United States Patent

Jones

[15] **3,665,790**

[45] **May 30, 1972**

[54] TWEEZERS

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[73] Assignee: **Swiss American Precision Imports, Inc.** El Segundo, Calif.

[22] Filed: **July 20, 1970**

[21] Appl. No.: **56,510**

[52] **U.S. Cl.** **81/43**

[51] **Int. Cl.** **B25b 9/02**

[58] **Field of Search** ..... 81/43; 128/354; 294/99; 7/1 P, 7/1 C

[56] **References Cited**

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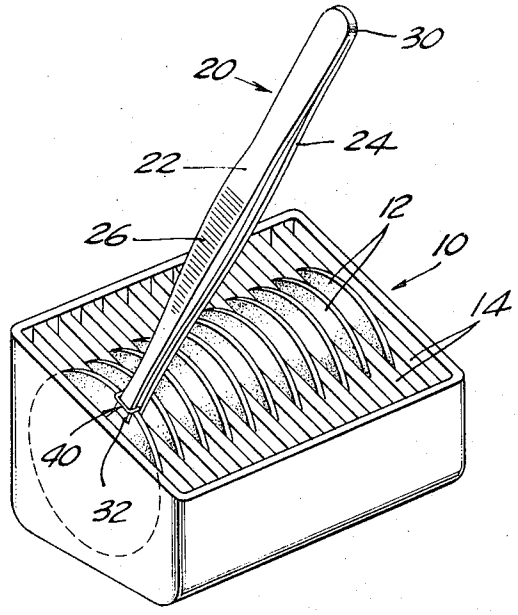
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Assistant Examiner—Roscoe V. Parker, Jr.
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[57] **ABSTRACT**

The device is a tweezers or tool particularly constructed and adapted for picking up and handling thin fragile objects such as silicon wafers or the like. The noses or jaws of the tweezer parts or legs are particularly configurated for the purpose intended. The end parts or jaws of the tweezer legs are configurated to limit the inward movement of the wafer or other object between the jaws and also to limit the opening movement of the jaws. The invention embodies several different preferred configurations for accomplishing these purposes.

2 Claims, 10 Drawing Figures



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2 Sheets-Sheet 1

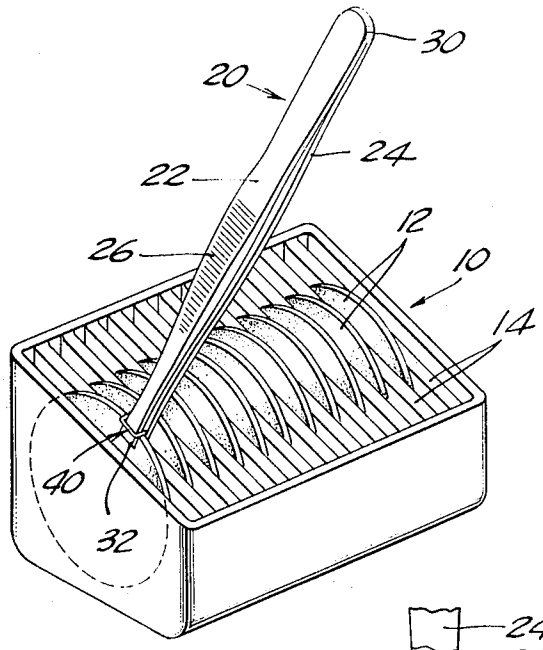


FIG. 1.

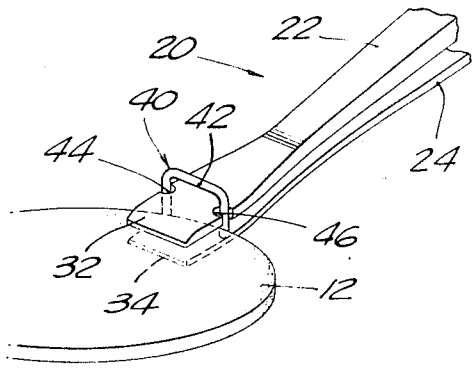


FIG. 2.

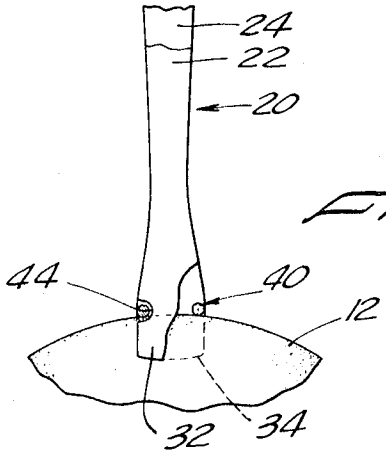


FIG. 3.

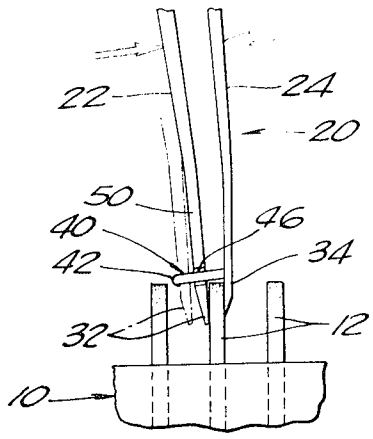


FIG. 4.

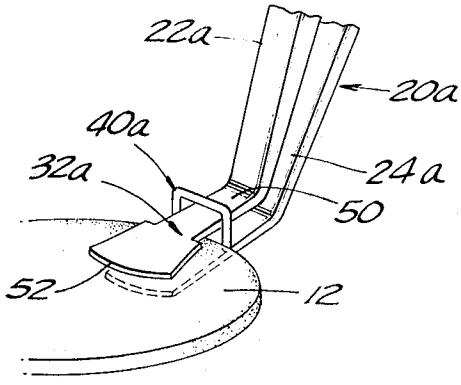


FIG. 5.

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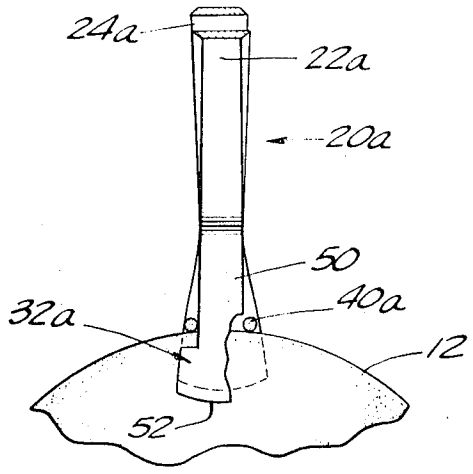


FIG. 6.

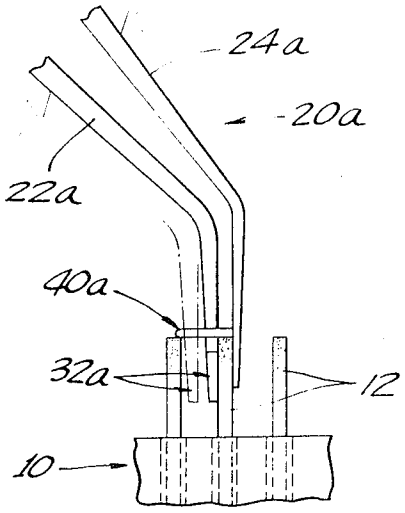


FIG. 7.

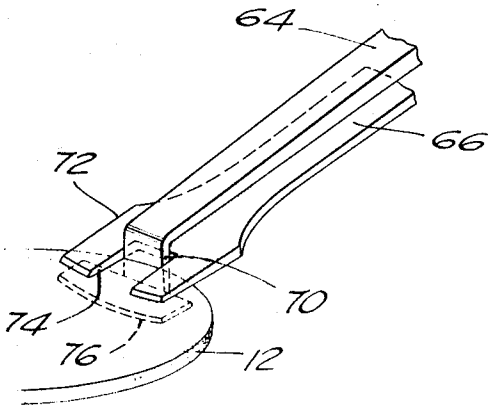


FIG. 8.

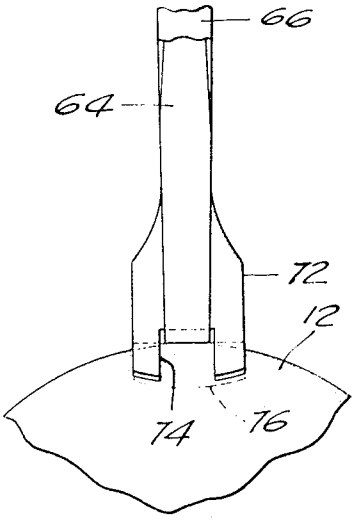


FIG. 9.

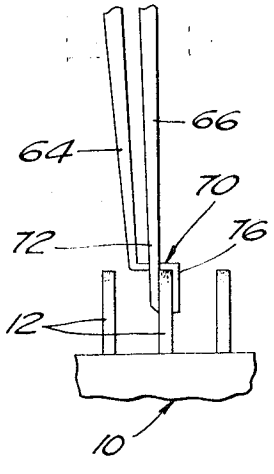


FIG. 10.

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TWEEZERS

SUMMARY OF THE INVENTION

The device of the invention is an improved tweezers or tool particularly adapted and configurated for handling of thin fragile objects such as for example silicon wafers that may have electrical circuitry etched thereon. The tweezers or tool is particularly adapted for picking up such objects or items from a flat horizontal surface without scratching the etched circuitry beyond one-eighth inch from the outer edge of the object or wafer.

The invention is an improvement over the tweezers shown in U. S. Pat. No. 3,496,807. The invention may take any one of several different forms. In a preferred form of the invention as identified hereinafter the legs of the tweezers or tool may be of generally conventional construction. The legs of the tool may have portions that cross or the legs may not have intermediate crossing portions and this is the configuration in preferred forms of the invention. In the preferred form of the invention when the handle portions of the legs are pressed together the jaws close for grasping an object and the legs open when pressure is released on the handle portions.

The improvement of the invention resides particularly in the form and configuration of the jaws at the ends of the legs of the tool or tweezers and in certain elements embodied at the ends of the legs. In a preferred form of the invention the jaws comprise a first jaw on one leg; a second jaw on the other leg; and an element carried by the first jaw positioned to limit the inward movement of an object between the jaws and to also limit opening movement of the jaws. Preferably this element may be U-shaped with the second jaw extending through it and engageable with the bight of the element to limit opening movement. Other configurations are provided as described in detail hereinafter adapted to serve these purposes.

The particular features embodied in the jaws greatly facilitate the handling of wafer-like objects that is in grasping edge portions of the objects and moving them about. It is easier to pick up or scoop up thin delicate objects from a flat horizontal surface on which they may be lying or from a tray wherein each wafer is in an individual slot. The limited amount of opening of the jaws is less than the spacing between wafers in adjacent slots so that the manipulation of grasping individual wafers with the tweezers is greatly facilitated without the tweezers engaging an adjacent wafer or a slot partition.

The primary object of the invention is to achieve and realize this additional facility and capability in the handling of objects of this type with the tool. Further objects reside in the provision of specific preferred constructions of the end part of the legs of the tweezers to accomodate these particular purposes. Another object resides in the provision of having an offset at the end of one leg of the tweezers with a jaw at the end of the offset positioned to engage the other jaw to limit the opening. In this form of the invention there is a cross-over as between the legs of the tweezers so that the jaws open when pressure is applied and close when pressure is released.

Further objects and additional advantages of the invention will become apparent from the following detailed description and annexed drawings wherein:

FIG. 1 is a perspective view of a slotted tray holding wafers and illustrating utilization of a preferred form of the invention;

FIG. 2 is a perspective view of the form of the invention shown in FIG. 1;

FIG. 3 is a sectional view of the form of the invention shown in FIGS. 1 and 2;

FIG. 4 is another view illustrating the utilization of the form of the invention shown in FIGS. 1, 2 and 3;

FIG. 5 is a perspective view of a slightly modified form of the invention;

FIG. 6 is a plan view partly broken away of the form of the invention shown in FIG. 5;

FIG. 7 is a view illustrating a utilization of the form of the invention shown in FIGS. 5 and 6;

FIG. 8 is a perspective view of another form of the invention

FIG. 9 is a plan view of the form of the invention shown in FIG. 8.

FIG. 10 is a partial side view illustrating the utilization of a form of the invention shown in FIGS. 8 and 9.

Referring now more in detail to FIGS. 1, 2, 3 and 4 of the drawings numeral 10 designates a tray for thin objects or wafer-like objects 12 which may be silicon discs of the type referred to in the foregoing. The tray 10 is open at the top which is slanted and it has a plurality of spaced partitions 14 the objects 12 being positioned in the spaces or slots between partitions.

Numeral 20 designates a preferred form of the invention which comprises metal legs 22 and 24 which may be made of suitable conventional materials and these legs having ribs or knurls as shown at 26 to facilitate grasping. The legs 22 and 24 are secured together at the end 30 in a conventional manner.

At the ends of the legs or leg members 22 and 24 are jaws as designated at 32 and 34. The legs have a shape or configuration in plan as may be seen in FIGS. 1 and 3 and the legs being slightly narrowed adjacent to the jaws. The jaws are generally rectangular and flat and are tapered to a relatively sharp edge at the ends as may be seen in FIG. 4.

Numeral 40 designates a U-shaped loop element the legs of which are attached by suitable means to the jaw 34, this element having a transverse portion or bight portion 42. In the form of the invention shown the jaw 32 has two cut-outs 44 and 46 to accommodate the legs of the element 40 so that the jaws 32 and 34 can conveniently be of the same width.

The figures illustrate the manner of utilization of the tweezers or tool. A wafer can readily be manually grasped by the tweezers as illustrated in FIG. 1. As may be observed in the figures the movement of the wafer inwardly between the jaws is limited by the element 40 or in other words the movement of the tweezers itself towards the center of the wafer is limited by element 40. The opening movement of the jaws is limited by the bight 42 of the element 40. As can be seen therefore the grasping and manipulative handling of the wafers is greatly facilitated and speeded up because the tweezers cannot be extended inwardly too far and this has the further benefit of protecting the surface of the wafer a distance inwardly more than the distance of the element 40 from the ends of the jaws. The limitation of opening of the jaws allows the jaws to open only sufficiently to grasp a wafer so as to avoid contact with an adjacent wafer or with the partition between wafers.

FIGS. 5, 6 and 7 show a slightly modified form of the invention but one which is very similar to the form of FIGS. 1, 2, 3 and 4. Similar parts in FIGS. 5, 6 and 7 are identified by similar reference numerals with the letter a. As may be seen in FIG. 5 of this form of the tweezers the jaws are positioned at an angle as shown from their respective legs 22*a* and 24*a*. The jaw 32*a* has a narrow portion 50 which is narrower than the jaw 32*a* and this portion extends through the U-shaped loop element 40*a*. The end part of the jaw 32*a* is broadened with tapering side edges as designated at 52 to be generally spatulate.

FIGS. 6 and 7 illustrate utilization of the form of the invention shown in FIG. 5 and this utilization being like that described in connection with FIGS. 1, 2, 3, and 4. The wafers are similarly grasped with the results as described in connection with the previous figures being achieved in the same manner. The broadening of the end 52 of jaw 32*a* provides greater surface area for grasping a wafer.

FIGS. 8, 9 and 10 show a modified form of the invention. The tool in this form of the invention is a tweezers having legs as designated at 64 and 66, made of suitable material. These legs are attached together at their outer ends as in the previous forms. Leg 64 has a generally right angular offset portion 70. The leg 66 is widened at the end forming a wider jaw 72 as shown. In the end of this jaw is a cutout 74. The leg 64 and its offset portion 70 are narrower than the jaw 72 so that the offset portion 70 can and does extend through the opening or cutout 74. At the end of the offset portion 70 is a jaw 76 which is laterally wider having a width similar to the overall width of jaw 72. The jaws 72 and 76 are generally parallel as may be

seen in FIG. 13. Thus as may be seen, considering the legs and their respective jaws, there is a cross-over at the position of the offset 70 with the result that the jaws in this form of the invention open when pressure is applied to the legs of the tweezers and on the other hand they close when the pressure is released. This form of the invention, however, has the same characteristics as the forms of the invention in that inward movement of a wafer with respect to the jaws is limited and opening movement of the jaws is limited. Inward movement of a wafer with respect to the jaws is limited by the offset portion 70 against which a wafer being grasped can abut. Opening movement of the jaws is limited by reason of the leg 64 and the jaw 72 coming together at the position of the offset part 70.

From the foregoing those skilled in the art will understand the nature and construction of the invention and the manner in which it achieves and realizes the objectives set forth in the foregoing. Particularly it will be observed that all forms of the invention have similar characteristics adapting them to have the desired capabilities of limiting inward movement between the jaws and limited opening movement of the jaws. At the present time the form of the invention shown in FIGS. 1, 2, 3 and 4 is considered the preferred form and mode of practicing the invention.

The foregoing disclosure is representative of preferred forms of the invention and is to be interpreted in an illustrative rather than a limiting sense, the invention to be accorded the full scope of the claims appended hereto.

I claim:

1. A tweezer tool comprising: members including a pair of resilient legs fixed together at one end, their free ends being movable toward and from each other; a first jaw means at the end of one of said legs; a second jaw means at the end of the other leg, and said jaw means being positioned to move towards each other for engaging a wafer-like object; and means for limiting inward movement of an object between the jaw means and for limiting opening separation of the jaws, said last means comprising one jaw means having a configuration through which the other jaw means extends for limiting inward movement between the jaws, said configuration being such as to limit opening movement of the jaws, said configuration comprising a U-shaped element carried by one jaw, the bight portion of the said element being positioned to engage and restrain opening movement of the other jaw.

2. A tweezers as in claim 1 wherein the U-shaped element has legs and the other jaw has a portion extending between said legs, the jaw having cutouts to accommodate the legs.

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