 251, the second positioning modules 252, and the third positioning module 253. After positioning is completed, the drive assembly 230 drives the mounting frame 241 to move toward the product 100 until the prisms 242 extend into the inner cavity 110 and oppose the mounting holes 120. Subsequently, the detection mechanism at the top and the detection mechanisms at the peripheral side of the carrier detect the outer side of the product 100 and the side walls 130 of the inner cavity 110.

[00100] After detection of the outer side of the product 100 and the side walls 130 of the inner cavity 110 is completed, the drive assembly 230 drives the mounting frame 241

away from the product 100, and at the same time, the positioning assembly 250 releases the positioning to release the product 100. Next, the product 100 is turned over and placed on the support assembly 220, such that the outer top surface 150 of the product 100 faces the mounting base 211. Then, the positioning assembly 250 clamps and positions the product 100 again. Finally, the detection mechanism at the top detects the bottom wall 140 of the inner cavity 110 of the product 100.

[00101] It should be noted that when detecting the outer side and the side walls 130 of the inner cavity 110, comprehensive detection of the product 100 can be achieved by rotating the rotary connection seat 213.

[00102] In addition, when the above-mentioned driving members are pneumatic cylinders, the air lines can be accessed through the base 212.

[00103] The technical features of the above-described embodiments may be combined in any manner. To keep the description concise, not all possible combinations of the technical features in the above embodiments are described. However, as long as there is no contradiction in the combination of these technical features, they should be considered as falling within the scope of this description.

[00104] The above-described embodiments merely express several implementation modes of the present application, and their descriptions are relatively specific and detailed, but they should not be construed as limiting the scope of the patent. It should be noted that for a person of ordinary skill in the art, several variations and improvements can be made without departing from the concept of the present application, and these all fall within the protection scope of the present application. Therefore, the protection scope of the patent of the present application should be subject to the appended claims.

CLAIMS

1. A carrier for carrying a product, the product having an inner cavity and a mounting hole in communication with the inner cavity, the mounting hole being located in a side wall of the inner cavity, wherein the carrier comprises:

a mounting base;

a support assembly provided on the mounting base and configured to support the product; and

a drive assembly and an optical path adjustment assembly, the drive assembly being provided on the mounting base and connected to the optical path adjustment assembly to drive the optical path adjustment assembly to reciprocate in a first direction;

wherein the optical path adjustment assembly, during movement in the first direction, is capable of extending into the inner cavity and opposing the mounting hole, so that light entering through the mounting hole is capable of being reflected, under the action of the optical path adjustment assembly, to the side wall of the inner cavity.

2. The carrier according to claim 1, wherein the drive assembly comprises a guide module and a drive module, the guide module being reciprocally movably connected to the mounting base in the first direction, the optical path adjustment assembly being connected to the guide module, and the drive module being configured to drive the guide module to reciprocate in the first direction.

3. The carrier according to claim 2, wherein the drive module comprises an adjustment driving member, a wedge block, and a return elastic member, the adjustment driving member being connected to the wedge block to drive the wedge block to reciprocate in a direction angled with respect to the first direction, the wedge block being capable of abutting against the guide module during movement of the wedge block to push the guide module to drive the optical path adjustment assembly to move toward the product, and the return elastic member being connected between the optical path adjustment assembly and

the mounting base and configured to provide an acting force for moving the optical path adjustment assembly away from the product.

4. The carrier according to claim 3, wherein the guide module comprises a guide member and a roller, the guide member being reciprocally movably connected to the mounting base in the first direction and extending through the mounting base in the first direction, the optical path adjustment assembly and the roller being respectively connected to two ends of the guide member in the first direction, and the roller being rotatably provided, the wedge block being capable of abutting against the roller during movement of the wedge block.

5. The carrier according to claim 2, wherein the drive assembly further comprises a limiting block provided on the mounting base; during a process in which the guide module drives the optical path adjustment assembly to move toward the product, the limiting block is capable of abutting against the optical path adjustment assembly to limit the optical path adjustment assembly from continuing to move toward the product.

6. The carrier according to claim 2, wherein the drive module is a pneumatic cylinder.

7. The carrier according to claim 2, wherein the drive module comprises an adjustment driving member and a return elastic member, the adjustment driving member being provided on the mounting base, and a driving end of the adjustment driving member being capable of abutting against the optical path adjustment assembly to drive the optical path adjustment assembly to move in the first direction away from the mounting base toward the product, and the return elastic member being connected between the mounting base and the optical path adjustment assembly and configured to provide an acting force for moving the optical path adjustment assembly in the first direction toward the mounting base.

8. The carrier according to claim 1, wherein the optical path adjustment assembly comprises a mounting frame and a prism, the drive assembly being connected to the mounting frame to drive the mounting frame to reciprocate in the first direction, the prism being provided on the mounting frame, and the prism being capable of extending into the inner cavity and opposing the mounting hole during movement in the first direction.

9. The carrier according to claim 8, wherein the optical path adjustment assembly comprises a plurality of prisms provided on the mounting frame, and when the plurality of prisms extend into the inner cavity, each of the prisms is capable of opposing one side wall of the inner cavity.

10. The carrier according to claim 8, wherein an angle of the prism relative to the mounting frame is adjustable.

11. The carrier according to any one of claims 1 to 10, wherein the carrier further comprises a positioning assembly, the positioning assembly comprising two first positioning modules and two second positioning modules, the two first positioning modules being spaced apart on the mounting base in a second direction and configured to position the product on the support assembly in the second direction, and the two second positioning modules being spaced apart on the mounting base in a third direction and configured to position the product on the support assembly in the third direction; wherein each of the second direction and the third direction is perpendicular to the first direction, and the second direction and the third direction are angled with respect to each other.

12. The carrier according to claim 11, wherein each of the first positioning modules comprises a first positioning driving member, a first connection plate, and a first positioning post, the first positioning driving member being connected to the first connection plate to drive the first connection plate to reciprocate in the second direction, the first positioning

post being provided on the first connection plate, and the two first positioning posts of the two first positioning modules being movable toward or away from each other to clamp the product on the support assembly during movement toward each other;

each of the second positioning modules comprises a second positioning driving member, a second connection plate, and a second positioning post, the second positioning driving member being connected to the second connection plate to drive the second connection plate to reciprocate in the third direction, the second positioning post being provided on the second connection plate, and the two second positioning posts of the two second positioning modules being movable toward or away from each other to clamp the product on the support assembly during movement toward each other.

13. The carrier according to claim 12, wherein the positioning assembly further comprises a third positioning module provided on one of the first connection plates or one of the second connection plates; when the two first positioning posts or the two second positioning posts clamp the product, the third positioning module is capable of pressing the product against the support assembly.

14. The carrier according to any one of claims 1 to 10, wherein the carrier further comprises a base and a rotary connection seat, the rotary connection seat being rotatably connected to the base about an axis parallel to the first direction, and the mounting base being connected to the rotary connection seat.

15. An detection apparatus, comprising an detection device and the carrier according to any one of claims 1 to 14, wherein the detection device is configured to detect the product on the carrier.