and the locating plate 8 is disposed within the layout space 9. There are a plurality of holes 10 disposed on the corresponding locations of the probes 5 of the upper die 6, the lower die 7, and the locating plate 8, respectively, wherein the plurality of holes 10 has a size corresponding to a diameter dimension of the probe 5. Hence, when the probes 5 are installed in line assembly, each probe 5 can pass through the corresponding holes 10 of the locating plate 8 and the lower die 7 and remain in a vertical configuration. After that, the locating plate 8 is covered by the upper die 6, such that the probes 5 can pass through the corresponding holes 10 of the upper die 6 to complete the assembly. FIG. 1-2 is a structural illustrative drawing of another conventional vertical probe card 4 having three dies according to the known art, which further includes a middle die 11 (MD) disposed between the upper die 6 and the lower die 7 and can be applied to the probes 5 having a longer length, thereby reducing degree of metalworking and assembly difficulty.

[0004] After frequent test operations have been performed on the vertical probe card 1, the probes 5 disposed in the probe head 4 may easily generate wear and abrasions of varying degrees. Hence, replacement and maintenance of the probes 5 are often required. In practice, during the process of replacing the probes 5, the upper die 6 must be removed from probe head 4 first. Then, the probe 5 to be replaced is taken out, and a new probe 5 is inserted thereon once more. However, the size or dimensions of the probes 5 is very small and precise, and the probes 5 are tightly aligned to each other. In addition, the locating plate 8 is a non-fixed or non-stationary structure, and thus the locating plate 8 can be easily turned back if the probe head 4 is removed from the upper die 6, or that the probe 5 is taken out, which may negatively affect other properly working probes 5 so as to be taken out together alongside. As a result, there-insertions of other replacement probes 5 are required, which may increase repair cost and thereby waste maintenance time and labor, especially probe cards having high pin count will be affected more seriously.

SUMMARY OF THE INVENTION

[0005] It is therefore one of the objectives of the present invention to provide a combined probe head to solve the above-mentioned problems in the prior art. The layout area of the probes in the vertical probe card can be divided into several regions, such that the mutual interference between probes can be avoided during repair process, in order to thereby reduce repair cost.

[0006] In order to achieve the above mentioned goal, a combined probe head is implemented by using the sub-probe heads or the upper sub-dies to differentiate the layout areas of the probes. According to one embodiment of the present invention, the combined probe head may include a locating plate and a plurality of sub-probe heads. The locating plate includes a plurality of fixed portions. Each sub-probe head includes a plurality of corresponding sub-dies and a plurality of probes inserted between the plurality of sub-dies, and each sub-probe head is assembled and fixed in the corresponding fixed portion in order to complete the assembly and alignment.

[0007] According to another embodiment of the present invention, the combined probe head may include a lower die and a plurality of upper sub-dies, in which the locations of the upper sub-dies are corresponding to a predetermined region of the lower die. Different layout areas of the probes are differentiated or segmented by using the upper sub-dies.

[0008] According to another embodiment of the present invention, a method for assembling and aligning a combined probe head is provided. In the method for assembling and aligning the first combined probe head, the combined probe head may include a locating plate and a plurality of sub-probe head, in which there are a plurality of probes inserted between the upper sub-die and the lower sub-die of each sub-probe head. After the sub-probe heads are assembled and fixed in the locating plate, an accurate alignment of each sub-probe head is achieved by using a probe alignment unit in order to position the proper locating distribution of all of the

respective probes, and the positioned sub-probe heads are assembled and fixed in the locating plate.

[0009] Therefore, by adopting the embodiments of the present invention, the layout areas of a vertical probe card can be differentiated or segmented in order to avoid mutual interference under or during repair process.

[0010] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1-1 is a structural illustrative drawing of a conventional vertical probe card according to the known art.

[0012] FIG. 1-2 is a structural illustrative drawing of another conventional vertical probe card according to the known art.

[0013] FIG. 2-1 is a 3 dimensional exploded view of a combined probe head according to an embodiment of the present invention.

[0014] FIG. 2-2 is a cross-sectional view of a combined probe head according to the embodiment of the present invention.

[0015] FIG. 3-1 and FIG. 3-2 are a plurality of views illustrating a method for assembling a combined probe head according to an exemplary embodiment of the present invention.

[0016] FIG. 4-1 is a 3 dimensional exploded view of a combined probe head according to another embodiment of the present invention.

CLAIMS

What is claimed is:

1. A combined probe head, being disposed in a space transformer of a vertical probe card, the combined probe head comprises:

a locating plate, comprising a plurality of fixed portions; and

a plurality of sub-probe heads, the sub-probe heads are disposed in horizontal alignment with each other, wherein each sub-probe head comprises:

an upper sub-die, a lower sub-die, and a plurality of probes being inserted between the upper sub-die and the lower sub-die,

and each sub-probe head is assembled and fixed in the corresponding fixed portion.

2. The combined probe head according to claim 1, wherein each fixed portion has a size corresponding to a placement space of the corresponding sub-probe head.

3. The combined probe head according to claim 1, wherein for each sub-probe head, a width of the upper sub-die is greater than a width of the lower sub-die in order to form a leaning portion; and each sub-probe head is leaned against a peripheral of the fixed portion through the leaning portion so as to be assembled and fixed in the locating plate.

4. The combined probe head according to claim 1, wherein each sub-probe head further comprises:

a middle sub-die, wherein for each sub-probe head, the middle sub-die is disposed between the upper sub-die and the lower sub-die.

5. The combined probe head according to claim 4, wherein the middle sub-die of each sub-probe head further comprises a leaning portion, and the sub-probe head is leaned against a peripheral of the fixed portion through the lean portion, so as to be assembled and fixed in the locating plate.

6. The combined probe head according to claim 4, wherein the middle sub-die of each sub-probe head further comprises a leaning beam structure, and the locating plate

comprises a support beam structure, such that the leaning beam structure is leaned against the support beam structure.

7. The combined probe head according to claim 1, wherein the locating plate and the sub-probe heads comprises a plurality of corresponding locking holes, respectively, and one of the locking holes located on the locating plate and the locking holes located on the plurality of sub-probe heads has an aperture greater than a screw diameter for the screw for the locking holes for locking and fixing the plurality of locking holes.

8. A combined probe head, being disposed in a space transformer of a vertical probe card, the combined probe head comprises:

a lower die, comprising a plurality of layout areas of probes;

a plurality of upper sub-dies, wherein two adjacent upper sub-dies are disposed in horizontal alignment with each other, and the locations of the upper sub-dies are corresponding to the layout areas of the lower die, respectively; and

a plurality of probes, wherein two terminal ends of each probe are corresponding to the layout areas, and are inserted between the upper sub-die and the lower die, respectively.

9. The combined probe head according to claim 8, wherein each upper sub-die is corresponding to the layout areas, and is assembled and fixed in the lower die.

10. The combined probe head according to claim 8, further comprising:

a plurality of middle sub-dies, wherein two adjacent middle sub-dies are in horizontal alignment with each other, the middle sub-dies are corresponding to the layout areas of the lower die, and are assembled and fixed in the lower die, and each layout area is sequentially composed of the upper sub-die, the middle sub-de, and the lower die.

11. The combined probe head according to claim 8, further comprising:

a middle die, directly disposed on the lower die, wherein the middle die comprises a layout area corresponding to the layout area of the lower die, and each upper sub-die is directly assembled and fixed in the layout area of the middle die.

12. The combined probe head according to claim 11, further comprising:

a locating plate, wherein the middle die is assembled and fixed in the locating plate, and is directly assembled and fixed in a space transformer of the vertical probe card through the locating plate.

13. The combined probe head according to claim 8, further comprising:

a locating plate, wherein the upper die is assembled and fixed in the locating plate, and the combined probe head is assembled and fixed in a space transformer of the vertical probe card through the locating plate.

14. A combined probe head, being disposed in a space transformer of a vertical probe card, the combined probe head comprises:

an upper die, comprising a plurality of layout areas;

a plurality of lower sub-dies, wherein two adjacent lower sub-dies are disposed in horizontal alignment with each other, and the locations of the plurality of lower sub-dies are corresponding to the plurality of layout areas of the upper die, respectively; and

a plurality of probes, wherein two terminal ends of each probe are inserted between the corresponding lower sub-die and the upper die, respectively.

15. The combined probe head according to claim 14, wherein each lower sub-die is corresponding to the plurality of layout areas of the lower die and is assembled and fixed in the upper die.

16. The combined probe head according to claim 14, further comprising:

a plurality of middle sub-dies, wherein two adjacent middle sub-dies are in horizontal alignment with each other, the middle sub-dies are assembled and fixed in the layout areas of the upper die, and each layout area is sequentially composed of the upper die, the middle sub-de, and the lower sub-die.

17. The combined probe head according to claim 14, further comprising:

a middle die, directly disposed on the upper die, wherein the middle die comprises a layout area corresponding to the layout area of the upper die, and each lower sub-die is directly assembled and fixed in the layout area of the middle die.

18. The combined probe head according to claim 17, further comprising:

a locating plate, wherein the middle die is assembled and fixed in the locating plate, and is directly assembled and fixed in a space transformer of the vertical probe card through the locating plate.

19. The combined probe head according to claim 14, further comprising:

a locating plate, wherein the upper die is assembled and fixed in the locating plate, and the combined probe head is assembled and fixed in a space transformer of the vertical probe card through the locating plate.

20. A method for assembling and aligning a combined probe head, the combined probe head comprising a locating plate and a plurality of sub-probe head, each sub-probe head comprising an upper sub-die and a lower sub-die, and a plurality of probes are inserted between the upper sub-die and the lower sub-die; wherein after the sub-probe heads are assembled and fixed in the locating plate, an accurate alignment of each sub-probe head is completed by using a probe alignment unit in order to position a locating distribution of all the probes, and the positioned sub-probe heads are assembled and fixed in the locating plate.

21. The method according to claim 20, wherein the probe alignment unit is a film having a locating distribution of the probes, and the sub-probe heads is positioned by calibrating the locating distribution of the probes on the film.

22. The method according to claim 20, wherein each sub-probe head further comprises a middle sub-die, the sub-probe head is sequentially composed of the upper sub-die, the middle sub-die, and the lower die, and the sub-probe heads are assembled and locked in the locating plate through the middle sub-dies.

and the locating plate 8 is disposed within the layout space 9. There are a plurality of holes 10 disposed on the corresponding locations of the probes 5 of the upper die 6, the lower die 7, and the locating plate 8, respectively, wherein the plurality of holes 10 has a size corresponding to a diameter dimension of the probe 5. Hence, when the probes 5 are installed in line assembly, each probe 5 can pass through the corresponding holes 10 of the locating plate 8 and the lower die 7 and remain in a vertical configuration. After that, the locating plate 8 is covered by the upper die 6, such that the probes 5 can pass through the corresponding holes 10 of the upper die 6 to complete the assembly. FIG. 1-2 is a structural illustrative drawing of another conventional vertical probe card 4 having three dies according to the known art, which further includes a middle die 11 (MD) disposed between the upper die 6 and the lower die 7 and can be applied to the probes 5 having a longer length, thereby reducing degree of metalworking and assembly difficulty.

[0004] After frequent test operations have been performed on the vertical probe card 1, the probes 5 disposed in the probe head 4 may easily generate wear and abrasions of varying degrees. Hence, replacement and maintenance of the probes 5 are often required. In practice, during the process of replacing the probes 5, the upper die 6 must be removed from probe head 4 first. Then, the probe 5 to be replaced is taken out, and a new probe 5 is inserted thereon once more. However, the size or dimensions of the probes 5 is very small and precise, and the probes 5 are tightly aligned to each other. In addition, the locating plate 8 is a non-fixed or non-stationary structure, and thus the locating plate 8 can be easily turned back if the probe head 4 is removed from the upper die 6, or that the probe 5 is taken out, which may negatively affect other properly working probes 5 so as to be taken out together alongside. As a result, there-insertions of other replacement probes 5 are required, which may increase repair cost and thereby waste maintenance time and labor, especially probe cards having high pin count will be affected more seriously.

SUMMARY OF THE INVENTION

The invention is defined in the independent claims. Some optional features of the invention are defined in the dependent claims.

[0005] Implementation of the techniques disclosed herein may solve the above-mentioned problems in the prior art. The layout area of the probes in the vertical probe card can be divided into several regions, such that the mutual interference between probes can be avoided during repair process, in order to thereby reduce repair cost.

[0006] In order to achieve the above mentioned goal, a combined probe head is implemented by using the sub-probe heads or the upper sub-dies to differentiate the layout areas of the probes. According to one arrangement the combined probe head may include a locating plate and a plurality of sub-probe heads. The locating plate includes a plurality of fixed portions. Each sub-probe head includes a plurality of corresponding sub-dies and a plurality of probes inserted between the plurality of sub-dies, and each sub-probe head is assembled and fixed in the corresponding fixed portion in order to complete the assembly and alignment.

[0007] According to another arrangement, the combined probe head may include a lower die and a plurality of upper sub-dies, in which the locations of the upper sub-dies are corresponding to a predetermined region of the lower die. Different layout areas of the probes are differentiated or segmented by using the upper sub-dies.

[0008] According to another arrangement, a method for assembling and aligning a combined probe head is provided. In the method for assembling and aligning the first combined probe head, the combined probe head may include a locating plate and a plurality of sub-probe head, in which there are a plurality of probes inserted between the upper sub-die and the lower sub-die of each sub-probe head. After the sub-probe heads are assembled and fixed in the locating plate, an accurate alignment of each sub-probe head is achieved by using a probe alignment unit in order to position the proper locating distribution of all of the

respective probes, and the positioned sub-probe heads are assembled and fixed in the locating plate.

[0009] Therefore, by adopting the techniques disclosed herein, the layout areas of a vertical probe card can be differentiated or segmented in order to avoid mutual interference under or during repair process.

[0010] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1-1 is a structural illustrative drawing of a conventional vertical probe card according to the known art.

[0012] FIG. 1-2 is a structural illustrative drawing of another conventional vertical probe card according to the known art.

[0013] FIG. 2-1 is a 3 dimensional exploded view of a combined probe head according to an embodiment of the present invention.

[0014] FIG. 2-2 is a cross-sectional view of a combined probe head according to the embodiment of the present invention.

[0015] FIG. 3-1 and FIG. 3-2 are a plurality of views illustrating a method for assembling a combined probe head according to an exemplary embodiment of the present invention.

[0016] FIG. 4-1 is a 3 dimensional exploded view of a combined probe head according to another embodiment of the present invention.

CLAIMS

What is claimed is:

1. A combined probe head, being disposed in a space transformer of a vertical probe card, the combined probe head comprises:

a locating plate, comprising a plurality of fixed portions and a support beam structure, wherein the fixed portions are defined by the support beam structure; and a plurality of sub-probe heads, the sub-probe heads are disposed in horizontal alignment with each other, wherein each sub-probe head comprises:

an upper sub-die, a lower sub-die, and a plurality of probes being inserted between the upper sub-die and the lower sub-die,

and each sub-probe head is assembled and fixed in the corresponding fixed portion;

the sub-probe head further comprises:

a middle sub-die, wherein for each sub-probe head, the middle sub-die is disposed between the upper sub-die and the lower sub-die.

2. The combined probe head according to claim 1, wherein each fixed portion has a size corresponding to a placement space of the corresponding sub-probe head.

3. The combined probe head according to claim 1, wherein for each sub-probe head, a width of the upper sub-die is greater than a width of the lower sub-die in order to form a leaning portion; and each sub-probe head is leaned against a peripheral of the fixed portion through the leaning portion so as to be assembled and fixed in the locating plate.

4. The combined probe head according to claim 1, wherein the middle sub-die of each sub-probe head further comprises a leaning portion, and the sub-probe head is leaned against a peripheral of the fixed portion through the lean portion, so as to be assembled and fixed in the locating plate.

5. The combined probe head according to claim 1, wherein the middle sub-die of each sub-probe head further comprises a leaning beam structure, such that the leaning beam structure is leaned against the support beam structure.

6. The combined probe head according to claim 1, wherein the locating plate and the sub-probe heads comprises a plurality of corresponding locking holes, respectively, and one of the locking holes located on the locating plate and the locking holes located on the plurality of sub-probe heads has an aperture greater than a screw diameter for the screw for the locking holes for locking and fixing the plurality of locking holes.

7. A combined probe head, being disposed in a space transformer of a vertical probe card, the combined probe head comprises:

a locating plate, comprising a support beam structure and a plurality of fixed portions, wherein the fixed portions are defined by the support beam structure;

a lower die, comprising a plurality of layout areas of probes;

a plurality of upper sub-dies, wherein two adjacent upper sub-dies are disposed in horizontal alignment with each other, and the locations of the upper sub-dies are corresponding to the layout areas of the lower die, respectively;

a plurality of probes, wherein two terminal ends of each probe are corresponding to the layout areas, and are inserted between the upper sub-die and the lower die, respectively; and

a plurality of middle sub-dies, wherein two adjacent middle sub-dies are in horizontal alignment with each other, the middle sub-dies are corresponding to the layout areas of the lower die, and are assembled and fixed in the lower die, and each layout area is sequentially composed of the upper sub-die, the middle sub-de, and the lower die.

8. The combined probe head according to claim 7, wherein each upper sub-die is corresponding to the layout areas, and is assembled and fixed in the lower die.

9. The combined probe head according to claim 7, further comprising:

a middle die, directly disposed on the lower die, wherein the middle die comprises a layout area corresponding to the layout area of the lower die, and each upper sub-die is directly assembled and fixed in the layout area of the middle die.

10. The combined probe head according to claim 9, wherein the middle die is

assembled and fixed in the locating plate, and is directly assembled and fixed in a space transformer of the vertical probe card through the locating plate.

11. The combined probe head according to claim 7, wherein the upper die is assembled and fixed in the locating plate, and the combined probe head is assembled and fixed in a space transformer of the vertical probe card through the locating plate.

12. A combined probe head, being disposed in a space transformer of a vertical probe card, the combined probe head comprises:

a locating plate, comprising a support beam structure and a plurality of fixed portions, wherein the fixed portions are defined by the support beam structure;

an upper die, comprising a plurality of layout areas;

a plurality of lower sub-dies, wherein two adjacent lower sub-dies are disposed in horizontal alignment with each other, and the locations of the plurality of lower sub-dies are corresponding to the plurality of layout areas of the upper die, respectively;

a plurality of probes, wherein two terminal ends of each probe are inserted between the corresponding lower sub-die and the upper die, respectively; and

a middle die, directly disposed on the upper die, wherein the middle die comprises a layout area corresponding to the layout area of the upper die, and each lower sub-die is directly assembled and fixed in the layout area of the middle die.

13. The combined probe head according to claim 12, wherein each lower sub-die is corresponding to the plurality of layout areas of the lower die and is assembled and fixed in the upper die.

14. The combined probe head according to claim 12, further comprising:

a plurality of middle sub-dies, wherein two adjacent middle sub-dies are in horizontal alignment with each other, the middle sub-dies are assembled and fixed in the layout areas of the upper die, and each layout area is sequentially composed of the upper die, the middle sub-de, and the lower sub-die.

15. The combined probe head according to claim 12, wherein the middle die is assembled and fixed in the locating plate, and is directly assembled and fixed in a

space transformer of the vertical probe card through the locating plate.

16. The combined probe head according to claim 12, wherein the upper die is assembled and fixed in the locating plate, and the combined probe head is assembled and fixed in a space transformer of the vertical probe card through the locating plate.

17. A method for assembling and aligning a combined probe head, the combined probe head comprising a locating plate and a plurality of sub-probe head, the locating plate comprising a support beam structure and a plurality of fixed portions, the fixed portions are defined by the support beam structure, each sub-probe head comprising an upper sub-die and a lower sub-die, and a plurality of probes are inserted between the upper sub-die and the lower sub-die and a middle sub-die, the sub-probe head is sequentially composed of the upper sub-die, the middle sub-die, and the lower sub-die, including the method steps:

assembling and locking the sub-probe heads in the locating plate through the middle sub-dies;

completing an accurate alignment of each sub-probe head after the sub-probe heads are assembled and fixed by the support beam structure of the locating plate by using a probe alignment unit in order to position a locating distribution of all the probes, after the positioned sub-probe heads are assembled and fixed in the locating plate.

18. The method according to claim 17, wherein the probe alignment unit is a film having a locating distribution of the probes, and the sub-probe heads is positioned by calibrating the locating distribution of the probes on the film.