

Pincers, device and method for positioning electronic components

The present invention concerns pincers for positioning electronic components, a positioning device comprising such pincers as well as a method for positioning electronic components. The present invention concerns in particular pincers, a device and a method for positioning small-
5 size electronic components during their processing by an automatic processing line, for example by a testing and/or conditioning line.

After their manufacture and before their integration in a housing or onto a printed circuit, for example, electronic components are generally subjected to tests, electric or mechanic, and/or to marking,
10 conditioning operations etc. These operations are most often effected by automatic processing lines comprising several successive processing stations placed along a conveyor transporting the components from one station to another.

The conveyor transports the electronic components by means of
15 component-holders, for example by means of aspiration nozzles allowing the components to be removed and held by their upper side. The components are thus brought onto the processing stations that will perform on them the operations for which they have been designed. Most of these operations, in particular electric testing operations, generally
20 require that the component be positioned in a very accurate manner relative to the processing station. This is particularly the case, for example, for electric tests on small components, for example on non-encapsulated electronic chips or on small encapsulated leadless components (LLP), having contact surfaces to be contacted by the testing probe or probes that are of
25 generally very small size.

To allow this accurate positioning of the electronic components, their position on the conveyor must be capable of being determined accurately. The components must thus be positioned with precision on the component-holder.

On most prior art processing lines, the positioning of the components on the component-holders occurs when they are introduced onto the line. A feed station brings the components from a reservoir towards the conveyor. During this displacement, the components are
5 generally oriented then placed one by one on a location from whence they are removed by the component-holders of the conveyor. This location generally comprises a reference surface against which the components come to rest, thus determining their position along at least one axis. The precision achieved by means of such devices is however limited and
10 sometimes insufficient to allow certain testing operations to proceed well. Furthermore, the position of the components on the component-holders can vary during their processing by the automatic line, in particular if they are placed on several stations to be then removed again, possibly by another component-holder than the one that placed them there.

15 Certain prior art devices suggest solving these precision problems by means of aspiration nozzles comprising an additional element allowing the positioning of the electronic component they carry. This additional element comprises for example centering pincers fastened directly to the aspiration nozzle such as those described for example in patents
20 US 5,497,983 and US 5,697,658. These solutions however have several disadvantages, such as:

- the difficulty of making them, in particular for very small components;
- their cost, due to the mechanic complexity of each aspiration nozzle;
- 25 the increased space requirements of the aspiration nozzles, making it for example difficult, not to say impossible, to place the components on certain processing stations.

A more advantageous solution consists in using a positioning device that is independent from the component-holder and comprising for
30 example one or several pairs of jaws, on which the component to be centered can be placed, positioned along one or several axes, then removed again for example by an aspiration nozzle. The positioning of the

electronic components can thus be performed at the most suitable moment of their processing.

Patent US 4,821,393 describes for example a centering device comprising two pairs of jaws for centering an electronic component along
5 two axes. This device, however, has the major disadvantage that the two pairs of jaws are closed alternatively. In a first time, the component is centered along a first axis, then, in a second time, along a second axis. The risks are thus considerable that the centering performed by the first pairs of jaws is disturbed during centering by the second pair of jaws. Such a device
10 thus does not allow the accurate positioning of the components along two axes to be guaranteed. In particular, it does not allow a sufficient precision to be achieved for positioning small size electronic components.

Furthermore, the centering of each component requires two distinct successive actuating movements. Each pair of jaws being actuated
15 by a guiding screw requiring several complete turns before the jaws come into contact with the component, these actuating movements are also slow. The time required for positioning a component by such a device is thus high, making impossible its integration into an automatic electronic-component processing line without strongly affecting the rate and thus
20 considerably impairing the performance.

An aim of the invention is to propose a device for positioning electronic components that avoid the inconveniences of prior art devices.

Another aim of the invention is to propose a device allowing the quick and accurate positioning of electronic components during their
25 processing by an automatic line.

Yet another aim of the invention is to propose a method for the fast and accurate positioning of electronic components during their processing by an automatic processing line.

These aims are achieved by pincers, a device and a method for positioning electronic components having the characteristics of the corresponding independent claims, preferred embodiments being given by the dependent claims.

- 5 These aims are achieved in particular by pincers for positioning electronic components, comprising a support and a mobile element comprising an actuating part, the mobile element comprising at least three jaws allowing an electronic component to be mechanically contacted in at least three resting points and along at least two non parallel directions for
10 positioning it relative to the support in a positioning plane, the pincers being actuated by a linear movement of the actuating part relative to the support along an actuating axis parallel to the positioning plane.

- These aims are also achieved in particular by a device for positioning electronic components comprising such pincers and by an
15 actuator for automatically actuating the pincers.

- These aims are also achieved in particular by a method for positioning electronic components, comprising the following steps:
 placing an electronic component on positioning pincers,
 positioning the electronic component in a positioning plane by the
20 pincers in mechanical contact with the electronic component in at least three resting points and along at least two non parallel directions,
 removing the electronic component from the pincers,
 the electronic component being removed from where it was placed.

- The inventive pincers are thus very compact since all their mobile
25 parts move in a single plane and their linear actuating can be effected automatically by relatively simple actuating mechanisms. Furthermore, since the components are thus placed and removed at the same place on the pincers, the latter are particularly adapted to being integrated onto an automatic processing line.

The present invention will be better understood in the light of the description of its preferred embodiments illustrated by the figures 1 to 5, in which:

Fig. 1 represents positioning pincers according to a preferred
5 embodiment of the invention in open position,

Fig. 2 represents the pincers of figure 1 in closed position,

Fig. 3 represents positioning pincers according to another preferred embodiment of the invention,

Fig. 4 represents positioning pincers according to yet another
10 preferred embodiment of the invention.

Fig. 5 represents a partial view of a positioning device according to a preferred embodiment of the invention.

The inventive pincers are preferably adapted to positioning small size electronic components, in particular for positioning non encapsulated
15 electronic chips, i.e. components of a semi-conducting material, generally of silicium, that are not protected by a housing. These components are fragile and thus require particular care when they are handled. Furthermore, due to their small size, their positioning has to be very accurate.

20 With reference to figures 1 and 2, the inventive pincers comprise a mobile element 1 and a support 2. The support 2 preferably comprises a plane surface on which is fastened the essentially flat mobile element, preferably of a thickness more or less equal to that of the electric components to position. The inventive pincers thus preferably form an
25 essentially flat ensemble of limited thickness, adapted to positioning very small electronic components.

The mobile element 1 comprises for example four jaws 11, 12, 13, 14 distributed in pairs 11-12 and 13-14, and a part allowing the pincers to be actuated. The actuating part is for example constituted of a rigid frame 10 of circular shape and encircling the four jaws 11, 12, 13, 14. It allows, as
 5 will be explained further below, the pincers to be actuated through its linear displacement relative to the support 2 when an external force is applied.

The mobile element 1 is fastened in several points to the support 2 by means of fixed elements of the latter, for example by means of
 10 cylindrical pegs 20, 21, 22, 23, 24 and 25 driven or formed on the support 2, preferably on its upper and flat surface. When the mobile element 1 is placed on the support 2, the pegs 20, 21, 22, 23, 24 and 25 are inserted in the openings provided to this effect in various parts of the mobile element 1. In order to hold the latter against the support 2, for example clips
 15 represented in figures 1 and 2, but not referenced due to legibility considerations, are inserted onto each peg 20, 21, 22, 23, 24 and 25 in a grooved provided to this effect, thus preventing any undesirable movement of the corresponding parts of the mobile element 1 perpendicularly to the upper surface of the support 2, whilst allowing their
 20 translation and/or rotation in a plane parallel to this selfsame surface.

The frame 10 of the mobile element 1 preferably comprises two elongated openings, for example oval, oriented parallel to one another. In each of these elongated openings, a cylindrical peg 20 resp. 21 is inserted. As previously explained, the frame 10 is held against the upper surface of
 25 the support 2 for example by clips fastened on these two pegs 20, 21. The elongated openings and the pegs 20, 21 are dimensioned so as to allow the frame 10 to move on the support 2 along a linear axis parallel to the longitudinal axis of the elongated openings whilst preventing any displacement in another direction. The amplitude of this linear
 30 displacement relative to the support 2 is determined by the length of the elongated openings of the frame 10. As will be explained further below, when the frame 10 finds itself at one end of its linear displacement, the

pincers are open (Fig. 1) whilst they are closed when the frame 10 finds itself at the opposite end of this same linear displacement (Fig. 2).

One or several elastic elements bring with a certain force the frame 10 back towards a resting position preferably corresponding to one of the extremities of its linear displacement. According to one embodiment of the invention, these elastic elements are two spring blades 150 connecting the frame 10 to a peg 25 fixed relative to the support 2 and bringing it back towards a resting position corresponding to the pincers' closed position.

The jaws 11, 12, 13, 14 are inside the perimeter defined by the frame 10. A first jaw 11 of the mobile element 1 is preferably fixed relative to the frame 10, so that its movements are identical to those of the latter. This first jaw 11 thus moves along an axis parallel to the actuating axis of the pincers. The other three jaws 12, 13, 14 are held in rotation, each around a peg 22, 23 resp. 24 fixed relative to the support 2. The jaws 12, 13, 14 and the pegs 22, 23, 24 are preferably disposed so that the jaw 12 forming the same pair as the first jaw 11 also comes into contact with the component to be centered 8 along a direction parallel to the pincers' actuating axis, whilst the jaws 13, 14 of the other pair come into contact with the component 8 along a direction more or less perpendicular to the pincers' actuating axis. Clips fastened on the pegs 22, 23, 24 prevent for example any undesirable movement of the jaws 12, 13, 14 perpendicular to the upper surface of the support 2. The jaws 12, 13, 14 are connected to the rigid frame 10 for example by elastic elements, for example spring blades 120, 130, 140.

The inventive pincers are actuated preferably through the frame 10 that comprises for example a tongue 100 provided to this effect. According to a preferred embodiment, the tongue 100 protrudes relative to the support 2 when the pincers are in resting position, for example closed (Fig. 2), and brought towards the center of the pincers when the latter are open, thus making easier their operation by means of a mechanical element placed close to the pincers, for example by means of a

rod 3, preferably comprising on its upper part a roller freely rotating around its center, whose configuration and function will be explained in more detail further below.

Thus, by applying on the tongue 100 sufficient force acting
 5 against the returning force generated by the spring blades 150, the frame 10 is moved away from its resting position and is displaced relative to the support 2 in a linear movement parallel to the longitudinal axis of its elongated openings. The spring blades 150 are then tensed and the jaws 11, 12, 13 and 14 are moved apart from one another, providing sufficient
 10 free space on the support 2 at the center of the pincers for placing there for example an electronic component 8 to position. The first jaw 11, mechanically united with the frame 10, is displaced according to a linear movement identical to the latter's. The other jaws 12, 13, 14 are driven in a rotational movement around their respective peg 22, 23, 24 under the
 15 traction of the corresponding spring blade 120, 130, 140, of which one extremity is fastened to the frame 10, preferably on the side opposed to the tongue 100.

After an electronic component 8 has been placed on the support 2 in the center of the pincers, the force applied on the frame 10 for holding
 20 it open is reduced or eliminated and the pincers are brought to their resting position under the force of the spring blades 150. The jaws 11, 12, 13, 14 then return to the center of the pincers, in a linear movement parallel to the axis of displacement of the frame 10 for the first jaw 11, or in a rotational movement around the peg 22, 23 resp. 24, induced by the
 25 elastic pressing force of the corresponding spring blade 120, 130, 140 for the other three jaws 12, 13, 14. As previously explained, the movement of the other three jaws 12, 13, 14 is preferably determined so that, upon coming into contact with the component 8 to position, the direction of the displacement of the jaw 12 forming the same pair as the first jaw 11 is
 30 more or less parallel to the pincers' actuating axis, whilst the direction of the displacement of the other two jaws 13, 14 is more or less perpendicular to the actuating axis.

When the pincers are closed, each pair of jaws determines the position of the component 8 on the support 2 along an axis parallel to the plane of the latter's upper surface. Under the effect of a single linear displacement of the frame 10, the component 8 is thus positioned with
 5 precision, along two axis that are preferably perpendicular to one another, on the positioning plane defined by the upper surface of the support 2. During this positioning, the electronic component 8 is contacted mechanically in at least three resting points by the jaws 11 and 12, 13, and 14, preferably in four distinct resting points located on its lateral sides.

10 Preferably, the returning force generated by the spring blades 150, 120, 130, 140 is not identical for each jaw 11, 12, 13, 14. Each pair thus comprises a reference jaw 11, resp. 14 exerting on the component 8 to position when the pincers are closed a force greater than that exerted by the other jaw 12, resp. 13 of the same pair. The return movement of each
 15 reference jaw 11, resp. 14 towards the pincers' closed position is preferably limited by one or several stop elements, for example by pegs 20 and 21, resp. 26 defining a precise and reproducible reference position of the jaw 11 resp. 14 when the pincers are closed. In this position, the component 8 is firmly pressed by its lateral sides against the reference jaws 11, 14 in their
 20 reference position by the two other jaws 12 and 13, thus ensuring its accurate positioning.

According to a variant embodiment of the invention, the reference jaws 11, 14 are replaced by elements fixed relative to the support 2 against which the component is for example pressed under the elastic
 25 pressing force of two mobile jaws.

One advantage of the previously described embodiment of the invention resides however in the fact that, since the reference jaws 11, 14 move apart when the pincers are open, the component 8 to position can be placed in the center of the latter whatever the precision of its initial
 30 position, without risking to involuntarily come into contact with a reference jaw 11, 14. The component 8 to position can thus be placed on the pincers at the same place from where it will be removed after its

positioning, thus avoiding an unnecessary displacement to the component-holder and/or to the pincers between these two actions.

It is also conceivable within the framework of the invention to configure the pincers so that the four jaws are held in rotation around a
5 peg and connected to the frame by elastic elements. It is then possible to dimension the elastic elements so that the two jaws of a same pair press with more or less the same force on the component to position. Ideally, the component finds itself perfectly centered on the pincers. Such an
10 embodiment of the invention is however more delicate to realize than the previously described embodiment, since small differences between the forces exerted by the jaws of a same pair can generate considerable inaccuracies on the centering of the component. These differences can for example be due to a lack of precision during the manufacture of the pincers or to wear of the elastic elements.

15 Figure 3 illustrates a variant embodiment of the inventive pincers in which the reference jaws 11, 14 are both fixedly united with the frame 10 whilst the jaws 12, 13 pressing the component 8 to position against them are connected to the frame by spring blades 120, 130 according to
20 the previously mentioned principle. According to the illustrated embodiment, the movement of the jaws 12, 13 is at least partially controlled by the pegs 26' limiting for example the amplitude of their return movement when the pincers are closed, in particular if no component 8 is in the center of the pincers.

Furthermore, according to the illustrated embodiment, the elastic
25 element bringing with a certain force the frame 10 towards a determined resting position is a spring 5 held in compression between the frame 10 and a peg 50 formed or inserted on the support surface 2. The spring 5 and the peg 50 are preferably placed so that the spring 5 exerts on the frame 10 a force bringing it towards a resting position corresponding to the pincers'
30 closed position. An advantage of using a spring 5 is that the returning force of the frame 10 can easily be determined or even adjusted by replacing the spring 5 by a spring having a different coefficient.

According to the embodiments of the invention illustrated in figures 1, 2 and 3, the mobile element 1 is constituted of a single piece formed, for example by cutting and/or stamping, from a metallic sheet, for example from a steel spring sheet of a thickness of 0,3 to 0,6 mm, whereas
5 the thickness of the metallic sheet and thus of the mobile element 1 is preferably more or less identical to the thickness of the electronic components 8 to position.

The mobile element 1 can also be constituted of a molded part, for example of metal or of a synthetic material, whose thickness is then
10 preferably more or less identical to the thickness of the electronic components 8 to position.

It is also conceivable within the framework of the invention to imagine a mobile element 1 formed of several distinct parts, for example of a frame and jaws manufactured separately and connected to one another
15 by elastic elements that are fastened thereto, for example soldered, or held together by other mechanical means, for example removable.

Figure 4 thus illustrates pincers according to yet another embodiment of the invention, having two reference jaws 11, 14 united to the rigid frame 10 and formed for example in the same piece as the latter,
20 and two jaws 12, 13 for pressing the component 8 to position against the reference jaws 11, 14 when the pincers are closed. According to this embodiment, the jaws 12, 13 are formed on parts distinct from the frame 10 and connected to the latter by one of the extremities in order to be driven by its movements when the pincers are closed and opened. Each of
25 the parts comprising the jaws 12 resp. 13 is for example connected to the frame 10 by an articulation formed for example by a salient part 121 resp. 131 inserted in a suitable lodging of the frame 10. The shape of the salient parts 121, 131 and of the respective lodging is determined so that when the frame 10 is moving, for example under the effect of a force exerted on the
30 tongue 100, the jaws 12, 13 are driven in rotation around their respective peg 22, 23, thus opening and closing the inventive pincers.

One advantage of the invention illustrated in figure 4 is that the returning force of each jaw 11, 12, 13 and 14 is known and can be determined with accuracy. In fact, use preferably of a spring 5 to bring the frame 10 into its resting position allows, as previously explained, to
5 determine or even adjust easily the returning force of the reference jaws 11, 14. Furthermore, the jaws 12, 13 being connected to the frame 10 by an essentially rigid articulation, the force exerted on each of these jaws 12, 13 is a determined fraction of the returning force of the frame 10 exerted by the spring 5, depending essentially on the geometry of the mobile element
10 1. By controlling and adjusting the force of the spring 5, the force exerted by each jaw 11, 12, 13 and 14 on the component 8 to position can thus be determined and adjusted with accuracy. This force can in particular be adapted to the solidity, the material, the size or other mechanical characteristics of the component 8 to position.

15 The amplitude of the movements of the frame 10 is limited by the pegs 20, 21' inserted in the corresponding elongated openings of the frame 10. The jaws 12, 13 being connected to the frame 10 by an essentially rigid articulation, their movement is also limited in the same way. The closing movement of the pincers is thus limited by the jaws 11, 12, 13, 14
20 resting on the sides of the component 8 to position and/or by the frame 10 resting against the pegs 20, 21'.

The parts comprising the jaws 12, 13 are preferably formed by a process similar to that used for forming the frame 10. The frame 10 and the parts comprising the jaws 12, 13 are for example all formed by stamping a
25 same metallic sheet or metallic sheets having the same thickness.

According to the illustrated embodiment, the parts comprising the jaws 12, 13 are positioned on the support 2 around the pegs 22, 23 serving also as rotational axis to their movement when the pincers are opened or closed. The frame 10 and the parts comprising the jaws 12, 13
30 are then held for example on the support by a fastening part (not represented) fastened on the support 2 and covering entirely the mobile element 1, with the exception of the center of the pincers where the

components 8 to position are placed and of the tongue 100 allowing the pincers to be actuated. The fastening part is for example a metallic plate fastened over the mobile element 1, thus preventing the parts that constitute it from coming out of the pegs 20, 21', 22 and 23.

5 With reference to figure 5, the pincers 1, 2 of the invention are for example integrated into a device for positioning electronic components 8 during their processing by an automatic processing line.

 The automatic processing line comprises for example a series of processing stations, of which only the positioning device is partially
10 represented in figure 3, placed around a circular conveyor 9 provided with component-holders allowing the electronic components 8 to process from one station to another. The component-holders are for example aspiration nozzles 90 that remove and transport the electronic components 8 through air vacuum. The aspiration nozzles are connected to a pneumatic system
15 (not represented) and controlled preferably by a control system (also not represented) of the circular conveyor and/or of the processing line.

 The processing stations are preferably fastened on a fixed plate 900 located under the conveyor 9 and partially represented in cross-section in figure 3. The positioning device is thus preferably placed on a base plate
20 4 comprising fastening elements (not represented) allowing it to be fastened in a predetermined and accurate position on the fixed plate 900. The position of the pincers 1, 2 relative to the component-holders 90 placing and/or removing the electronic components on the positioning device is thus perfectly known. This position is preferably determined so
25 that the electronic components 8 removed after their positioning find themselves more or less in the center of the corresponding component-holder 90.

 According to a preferred embodiment of the positioning device, the pincers 1, 2 are fastened on a rotating element, for example on the
30 rotor of a revolving pulse motor 30 whose stator is fixed relative to the base plate 4. A fixed and rigid element, for example a metallic rod 3 is

fastened more or less vertically on the base plate 4, close to the pincers 1, 2. The rod 3 is placed preferably against the perimeter of the pincers support 2, so that according to the latter's angular position, it exerts a pressure on the tongue 100 of the frame 10, which causes the pincers to open (cf. figure 1). The latter is thus actuated by its rotation relative to the base plate 4.

In order to avoid friction between the tongue 100 and the rod 3 when the pincers are actuated, the upper part at least of the rod 3 preferably rotates freely around its longitudinal axis. The rod 3 thus comprises for example on its upper part a roller capable of rotating around its center, so that the rod 3 rests against the tongue 100 through this rotating part.

Before a component-holder 90 places an electronic component 8 to position, the pincers are open. They are then brought by the motor 30 into the angular position illustrated in figure 1. In this position, the rod 3 rests on the tongue 100, thus opening the pincers and allowing a component 8 to be placed in its center. Once the component 8 has been placed on the support 2, the revolving motor 30 is actuated to turn the pincers for example by a quarter of turn clockwise, thus bringing the latter in the position illustrated in figure 2. During this rotation movement, the jaws 11, 12, 13, 14 are brought towards the center of the pincers according to the previously explained principle, thus bringing the component 8 into the sought position. The pincers are then again turned by a quarter of turn, but in the opposite direction, moving apart the jaws 11, 12, 13, 14 of the positioned component 8 that can thus be removed by a component-holder 90 of the processing line. The one skilled in the art will certainly understand that the pincers can also be turned by different angles than quarters of turns. In particular, in order to avoid the to-and-fro movements of the revolving motor 30 and of the pincers, the latter can for example be turned by two half-turns, thus allowing the positioned electronic component to be removed in its initial angular position, without requiring the motor to work in two different directions.

According to a variant embodiment (not represented) of the invention, the positioning device comprises two mechanical elements for actuating the pincers, for example two rods 3, placed in opposite positions against the perimeter of the pincers' support 2. The pincer thus has two
5 angular positions separated by a half-turn at which they are open. According to this embodiment, the pincers can be open in a first angular position before the component to position is placed, turned by a quarter of turn in one direction to be closed and thus position the component, then turned again by a quarter of turn in the same direction to be open again
10 and allow the positioned component to be removed by the processing line, the component being thus turned by a half-turn relative to its initial position. According to this embodiment, the inventive device then allows the simultaneous rotation and positioning of the electronic component, such a rotation being for example required to allow access to certain
15 processing stations to specific parts of the component.

The one skilled in the art will understand that the number and arrangement against the pincers' support perimeter of mechanical elements allowing the pincers to open can thus be varied so as to allow rotations of different angles. The positioning device can for example
20 comprise four distinct mechanical elements, for example four rigid rods, thus allowing the positioned component to be removed after a quarter of turn rotation of the pincers.

The one skilled in the art will also understand that the pincers can, within the framework of the invention, also be actuated by the
25 pincers' linear movements towards to mechanical element or elements allowing it to be actuated, or by a combination of linear and rotating movements.

In order to avoid any undesired displacement of the component 8 during the pincers' movements, in particular when it re-opens after the
30 component 8 has been positioned, the base 3 preferably comprises a nozzle (not represented), situated under the component 8 when the latter is correctly positioned, in which air can be aspirated to press the component 8

against the upper surface of the base 2. The air aspiration through the nozzle is preferably controlled by the control system of the positioning device and/or of the processing line, thus allowing its coordination with the movements of the pincers and/or of the component-holders 90. Thus, when
5 a component is placed on the open pincers, air is for example aspirated through the nozzle in order to immediately press the component 8 against the base 2. When the component is positioned, i.e. when the pincers are being closed, the aspiration is preferably reduced to allow the component's displacement on the upper surface of the base 2. The aspiration is then
10 increased again when the component 8 is in the desired position, in order to avoid any displacement of the latter relative to the base 2 when the pincers are re-opened. Once the pincers are open, the aspiration is preferably stopped during removal by the aspiration nozzle 90. According to a preferred embodiment of the invention, a short pulse of compressed
15 air is then expelled by the nozzle in order to ensure that the component 8 becomes unstuck from the upper surface of the base 2.

According to the previously described embodiments of the invention, the pincers are actuated by its movement, for example its rotation, relative to one or several fixed mechanical elements 3 exerting a
20 pressure on the tongue 100 following the pincers' position. It is however also conceivable within the framework of the invention, to actuate the pincers, fixed relative to the device's base plate, by means of a moving mechanical element, for example along a linear and/or rotating movement. Such an embodiment, though it does not allow the component to rotate
25 during its positioning, has the advantage that it allows avoiding the use of for example pneumatic means in order to hold the component onto the pincers, and that the movement of the mechanical element actuating the pincers is often more easily realized and requires less precision than the movement of the pincers themselves. The pincers can thus for example be
30 fastened on the device's base plate 4 whereas the rod 3 or any other mechanical element preferably rigid is brought by a linear movement in the direction of the tongue 100.

According to a preferred embodiment, the pincers are thus actuated by means of a cylinder rotating around its longitudinal axis, actuated for example by means of a revolving pulse motor. On the upper part of the cylinder, a roller for example is placed, rotating around a
5 parallel axis and off-centered relative to the cylinder's rotation axis. The roller is then placed in such a manner that following the cylinder's angular position, it rests on the tongue 100, thus opening the pincers.

The previously described pincers' actuating mechanisms are given by way of illustrating but non-limiting example. The one skilled in the art
10 will understand that the inventive pincers can be actuated by linear and/or rotational movements of mechanical elements and/or of the pincers, moved for example by means of one or several revolving pulse motors, pneumatic jacks, electromagnetic revolving and/or linear motors or by a combination of these means, although some of these embodiments can have certain
15 disadvantages relative to the previously described examples, notably as regards simplicity, sturdiness and working rate.

As previously explained, the inventive pincers are preferably adapted for positioning small electronic components, in particular for positioning non-encapsulated electronic chips, which are fragile
20 components. In order to prevent the components from becoming damaged during positioning, the jaws 11, 12, 13 and 14 are preferably formed so as to come into contact only with the central part of the lateral sides of the components, avoiding resting against the latter's corners or edges which are particularly delicate.

25 The inventive pincers thus comprises four jaws 11, 12, 13 and 14 distributed in pairs and resting each on one of the four lateral sides of the component 8 in order to position the latter along two axes in the positioning plane defined by the support 2 on which it rests, the pincers' configuration further allowing them to be actuated by means of a single
30 linear movement along a single actuating axis.

The one skilled in the art will however understand that it would also be conceivable, within the framework of the invention, to configure the jaws to that they rest differently on the component to position. It would notably be possible to configure one or several jaws to press
5 simultaneously on two sides of the component to position, possibly allowing the number of jaws necessary for its positioning along two axes to be reduced.

It would also be conceivable to design pincers comprising only a single pair of jaws for positioning components along a single axis.

Claims

1. Pincers for positioning electronic components, comprising a support (2) and a mobile element (1) comprising an actuating part (10),
said mobile element (1) comprising at least three jaws (11, 12, 13, 14) allowing an electronic component (8) to be contacted
5 mechanically in at least three resting points and along at least two non parallel directions for positioning said electronic component (8) relative to said support (2) in a positioning plane,
said pincers being actuated by a linear movement of said actuating part (10) relative to said support (2) along an actuating axis
10 parallel to the positioning plane.
2. Pincers according to the preceding claim, at least one of said two non parallel directions being parallel to said actuating axis.
3. Pincers according to one of the preceding claims, said support (2) allowing the position of said electronic component (8) to be
15 determined along an axis perpendicular to said positioning plane.
4. Pincers according to the preceding claim, said support (2) comprising a resting surface more or less plane defining said positioning plane.
5. Pincers according to one of the preceding claims, said
20 mobile element (1) allowing said electronic component to be contacted mechanically in four resting points.
6. Pincers according to the preceding claim, said mobile element (1) comprising four jaws (11, 12, 13, 14) for mechanically contacting said electronic component (8) in four resting points.
- 25 7. Pincers according to one of the preceding claims, at least one of said at least three jaws (12, 13, 14) being connected to said actuating part (10) by an elastic element (120, 130, 140).

8. Pincers according to the preceding claim, said elastic element being a spring blade (120, 130, 140).

9. Pincers according to one of the preceding claims, at least one of said at least three jaws (12, 13) being connected to said actuating part (10) by an essentially rigid articulation (121, 131).

10. Pincers according to one of the claims 7 to 9, said at least one of said at least three jaws (12, 13, 14) being held on said support (2) in rotation around an axis (22, 23, 24) perpendicular to said positioning plane.

11. Pincers according to one of the preceding claims, at least one of said three jaws (11, 14) defining a reference position for positioning said electronic component (8).

12. Pincers according to the preceding claim, two of said at least three jaws (11, 14) defining a reference position for positioning said electronic component (8).

13. Pincers according to one of the preceding claims, said mobile element (1) being formed of a single piece.

14. Pincers according to one of the preceding claims, said mobile element (1) being formed by stamping a metallic sheet or several metallic sheets having more or less the same thickness.

15. Pincers according to one of the preceding claims, said actuating part (10) allowing said pincers to be automatically actuated.

16. Pincers according to the preceding claim, said actuating part (10) comprising a tongue (100) for automatically actuating said pincers.

17. Device for positioning electronic components, comprising pincers (1, 2) according to one of the preceding claims and an actuator (30) for automatically actuating said pincers (1, 2).

18. Device according to the preceding claim, comprising a control system controlling said actuator (30).

19. Device according to one of the claim 17 or 18, comprising a mechanical element (3) for actuating said pincers (1, 2).

5 20. Device according to the preceding claim, said actuator (30) allowing the movement of said pincers (1, 2) and/or of said mechanical element (3) for actuating said pincers (1, 2) by means of said mechanical element (3).

10 21. Device according to the preceding claim, said actuator (30) being a revolving motor allowing said pincers (1, 2) to turn, said mechanical element being a rigid rod (3) fastened on said device close to the perimeter of said pincers (1, 2).

15 22. Device according to one of the claims 20 or 21, comprising means for holding said electronic component (8) on said pincers (1, 2) when said pincers (1, 2) are moving.

 23. Device according to the preceding claim, said means for holding said electronic component (8) comprising pneumatic means holding said electronic component (8) on said pincers (1, 2) through aspiration.

20 24. Device according to claim 20, said actuator allowing the movement of said mechanical element, said pincers (1, 2) being fastened on said device.

25 25. Device according to one of the claims 17 to 24, comprising fastening elements for integrating it into an automatic electronic-component processing line.

 26. Device according to the preceding claim for positioning electronic components (8) processed by said automatic processing line.

27. Method for positioning electronic components, comprising the following steps:

placing an electronic component (8) on positioning pincers (1, 2),

5 positioning the electronic component (8) in a positioning plane by said pincers (1, 2) in mechanical contact with said electronic component (8) in at least three resting points and along at least two non parallel directions,

10 removing said electronic component (8) from the pincers (1, 2),

characterized in that said electronic component (8) is removed from where said electronic component (8) was placed.

28. Method according to the preceding claim, said electronic component (8) being positioned by automatically actuating said pincers (1, 2) by means of a mechanical element (3).

29. Method according to the preceding claim, said pincers (1, 2) being actuated by the movement of said pincers (1, 2) and/or of said mechanical element (3).

30. Method according to the preceding claim, said pincers (1, 2) being actuated by rotating said pincers (1, 2), said mechanical element (3) being fastened close to the perimeter of said pincers (1, 2).

31. Method according to one of the claims 29 or 30, further comprising the step of holding said electronic component on said pincers (1, 2) when said pincers (1, 2) are moved.

32. Method according to the preceding claim, said electronic component being held by aspiration.

33. Method according to claim 29, said pincers (1, 2) being actuated by the movement of said mechanical element, said pincers (1, 2) being fixed.