METHOD FOR HOLDING PARTS IN A TRANSFER POSITION

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ABSTRACT
A method for holding a plastic fastener on a holding device in a position for transfer to an assembly tool, the method comprising the steps of: locating the fastening element in proximity to the holding device and oriented so that a thin wall on the fastener is aligned with the axis of a projecting needle on the holding device; pressing the fastening element and the holding device together; piercing the thin wall with the projecting needle; forming an opening through the thin wall; and frictionally engaging the needle with the thin wall edge that defines the opening to thereby hold the fastener on the holding device in the transfer position.
METHOD FOR HOLDING PARTS IN A TRANSFER POSITION

CROSS-REFERENCE TO RELATED APPLICATION


BACKGROUND OF THE INVENTION

This invention relates to a method and apparatus for holding parts such as plastic elements in a position for transfer to a receiver, such as a tool that uses the parts. The invention also relates to parts constructed for use in such method and apparatus.

Plastic fastening elements are frequently used in vehicles to attach cables, conduits, paneling elements, or the like to parts of the vehicle. In this connection, it is frequently desirable for the fastening elements to be installed in an automated fashion, for example with the aid of a robot. For automated installation, it is necessary to place a fastening element at the ready in a definite transfer position in which it can be grasped by the installation tool of the robot so that it can then be installed in the required fashion. In other cases, it can also be necessary to keep the fastening element at the ready in an assembly or installation tool, so that by actuating the tool, the assembly or installation can be executed. Plastic fastening elements are embodied in a wide variety of forms, so that keeping the various fastening elements at the ready is often difficult and requires a variety of holding devices. In addition, it is sometimes a challenge to design the fastening elements so that they can be held and secured by the available holding devices.

BRIEF DESCRIPTION OF THE INVENTION

An object of the invention is to provide a method and an apparatus for holding parts such as plastic fastening elements at the ready, more particularly for holding uniquely constructed parts at a transfer position, where the parts can be delivered to a receiver, such as a tool.

Parts utilized in the invention have a wall with one or more pierceable wall regions, and a holding device for the parts has one or more needles. With a part in a predetermined position, a pierceable wall region is pressed against a needle, so that the needle penetrates the pierceable wall region, and the wall is secured to the needle.

In an embodiment of the invention, a holding device is in the form of a magazine with multiple sockets provided with needles, each socket holding a corresponding part. A slider pushes a part situated in front of the slider off the needles of the socket, so that the part is transferred to a receiver.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further described in conjunction with the accompanying drawings, which illustrate preferred (best mode) embodiments, and wherein:

FIG. 1 shows a pierceable wall region of a plastic element and a needle intended for piercing the wall region;

FIG. 2 shows a holding device according to the invention, with a plastic element held by it;

FIG. 3 is a view of a round magazine with plastic elements held by it;

FIG. 4 shows a pierceable wall region comprised of a film;

FIG. 5 shows a perforated pierceable wall region, and

FIG. 6 shows a slit pierceable wall region.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a section of a wall 1 of a plastic fastening element in one embodiment of the invention. In the vicinity of its edge, the wall 1 is provided with a recess 2 that forms a wall region 3 with a significantly thinner wall thickness. The thickness of the wall region 3 is dimensioned so that the wall region 3 can be pierced by a sharp needle 4 without exerting a large amount of force. The needle 4 is part of a holding device that serves to keep the fastening element at the ready for transfer to a receiver, such as a tool for automatic installation or assembly of the fastening element. At its free end, the needle 4 has a tip 5 and, spaced apart from the tip, has a holding recess in the form of an annular groove 6, or a notch or undercut.

In the embodiment, the recess 2 is round and has a diameter D. Alternatively to this, however, the recess can also be embodied in an oval or polygonal form. The needle has a diameter d, which is considerably smaller than the diameter D of the recess. This diameter difference means that the center of the recess can have an offset x in relation to the central axis of the needle 4, which corresponds to half of the difference of the diameters D minus d, without hindering the insertion of the needle 4 into the wall region 3 and without causing constraining forces to act on the needle in a transverse direction. The embodiment of the wall region 3 in relation to the needle 4 consequently permits a fastening of the wall 1 through insertion of the needle 4 into the wall region 3, even when the fastening element with the wall 1 is not exactly aligned in relation to the needle 4, but when the needle 4 is inserted in a region that is offset from the needle 4 by an amount determined by the diameters D, d. Thus, manufacturing tolerances are accommodated.

In order to secure the wall 1, it is pressed with its pierceable wall region 3 against the sharp end of the needle 4. The needle 4 penetrates the wall region 3 and elastically and plastically deforms it while forming a hole. In the position of the wall 1 achieved by a stop 7 of the holding device adjacent to the needle 4, the edge of the opening, which is pierced by the needle 4 and encompasses the needle 4 in an elastic fashion, engages in the material of the annular groove 6, fixing the wall 1 on the needle 4 in a fashion suitable for temporarily holding it.

A single needle can sometimes be sufficient to hold a part if the part is small and additional supports can be provided on the holding device. In many cases, however, it is suitable to fix a part with several needles at several points. FIG. 2 shows one such example. A plate-shaped holding device 10 is provided with three needles 11 spaced uniformly apart from one another, only two of which are visible in the drawing. The needles hold a fastening element 12, which is designed to be fastened in a circular opening in sheet metal. The fastening element 12 has an annular flange 13, which has thin-walled, pierceable wall regions 14 spaced the same distance apart as the needles 11. Oriented so that the wall regions 14 are situated in front of the needles 11, the fastening element 12 is pressed against the holding device 10. As a result,
the needles 11 pierce the wall regions 14 as shown, forming openings whose edges adhere to the outside surface of the needles 11 in a frictionally engaging fashion (with or without needle recesses). The contact of the fastening element 12 against the holding device 10 defines the final position in the axial direction of the needles 11. The fastening element 12 is thus placed in readiness in a position in relation to the holding device, which position is defined in all three spatial directions in relation to the holding device, so that a subsequent assembly procedure can start from this position.

**[0018]** FIG. 3 shows a round magazine 20, which is composed of a rotatable disk 21 and an annular holding device 22 situated on the rim of the disk 21. The holding device 22 is coaxial to the rotation axis of the round magazine 20 and on its outside has a multitude of sockets 23 spaced uniformly circumferentially. Each socket 23 is provided with several parallel needles 24 that project outward, each set of which holds a respective fastening element 25 in the above-described manner. In the center of each socket, the annular holding device 22 is provided with a through bore 26. On the inside of the holding device 22 is situated an actuator 27, which is equipped with a radially mobile slider 28 that is aligned with a through bore in the depicted position of the round magazine 20 and, when the actuator 27 is triggered, can move outward through the through bore 26. The socket 23 in front of the slider 28 is situated at a position provided for transferring a fastening element 25 to a receiver such as an assembly tool. If such a tool is situated on the outside, in front of the socket 23, ready for transfer of the fastening element 25, then the actuator 27 is triggered and the slider 28 pushes the fastening element 25 off of the needles and toward the assembly tool. This simplifies the transfer, so that the assembly tool does not have to be brought snugly against the round magazine 20.

**[0019]** After the fastening element is transferred, a stepper motor (not shown) rotates the round magazine 20 by a fraction predetermined by the spacing of the through bores so that the slider can transfer the next fastening element.

**[0020]** FIG. 4 shows a section through a pierceable wall region 31 composed of a film 30 on a wall 32 of a fastening element. The film covers an opening 33 in the wall 32 and, after the manufacture of the fastening element, can be welded to the wall or stuck to the wall in the form of a self-adhesive film.

**[0021]** If it is not possible to manufacture the pierceable wall region with a thin enough film, then it is possible, as shown in FIG. 5, for the pierceable wall region 35 to be perforated with a hole 36. The diameter of this hole 36, however, must be smaller than the diameter of the needle.

**[0022]** FIG. 6 shows a variant in which the pierceable wall region 38 of a wall 39 is provided with a slit 40. The width of the slit 40, too, must be smaller than the diameter of the needle.

**[0023]** The above-described method, and the apparatus described for executing it are suitable not only for plastic fastening elements, but also for a wide variety of parts that must be kept in readiness for processing steps or between such processing steps. The invention is particularly advantageous when the outer form of the parts does not provide any suitable engagement surfaces for holding mechanisms.

**[0024]** While preferred embodiments of the invention have been shown and described, it will be apparent that changes can be made without departing from the principles and spirit of the invention, the scope of which is defined in the accompanying claims. For example, a multi-socket magazine may be rod-shaped, rather than round, with needles of adjacent sockets projecting in the same direction from one side of the magazine, and with the slider arranged at the opposite side of the magazine and adjustable along the length of the magazine to different positions at which the slider can eject corresponding parts from the magazine.

What is claimed is:

1. A method for holding a fastening element on a holding device in a transfer position ready for transfer to an assembly tool, wherein the fastening element includes a pierceable thin wall accessible from a first side and the holding device includes a projecting needle defining an axis, and wherein the method of holding the fastening element on the holding device comprises the steps of:

   - locating the fastening element in proximity to the holding device and oriented so that the thin wall is aligned with the axis of the projecting needle;
   - pressing the fastening element and the holding device together;
   - piercing the thin wall with the projecting needle;
   - forming an opening through the thin wall, the opening defined by an edge of the pierced thin wall;
   - frictionally engaging the needle with the thin wall edge that defines the opening; and
   - holding the fastening element on the holding device in the transfer position.

2. The method as recited in claim 1, wherein: the thin wall of the fastening element is a first thin wall, and the fastening element includes a second thin wall radially separated from the first thin wall; and the projecting needle of the holding device is a first needle defining a first axis, and the holding device includes a second needle radially separated from the first needle and defining a second axis parallel to the first axis; and wherein the method of holding the fastening element on the holding device the step of locating the fastening element in proximity to the holding device includes:

   - locating the fastening element in proximity to the holding device and oriented so that the first thin wall is aligned with the first axis of the first projecting needle and the second thin wall is aligned with the second axis of the second projecting needle.

3. The method as recited in claim 1, wherein the needle includes a holding recess and the method of holding the fastening element on the holding device further comprises the steps of:

   - engaging the thin wall edge that defines the opening into the holding recess of the needle.

4. A method for removably holding a plastic fastening element on a holding device in a transfer position at the ready for transfer to a tool or for assembly, wherein the fastening element includes a pierceable thin wall section that is accessible from a first side, and the holding device includes a needle with a piercing tip located at a free piercing end, and wherein the method of holding the plastic fastening element on the holding device comprises the steps of:

   - pressing the the pierceable thin wall section against the needle;
   - penetrating the thin wall section with the needle;
   - deforming the thin wall section plastically and elastically with the needle; and
   - securing the thin wall section to the needle.

5. The method as recited in claim 4, characterised in that the fastening element is provided with three pierceable wall
sections spaced apart from one another and the holding device is provided with three parallel needles spaced a corresponding distance apart from one another.

6. The method as recited in claim 4, wherein the needle includes a holding feature that comprises one of a groove, a recess, and an undercut, and the method of holding the plastic fastening element on the holding device further comprises the steps of:

engaging the holding feature of the needle with the penetrated and deformed thin wall edge section.

7. A method for holding a fastener on an apparatus for presenting the fastener in a transfer position to an assembly tool for the start of an assembly procedure, wherein the method of holding the fastening on the presenting apparatus comprises the steps of:

providing a fastener comprising a flange portion and defining an axis, and the flange portion includes a pierceable thin wall accessible from a first side of the fastener;

providing a presenting apparatus comprising:

a plurality of holding devices, each holding device including a fixed projecting needle, the needle able to pierce the thin wall of the fastener and support the fastener on the holding device in the transfer position; wherein the plurality of holding devices are arranged as a magazine operable for holding multiple fasteners and movable from a first position, wherein a first holding device is presented to the assembly tool, to a second position, wherein a second holding device is presented to the assembly tool;

locating the fastener in proximity to the first holding device and oriented so that the axis of the fastener is substantially parallel to an axis of the projecting needle and the thin wall is aligned with the axis of the projecting needle;

pressing the fastening element and the holding device together;

piercing the thin wall with the projecting needle;

forming an opening through the thin wall, the opening defined by an edge of the pierced thin wall;

frictionally engaging the needle with the thin wall edge that defines the opening; and

holding the fastener on the holding device in the transfer position.

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