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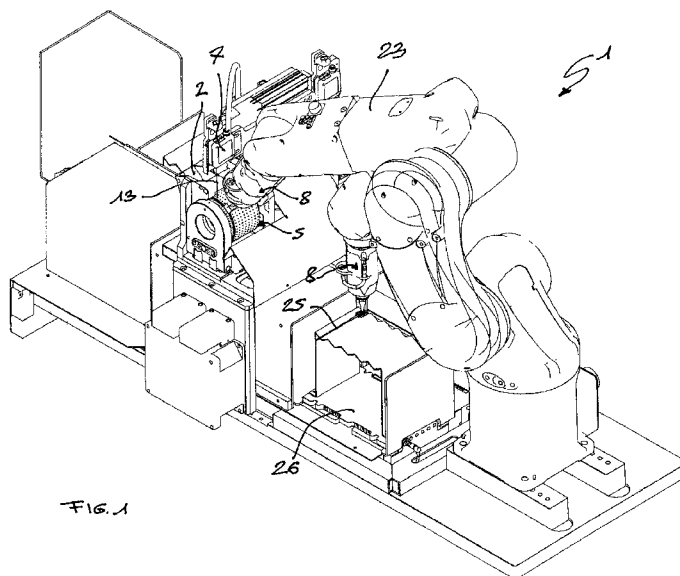
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(54) Title: APPARATUS FOR POSITIONING SMALL-SIZED ITEMS, IN PARTICULAR RHINESTONES, IN A CONTROLLED MANNER



(57) Abstract: The present invention refers to an apparatus for positioning small-sized items, in particular rhinestones or the like, in a controlled manner, comprising a support surface (4) provided with a plurality of recesses (6), each one of which is adapted to accommodate one of said small-sized items (3); sensor means (7), which are provided in a position facing said support surface (4), and which are adapted to scan, i.e. inspect the recesses (6) in order to detect the items (3) that are positioned according to a pre-determined orientation in said recesses (6); and pick-up means (8), which are provided to pick up from said recesses (3) the items (3) that are arranged there with said pre-determined orientation as detected by the sensor means (7).

WO 2009/089911 A1

10 **APPARATUS FOR POSITIONING SMALL-SIZED ITEMS, IN PARTICULAR
RHINESTONES, IN A CONTROLLED MANNER**

DESCRIPTION

15 The present invention refers to an apparatus for positioning small-sized items, in particular rhinestones or the like, in a controlled manner.

Rhinestones are small-sized gems, in the order of just a few millimetres, which are generally made of artificial crystals and are applied to a variety of articles and
20 items to decorative purposes. Rhinestones usually gave two mutually opposing facets, one of which is pyramid-shaped, convex, or anyway processed into similar shapes, so as to be adapted to be set in or otherwise applied to proper receptacles or seats provided in the article to be decorated, whereas the other one is a substantially planar facet that – in the set state of the gem – is intended to be
25 facing outwards, i.e. exposed to view on the surface of the article being decorated, so as to generate the desired visual effect on the buyer, user or wearer. The size of a rhinestone between said two facets thereof amounts to approx. 0.6 to 2.0 millimetres, whereas the diameter or, anyway, the largest size of the planar facet amounts to approx. 1.0 to 3.0 millimetres.

30

The rhinestones are applied and attached manually by an operator, who uses a tool to pick up the gem by the planar facet side thereof and fit the pyramid-shaped facet thereof into the proper recess or accommodation provided in the article to be decorated.

Obviously, the need arises in this case for the rhinestones to be pre-arranged in a certain order, i.e. with a definite orientation on a proper support, so as to enable the operator to most easily and conveniently pick up the gems by the planar facet thereof.

5

In other words, the position of the rhinestones on their support is selected so that the planar facet thereof is exposed, i.e. facing upwards on the support and readily accessible to the operator with the aid of the above-cited tool.

10 Usually, rhinestones are oriented manually on their support.

In fact, such orientating job requires the operator to visually inspect each single rhinestone in view of being able to fit it in a recess in the support with the planar facet thereof facing upwards, i.e. outwards from the recess, and is therefore
15 readily accessible on the support with the aid of the pick-up tool used by the operator. When all rhinestones are then ready in the corrected orientation and arrangement thereof in their recess on the support, the operator can start applying, i.e. setting them on the article to be decorated.

20 However, it can be most readily appreciated that the above-described process of arranging the rhinestones according to a pre-determined orientation thereof turns necessarily out as being not only scarcely practical, but also quite complicated, and – above all – requires a lot of working hours with a resulting high cost.

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It is an object of the present invention to provide an apparatus for positioning small-sized items, in particular rhinestones or the like, in a controlled manner, which is effective in doing away with the above-cited drawbacks of the prior art.

30 According to the present invention, these aims, along with further ones that will become apparent from the following disclosure, are reached in an apparatus incorporating the features and characteristics recited in the appended claims.

Features and advantages of the present invention will anyway be more readily

understood from the description of a preferred, although not sole embodiment that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

5 - Figure 1 is a side perspective view of an apparatus for positioning small-sized items, in particular rhinestones or the like, in a controlled manner according to the present invention;

10 - Figure 2 is a side perspective detail view of the apparatus without the mechanical arm thereof;

 - Figure 3 is a perspective rear view of the assembly shown in Figure 2;

15 - Figure 4 is a perspective view of a detail of the apparatus according to the present invention;

 - Figure 5 is a perspective enlarged view of the apparatus according to the present invention;

20 - Figure 6 is a perspective enlarged view of the rotating drum;

 - Figure 7 is a cross-sectional view of the drum and the pick-up means, as viewed in the state in which the suction mouth is approaching the planar facet of the rhinestone;

25 - Figure 8 is an enlarged view of a detail of Figure 7;

 - Figure 9 is a cross-sectional view of the drum and the pick-up means, as viewed in the state in which the suction mouth, upon engaging the planar facet of the rhinestone, is moving away from the drum;

 - Figure 10 is an enlarged view of a detail of Figure 9;

 - Figure 11 is a detail view of the cylindrical surface of the drum and the related

recesses provided therein;

- Figure 12 is a detail view of the pick-up means in the process of positioning a rhinestone onto an article to be decorated.

5

With reference to the above-cited Figures, the apparatus for positioning small-sized items, in particular rhinestones or the like, in a controlled manner according to the present invention, as generally indicated at 1, comprises a support surface 4 provided with a plurality of recesses 6, each one of which is adapted to
10 accommodate one of said small-sized items 3; sensor means 7, which are provided in a position facing said support surface 4, and which are adapted to probe, i.e. inspect the recesses 6 in order to detect the items 3 being positioned according to a pre-determined orientation in said recesses 6; pick-up means 8, which are provided to pick up from said recesses 3 the items 3 that are arranged
15 there with said pre-determined orientation as detected by the sensor means 7.

The apparatus, which shall be described in greater detail below, has been found to be particularly advantageous in applications involving the selection of the position of rhinestones; however, the apparatus may be employed in other
20 applications as well, e.g. in applications involving the selection of the position of a number of other small-sized items, such as small screws and the like.

Advantageously, the support surface 4 is provided by the cylindrical surface of a rotating drum 5.

25

However, the apparatus according to the present invention may comprise – as an alternative option to said cylindrical surface of a rotating drum 5 – a support surface 4 having a planar configuration of either a moving type, e.g. in the form of a conveyor-belt, or a stationary type. In the case of a stationary support surface 4,
30 the sensor means 7 and the pick-up means 8 may be provided to be moving relative to the stationary support surface 4.

The apparatus further comprises conveyance means 2 adapted to convey said small-sized items 3 onto the cylindrical surface 4 of the rotating drum 5.

Such conveyance means 2 include a hopper adapted to direct the small-sized items 3 onto the cylindrical surface 4 of the rotating drum 5. The drum 5 is provided in a position immediately below said hopper, with the axis of rotation thereof extending, i.e. lying horizontally.

5

Motor means 9 are provided to rotatably drive said drum 5. In detail, the drum 5 is connected in a firmly joined or integral manner to a rotating shaft 10 that is driven, via a driving belt 11, by an electric stepper motor.

10 Control means are provided to operate said motor means 9 so as to control the rotation of the drum 5.

The cylindrical surface 4 of the drum 5 comprises a plurality of recesses 6, or the like, which are preferably arranged so as to form a plurality of parallel rows
15 extending in a direction that is parallel to the axis of rotation of the drum 5.

Such recesses 6 are so shaped as to be able to receive – and accommodate thereinside – a respective small-sized item 3, such as for instance a rhinestone, and cause it to rotate jointly with the drum 5.

20

The conveyance means 2 define, jointly with the cylindrical surface 4 of the drum 5, a containment zone in which the small-sized items are delimited and in contact with the cylindrical surface 4 so as to be engaged by the recesses 6 of the drum 5 as it rotates.

25

In particular, the recesses 6 are sized so as to be able to receive and accommodate a rhinestone arranged according to two preferential orientations, or in two preferential positions, and namely with the pyramid-shaped or convex facet thereof facing the inside of the recess 6, i.e. turned towards the axis of rotation of
30 the drum 5, or with the planar facet thereof facing outwardly, so as this is shown in Figures 8, 11. However, given the substantially casual, random-like manner in which rhinestones are moving on the cylindrical surface 4 of the drum 5, and thus the substantial casual character of the position taken by each rhinestone as it engages a respective recess 6, even other orientations of the rhinestones may

occur, actually. In addition, the recesses 6, or at least some of them, may of course fail to engage a rhinestone and, therefore, remain void.

The drum 5, as it is driven to rotate by said motor means under control of said control means, successively brings each row of recesses 6 into an angular detection position, where the afore-cited sensor means 7 are provided to probe the recesses 6 themselves. Said sensor means 7 are in a stationary position relative to the rotating drum 5, and are preferably associated to a cross member 12 provided above the drum 5, so as to face, i.e. look onto such angular detection position, in which the recesses 6 are preferably facing upwards, from above.

The sensor means 7 comprise proximity sensors that are adapted to detect the orientation of the small-sized item 3 engaging a recess 6, i.e. the way in which said item 3 is positioned in the recess 6.

15

Advantageously, said sensor means 7 comprise at least one optoelectronic detector and, in particular, a laser detector adapted to both issue an incident beam 13 directed into the recess 6 and detect the interaction of said incident beam 13 with the item 3 that is possibly contained in said recess 6, so as to determine the orientation and the position of the item 3 in the recess 6. For instance, such laser detector is in particular adapted to detect the beam that is reflected from the surface of the item 3 being hit by the incident beam.

The reflected beam will in fact depend on an item 3 being or not being present in the recess 6, and it markedly varies in accordance with the geometry, i.e. shape of the surface of the item 3 being hit by the incident beam and, therefore, is subject to marked variations depending on how the item 3 is positioned in the recess 6, actually, since a given surface of the item exposed to the beam will of course provide definite and clear information about the actual position taken by the item 3 in the recess 6.

The characteristic of the reflected beam is indicative of the fact that it is a certain surface of the item that is exposed to the incident beam 13, i.e. that it is such certain surface of the item that is facing upwards from the recess 6 and, as a

result, is accessible on the cylindrical surface 4 of the drum 5. From this information it can therefore be derived that the item 3 is positioned according to a certain orientation in the recess 6.

5 The items 3 that are so detected as being positioned according to a pre-determined orientation in the respective recesses 6 may be picked up by seizing them by their surface facing upwards from the recess 6, as this is shown in Figures 10, 11.

10 The items being picked up in this way may then be conveniently handled for ultimate application onto an article to be decorated.

15 In a manner that is largely known as such in the art, the laser detector may be able to directly determine – on the basis of the reflected beam – the actual geometry, i.e. shape or contour of the reflecting surface of the item 3 in the recess 6 to then compare the so detected surface with a reference one or, as an alternative thereto, is able to compare the reflected beam with pre-set parameters that are representative of a given surface of the item.

20 In the specific case of the items considered in connection with the embodiment being described by way of illustrative example, the beam reflected by the planar surface of the rhinestone is indicative of a determined orientation of the same rhinestone inside the recess 6. In such orientation, in fact, the rhinestone will be positioned in the recess with the pyramid-shaped facet thereof turned towards the interior of the recess and the planar facet thereof facing upwards, i.e. outwards from the recess, and therefore exposed to the incident beam and accessible on the cylindrical surface 4 of the drum 5, as shown in Figure 11.

30 As already described hereinbefore, based on the characteristics of the reflected beam, the sensor means 7 are able to determine that the item 3 contained in the recess 6 is positioned there so as to have a given surface, i.e. facet thereof facing upwards from the recess 6 and, as a result, exposed on the surface 4 of the drum 5.

The control means control said sensor means 7 so as to have them successively sensing each one of said recesses 6 that are moved in a sequence into said angular detection position, in view of having each row of aligned recesses monitored and determining in which such recesses 6 the rhinestones are oriented
5 with their planar facet looking outwards, i.e. upwards from the recess.

The control means are further adapted to control the rotary motion of the drum
5 so as to bring the row of recesses that have been so sensed by the sensor means 7 from said angular detection position to an angular pick-up position, in
10 which the pick-up means 8, as controlled by said control means based on the indications delivered by said sensor means 7, will successively pick up from each one of the recesses 6 those items 3, which are oriented with a pre-determined facet looking upwards, i.e. facing outwards from the recess, and lying exposed on the cylindrical surface 4 of the drum 5. In the case being discussed, the pick-up
15 means 8 pick up the rhinestones that are oriented with the planar facet thereof looking upwards, i.e. facing outwards from the respective recess, as shown in Figures 10, 11.

The pick-up means 8 comprise a suction mouth 14 adapted to engage the
20 surface of the item 3 facing upwards from the recess 6 – and exposed on the cylindrical surface 4 of the drum 5 – by suction, i.e. by vacuuming it up, so as to pick up the same item from the recess 6. As a result, owing to such suction mouth 14 engaging the rhinestone and picking it up by the planar facet thereof, the same rhinestone will have the pyramid-shaped facet thereof free and ready for fitting
25 onto an article to be decorated.

The pick-up means 8 further comprise a suction conduit 15, which defines – at an end portion thereof – said suction mouth 14 and is adapted to be guided into a position lying close to each such recess 6 so as to be able to engage the facet of
30 the item lying exposed on the cylindrical surface 4 of the drum 5 and remove the same item from the recess 6.

Such suction conduit 15 is associated to a removable head 16, which is capable of being magnetically applied to a suction body 17 that defines a channel

18 fluidly communicating with said suction conduit 15. The suction body 17 includes suction means provided to generate a negative pressure in the channel 18 and, as a result, in the suction conduit 15 in view of in this way enabling the suction mouth 14 to engage the surface of the item 3 facing upwards from the recess 6 and remove the same item therefrom. The suction means may for instance include a venturi tube or a pump.

The suction conduit 15 may include a needle-shaped member associated to or provided integrally with the head 16.

The suction body 17 further comprises magnetic members 19 provided to enable the head 16 to be removably attached to the suction body 17.

Advantageously, in the afore-mentioned angular pick-up position there are provided centering means 20 adapted to guide, i.e. lead the suction mouth 14 into a proper position in proximity of the recess 6 along a radial direction relative to the axis of rotation of the drum 5 in view of facilitating the removal of the item 3 from the same recess 6. These centering means 20 are in a stationary position relative to the rotating drum 5, and are associated to an appropriate support so as to be facing the cylindrical surface 4 of the drum 5. The centering means 20 comprise a conical bush facing the recess 6 situated therebelow and adapted to receive the complementarily shaped head 16 of the suction body 17. In particular, the centering means 20 comprise a row of conical bushes 21 adapted to face the row of recesses 6 in the angular pick-up position, so that each such bush 21 is adapted to guide the head 16 of the suction body 17 and, as a result, the suction mouth 14 to a position in proximity of a respective recess 6.

The suction body 17 further comprises elastic means 22 adapted to damp the head 16 fitting into the bush 21 and prevent the suction mouth 14 from impinging against the drum 5.

The pick-up means 8 are associated to a mechanical arm 23, which is operated by the control means and is adapted to displace the pick-up means 8 so as to position the suction mouth 14 in proximity of the recess 6 containing an item

3 arranged according to the pre-determined orientation, as detected by the sensor means 7. In other words, such mechanical arm 23 is adapted to fit the head 16 of the suction body 17 into the bush 21 that faces the recess 6 holding the item 3 positioned there in the due manner, i.e. with the due orientation. The mechanical
5 arm 23 is then adapted to successively bring the head 16 of the suction body 17 close to each recess 6 in the row of recesses in the angular pick-up position, so as to pick up the items 3 that are possibly indicated as being arranged correctly by the sensor means 7.

10 In this connection, it should be noticed that the mechanical arm 23 will of course not be operated so as to guide the head 16 towards those recesses 6, which do not contain any item 3, i.e. are empty, or contain items 3 that are not oriented correctly therein.

15 Once the correctly oriented items 3 in a row of recesses 6 have been in this way picked up, the control means of the apparatus are arranged to operate the driving means of the drum 5 so as to cause the latter to perform a further rotational increment to bring said row of recesses 6 into a lower angular position in which the recesses are turned upside down, i.e. are facing downwards, so that all items 3
20 that would not have been previously selected for picking up – due to them not having been detected as being correctly oriented – are now caused to drop, i.e. fall off their recesses 6 by gravity.

These items 3 are filled again into the hopper of the apparatus for them to be
25 sent again into the drum and be positioned in a controlled manner.

The rotating drum 5 comprises a plurality of channels 24, which are fluidly communicating with the recesses 6 and are adapted to direct compressed air into the same recesses so as to both facilitate the items 3 separating from, i.e. leaving
30 the recesses and keep the same recesses clean in view of preventing them from clogging, i.e. becoming so obstructed as to prove unable to engage any further item 3.

Such channels 24 are preferably connected to a portion of the recesses, which

is looking onto the axis of rotation of the drum 5.

The channels 24 are provided to extend in a direction running parallel to the axis of rotation of the drum 5 below and close to the cylindrical surface 4 of the drum 5, so that each such channel 24 turns out as being connected to the aligned recesses 6 making up each row of recesses 6 on the same cylindrical surface 4.

Pump means are provided in a stationary arrangement relative to the rotating drum to let compressed air into and through a respective channel, whenever the recesses connected thereto are brought into the afore-mentioned lower angular position.

Each channel 24 exhibits an inlet port provided in a head wall of the drum 5 and adapted to come in front of and meet with an outlet nozzle through which said pump means blow compressed air thereinto.

Advantageously, the mechanical arm 23 is comprised of a 5-axis or 6-axis anthropomorphous robot, which, as controlled by the control means of the apparatus, is adapted to pick up from the recesses 6 the items 3 that are detected as being arranged with a pre-determined orientation therein, as this has been described hereinbefore, and apply the same items 3 to an article 25 through a sequence of movements that will have been pre-set on the basis of pre-determined space coordinates that are representative of the contour of the article 25. In the case being discussed by way of illustrative example, the mechanical arm 23 of the robot uses the suction mouth 14 to engage the rhinestone by the planar facet thereof and pick it up from the respective recess 6, and – through a sequence of preliminarily stored motions – sets the same rhinestone by the pyramid-shaped facet thereof into or onto the proper place, seat or recess provided on the article to be decorated, e.g. a spectacles frame. When the suction means are de-activated or switched off, the planar facet of the rhinestone and the suction mouth 14 are able to disengage from each other. The thus released rhinestone is then set onto or into the proper place or seat so as to be able to be appropriately attached to the spectacles frame with the planar facet thereof facing outwards, i.e. exposed to view.

The article 25 due to receive the rhinestone – the spectacles frame in the case being considered by way of illustrative example – is adapted to be arranged, i.e. laid upon a reference support 26, relative to which the afore-mentioned space coordinates of the points on the contour of the article 25, where the item 3, i.e. the
5 rhinestone, shall be positioned, will have been pre-determined.

The space coordinates of said points are converted – with the aid of proper software – into programmed motions that are stored for the robot to perform them in order to set the rhinestones at the proper place thereof as provided on the
10 article 25, i.e. the spectacles frame in the case being considered.

To this purpose there is provided a recognition station comprising a reading arm with a read head to detect, on the article, the space coordinates of the points at which the rhinestones due to decorate the same article must be set. As noted
15 above, such space coordinates are determined relative to the reference support on which the article to be decorated is placed.

Based on such space coordinates, a proper software will process out the movements that shall be imparted to the mechanical arm 23, i.e. which the
20 mechanical arm 23 shall be caused to perform in order to reach the points on the article 25 where the rhinestones are due to be positioned. The movements are then stored in the control means of the apparatus for the anthropomorphous robot to be operated accordingly.

25 The operating method of the apparatus according to the present invention calls for the rhinestones collected by the recesses 6 on the cylindrical surface 4 of the rotating drum 5 to be brought into the angular detection position, in which the corresponding row of recesses is scanned by the sensor means 7 to detect the presence there of rhinestones that are correctly oriented with the planar facet
30 thereof facing upwards, i.e. outwardly from the respective recess 6. The control means cause then the drum 5 to rotate by a further increment so as to bring the row of recesses 6 to a level corresponding to the centering bushes 21, i.e. into the afore-mentioned angular pick-up position. At the same time, other rows of recesses 6 collect items and are brought in front of the sensor means 7. Based on

the data issuing from the sensor means 7 and the position of the recesses 6 on the surface of the drum, in which the rhinestones are present and correctly oriented, the control means operate the mechanical arm 23 to pick up the rhinestones from said recesses 6 with the aid of the suction mouth 14 engaging
5 the planar facet thereof, and set them onto or into their due place on the article to be decorated therewith, i.e. the spectacles frame in the case considered.

A further rotation of the drum 5 brings the row of recesses into the lower angular position, in which the rhinestones that have failed to be selected, i.e.
10 picked up, are able to fall off the respective recesses owing also to the action of the compressed air let into the channels 24 by the pump means.

Said row of recesses 6 is at this point ready for receiving other rhinestones being delivered onto the cylindrical surface 4 of the drum 5 by the hopper. The
15 above-cited operating steps of the apparatus are then repeated cyclically.

Fully apparent from the above description is therefore the ability of the present invention to effectively reach the aims and advantages cited afore, through the provision of an apparatus enabling the position and orientation of small-sized
20 items to be detected and selected in a quick, continuous manner.

It shall be further appreciated that the inventive apparatus as described above may of course be the subject of a number of modifications and may be embodied in a number of different manners without departing from the scope of the present
25 invention, wherein all afore-cited details may furthermore be replaced with technically equivalent elements.

Finally, it goes without saying that the materials used, as well as the shapes and the sizing of the individual items of the inventive apparatus as described
30 above may each time be selected so as to more appropriately meet the particular requirements or suit the particular application.

5

10

CLAIMS

1. Apparatus for positioning small-sized items, in particular rhinestones or the like, in a controlled manner, **characterized in that** it comprises a support surface (4) provided with a plurality of recesses (6), each one of which is adapted to
15 accommodate one of said small-sized items (3), sensor means (7), which are provided in a position facing said support surface (4), and which are adapted to scan, i.e. inspect the recesses (6) in order to detect the items (3) that are positioned according to a pre-determined orientation in said recesses (6), and pick-up means (8), which are provided to pick up from said recesses (3) the items
20 (3) that are arranged there with said pre-determined orientation as detected by the sensor means (7).

2. Apparatus according to claim 1, wherein said sensor means (7) comprise at least one optoelectronic detector adapted to both issue an incident
25 electromagnetic beam (13) directed into the recess (6) and detect the interaction of said incident beam with the item (3) contained in said recess (6), so as to determine the orientation and the position of the same item in the recess (6).

3. Apparatus according to claim 2, wherein said optoelectronic detector is
30 adapted to detect the beam that is reflected from the surface of the item (3) being hit by the incident beam (13), said detector, based on the characteristics of the reflected beam, being then able to determine whether a certain surface of the item (3) contained in the recess (6) is exposed to the incident beam (13), i.e. such certain surface is facing upwards from the recess (6) and, as a result, is accessible

on the support surface (4).

4. Apparatus according to claim 3, wherein said pick-up means (8) comprise a suction mouth (14) adapted to engage by suction said certain surface of the item (3) facing upwards from the recess (6), and exposed on the support surface (4), so as to pick up the same item (3) from the recess (6).

5. Apparatus according to claim 4, wherein said pick-up means (8) comprise a suction conduit (15), which defines, at an end portion thereof, said suction mouth (14), and which is adapted to be guided to a position lying close to the recess (6) for it to be able to engage said certain surface of the item (3).

6. Apparatus according to claim 5, wherein said suction conduit (15) is associated to a suction body (17) that defines a channel (18) fluidly communicating with said suction conduit (15), said suction body (17) including suction means provided to generate a negative pressure in the channel (18) and, as a result, in the suction conduit (15) in view of in this way enabling the suction mouth (14) to engage said certain surface of the item (3) facing upwards from the recess.

20

7. Apparatus according to claim 6, wherein said suction body (17) is associated to a mechanical arm (23), which is adapted to displace the pick-up means (8) so as to position the suction mouth (14) in proximity of the recess (6) containing an item (3) arranged according to said pre-determined orientation, as detected by the sensor means (7).

25

8. Apparatus according to claim 7, wherein said mechanical arm (23) is comprised of a 5-axis or 6-axis anthropomorphous robot, which is adapted to pick up from the recesses (6) the items (3) that are detected as being arranged with a pre-determined orientation therein, and apply the same items (3) on to an article (25) through a sequence of movements that will have been pre-set on the basis of pre-determined space coordinates that are representative of zones along the contour of the article (25) where the items (3) must be set.

30

9. Apparatus according to any of the preceding claims, wherein said support surface (4) comprises a cylindrical surface of a rotating drum (5).

10. Apparatus according to any of the preceding claims, comprising conveyance means (2) adapted to convey said small-sized items (3) onto the cylindrical surface (4) of the rotating drum (5).

11. Apparatus according to any of the preceding claims, wherein said cylindrical surface (4) of the drum (5) comprises a plurality of said recesses (6), which are arranged so as to form a plurality of parallel rows extending in a direction that is parallel to the axis of rotation of the drum (5).

12. Apparatus according to any of the preceding claims, wherein said drum (5) is driven to rotate so as to successively bring each such row of recesses (6) into an angular detection position, where the sensor means (7) are provided, said sensor means (7) being situated in a stationary position relative to the rotating drum (5), so as to face, i.e. look onto such angular detection position from above.

13. Apparatus according to any of the preceding claims, wherein said sensor means (7) are adapted to successively sense each one of said recesses (6) that are moved into said angular detection position, in view of having each row of aligned recesses monitored and determining in which such recesses (6) the items (3) are arranged according to said pre-determined orientation.

14. Apparatus according to any of the preceding claims, wherein said drum (5) is adapted to rotate so as to successively bring each row of recesses (6) from said angular detection position to an angular pick-up position, in which, based on the indications delivered by said sensor means (7), the pick-up means (8) are able to successively pick up from each one of the recesses (6) those items (3) featuring said pre-determined orientation.

15. Apparatus according to any of the preceding claims, wherein said suction conduit (15) is integrally formed with a head (16) that is capable of being magnetically applied in a removable manner to said suction body (17).

16. Apparatus according to any of the preceding claims, wherein said suction body (17) comprises magnetic members (19) provided to enable the head (16) to be removably attached to the suction body (17).

5 **17.** Apparatus according to any of the preceding claims, wherein in said angular pick-up position there are provided centering means (20) adapted to guide the suction mouth (14) into a proper position in proximity of the recess (6) along a radial direction relative to the axis of rotation of the drum (5) in view of facilitating the removal of the item (3) from the same recess (6).

10

18. Apparatus according to any of the preceding claims, wherein said centering means (20) are in a stationary position relative to the rotating drum (5), and comprise a conical bush (21) adapted to receive the complementarily shaped head (16) of the suction body (17).

15

19. Apparatus according to any of the preceding claims, wherein a plurality of conical bushes (21) are adapted to face the row of recesses (6) in the angular pick-up position, so that each such bush (21) is adapted to guide the head (16) of the suction body (17) to a position in proximity of a respective recess (6).

20

20. Apparatus according to any of the preceding claims, wherein said suction body (17) comprises elastic means (22) adapted to damp the head (16) fitting into the bush (21) and prevent the suction mouth (14) from impinging, i.e. bumping against the drum (5).

25

21. Apparatus according to any of the preceding claims, wherein said drum (5) is adapted to rotate so as to successively bring each row of recesses (6) into a lower angular position, in which the recesses (6) are turned upside down, i.e. are facing downwards, so that all items (3) that would have failed to be picked up in the
30 preceding step are now caused to drop, i.e. fall off their recesses (6) by gravity.

22. Apparatus according to any of the preceding claims, wherein said drum (5) comprises a plurality of channels (24), which are fluidly communicating with the recesses (6) and are adapted to direct compressed air into the same recesses (6)

so as to both facilitate the items (3) separating therefrom and keep the same recesses (6) clean in view of preventing them from becoming obstructed.

23. Apparatus according to claim 22, wherein said channels (24) are provided to
5 extend in a direction running parallel to the axis of rotation of the drum (5) under
and close to the cylindrical surface (4) of the drum (5), so that each such channel
(24) turns out as being connected to the aligned recesses (6) making up each row
of recesses (6) on said cylindrical surface (4).

10 24. Apparatus according to claim 23, wherein pump means are provided to let
compressed air into and through each channel (24), whenever the recesses (6)
connected thereto are brought into said lower angular position.

25. Method for positioning small-sized items, in particular rhinestones or the like,
15 in a controlled manner, **characterized in that** it comprises following steps:

- providing a support surface (4) provided with a plurality of recesses (6), each
one of which is adapted to accommodate one of said items (3),
- conveying said items (3) onto said support surface (4),
- scanning the recesses (6) so as to detect the items (3) that are positioned
20 according to a certain, pre-determined orientation in said recesses (6),
- picking up from said recesses (6) the items (3) that have been sensed as being
arranged according to said pre-determined orientation.

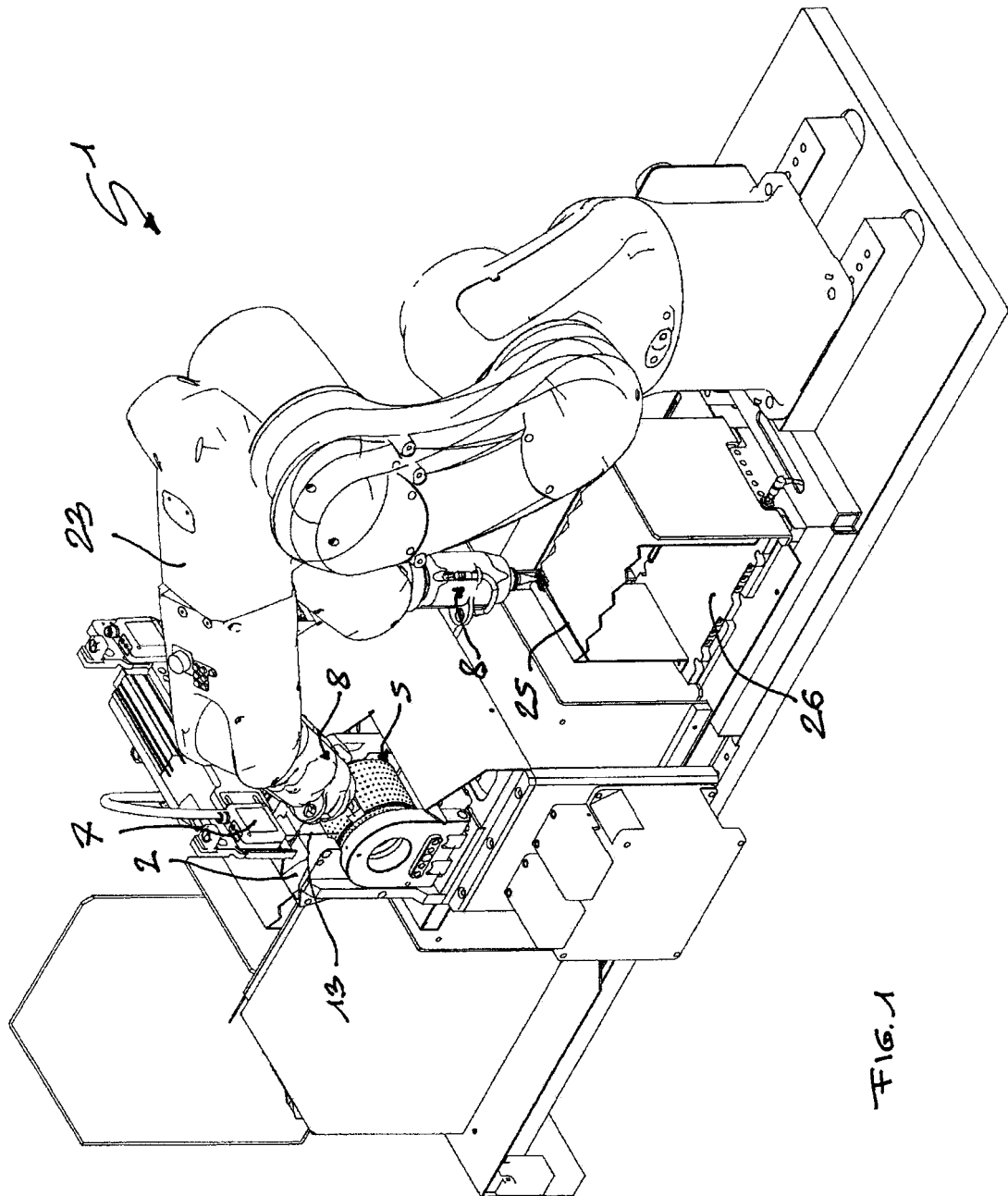
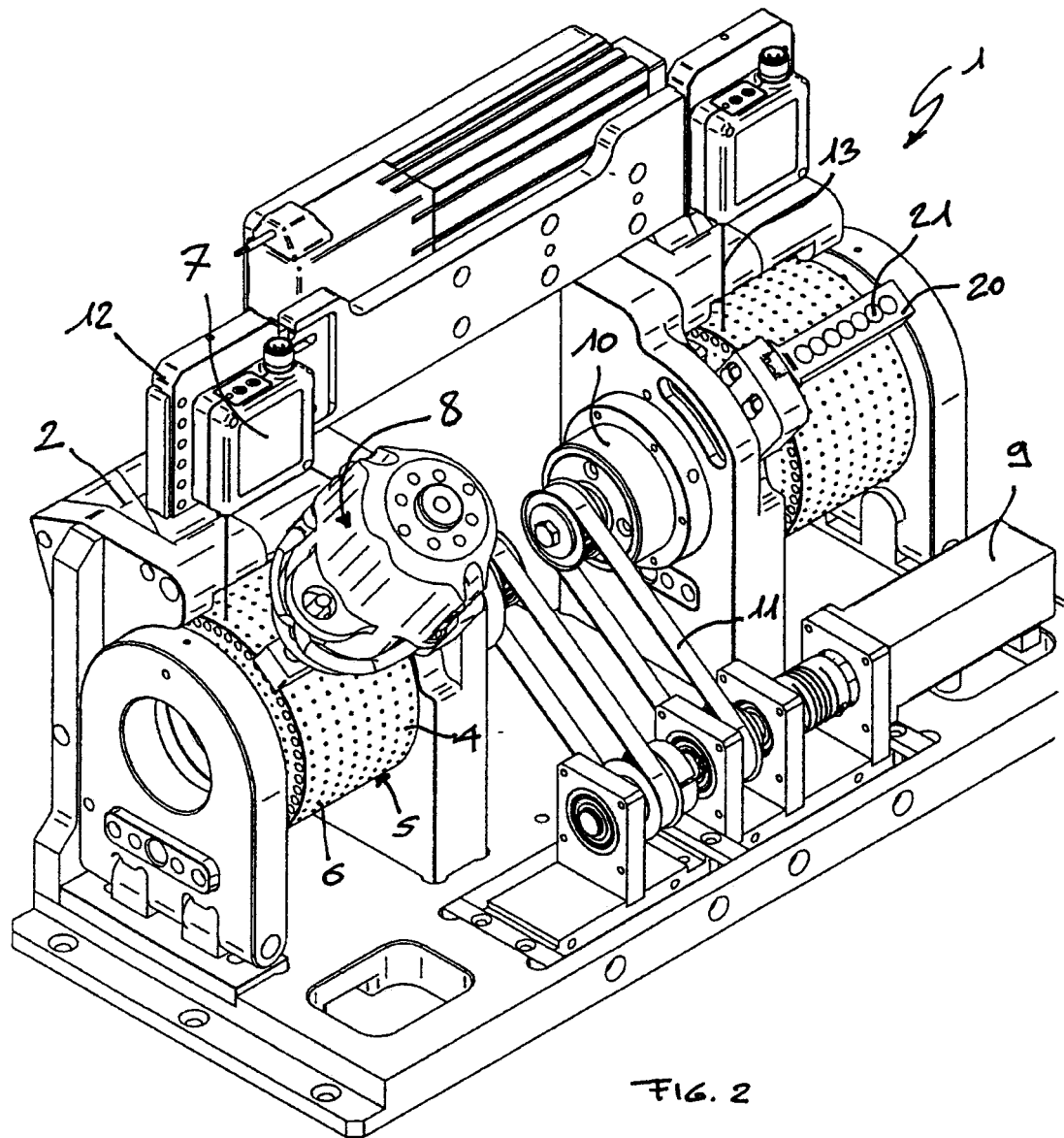


FIG. 1



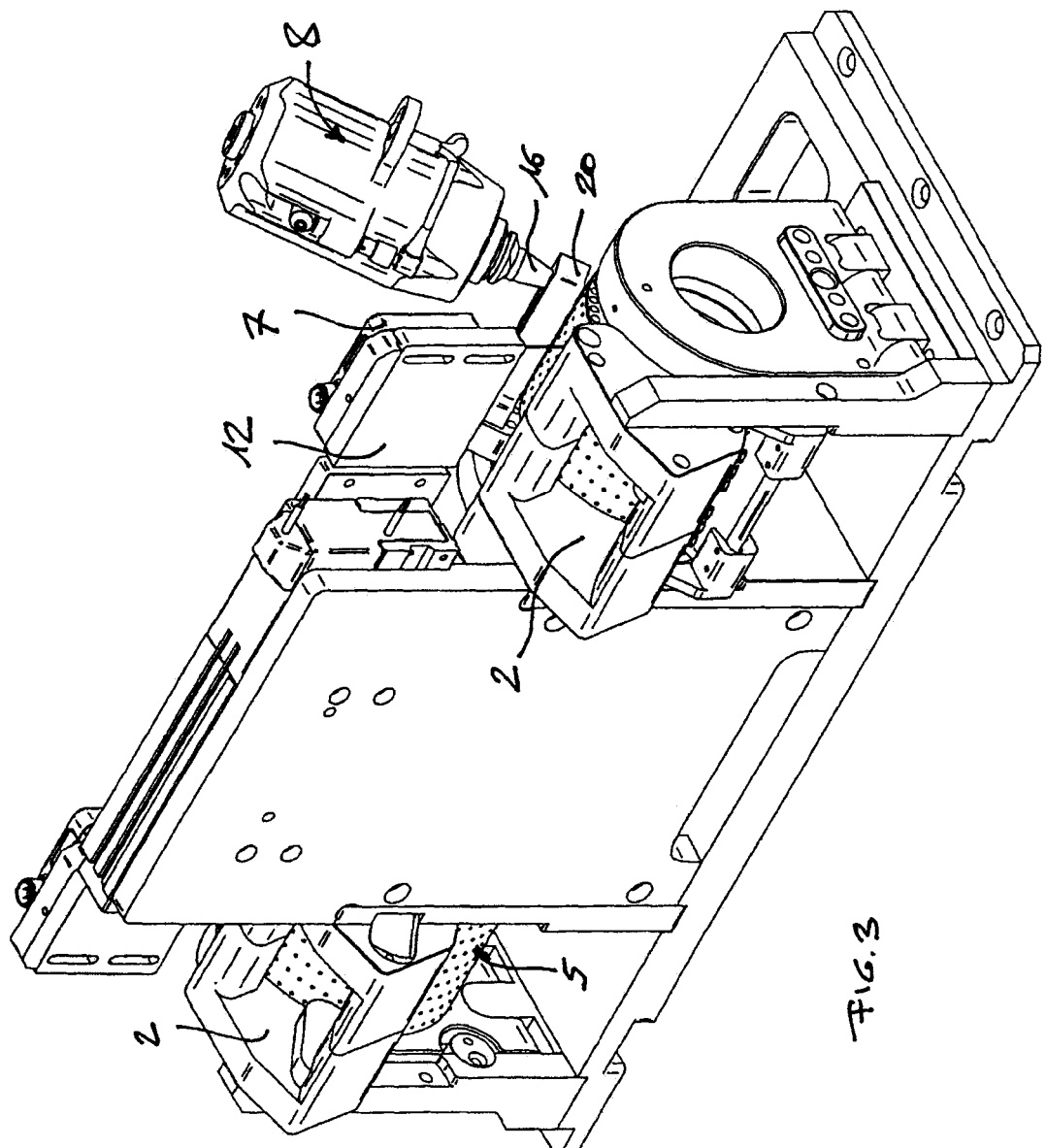
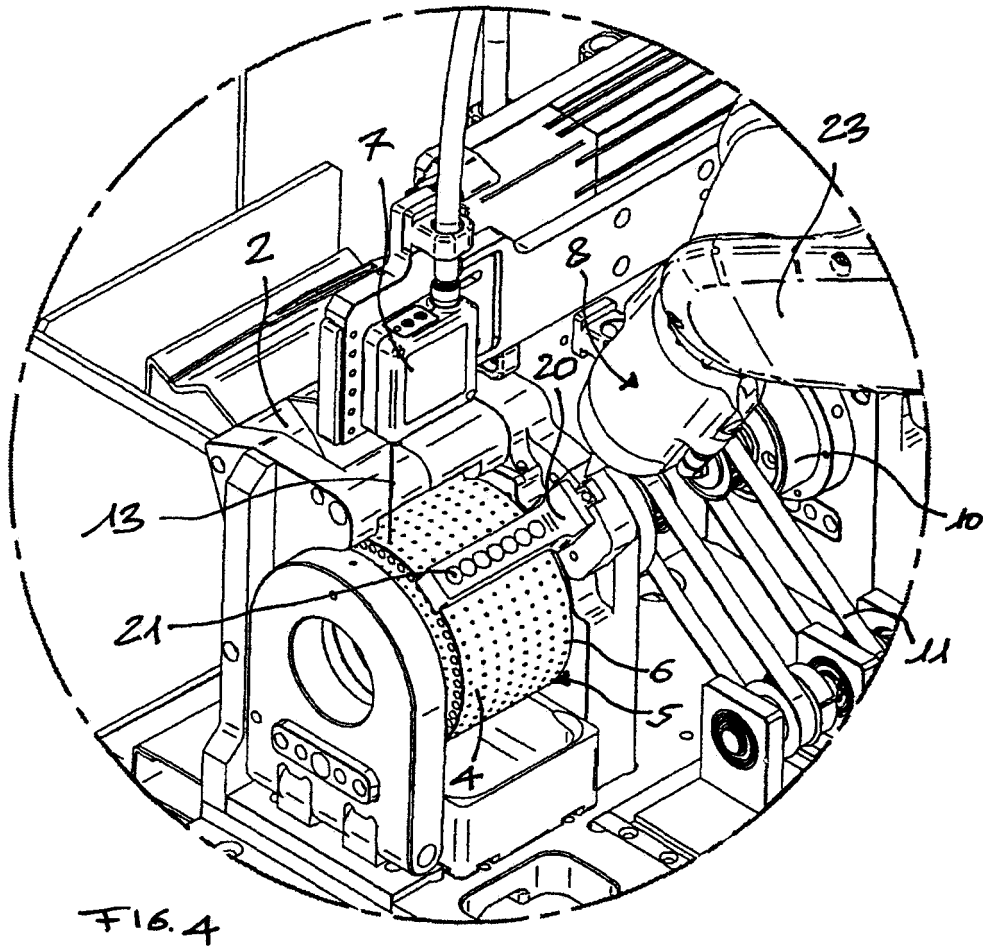
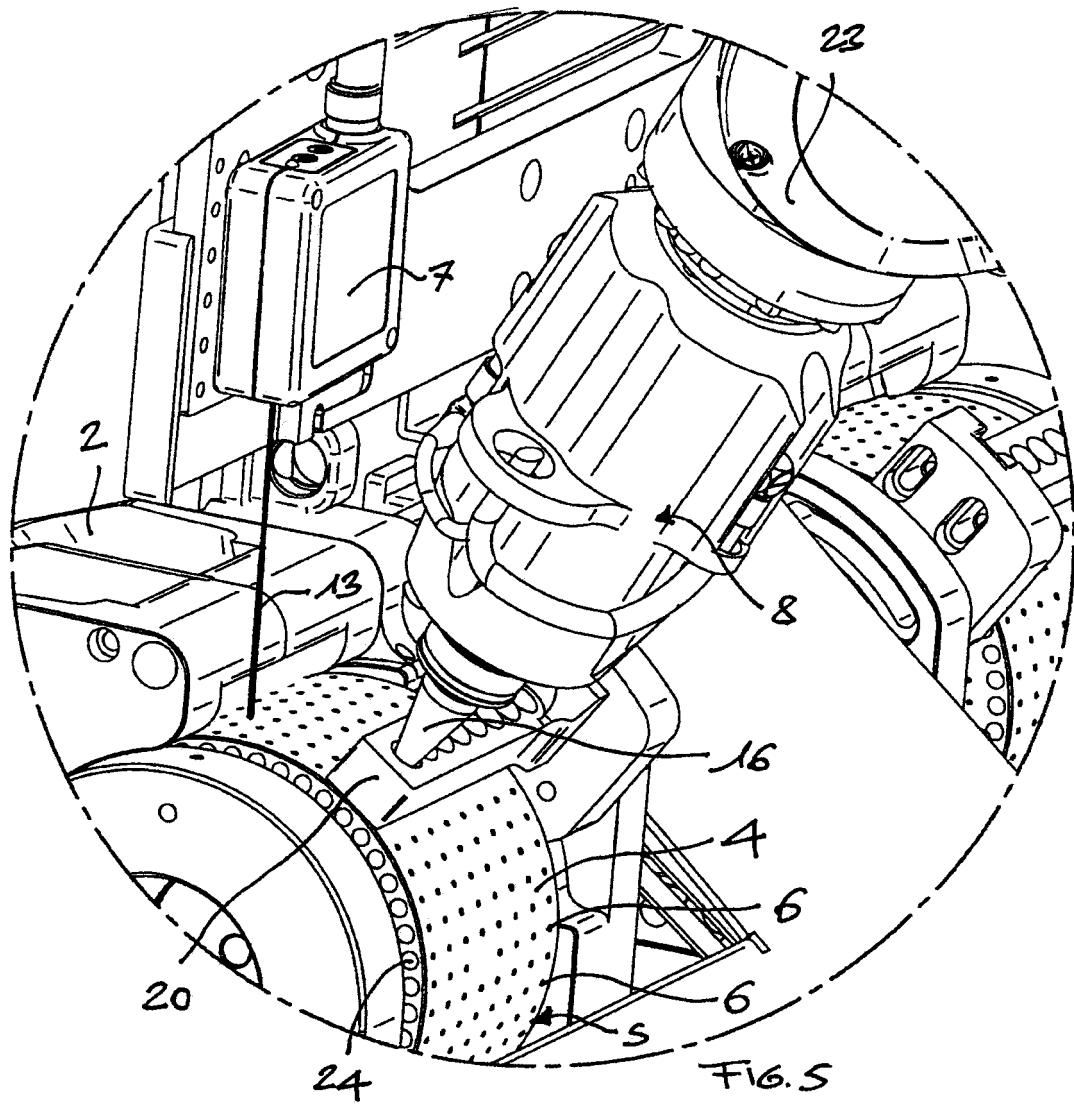
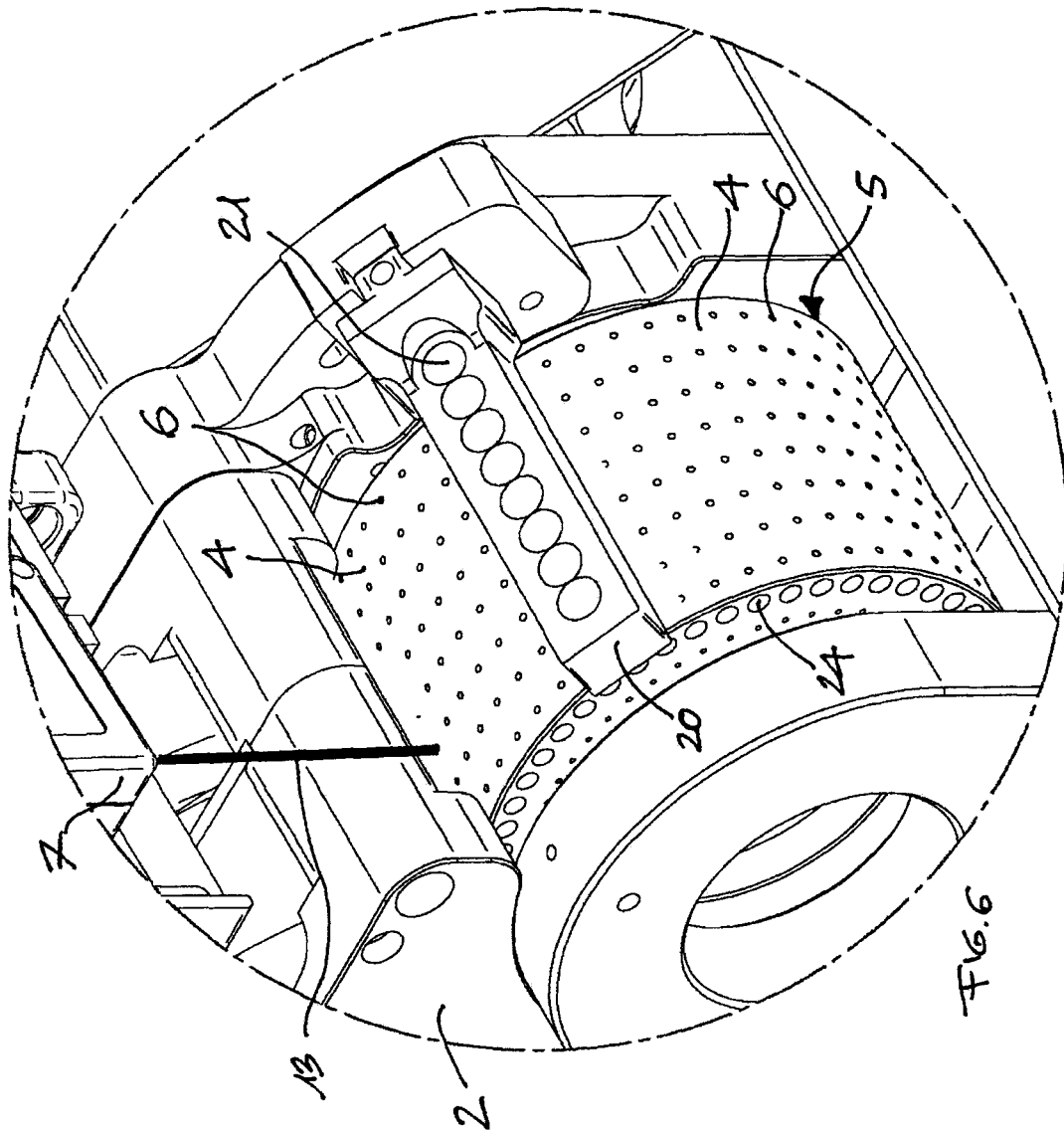
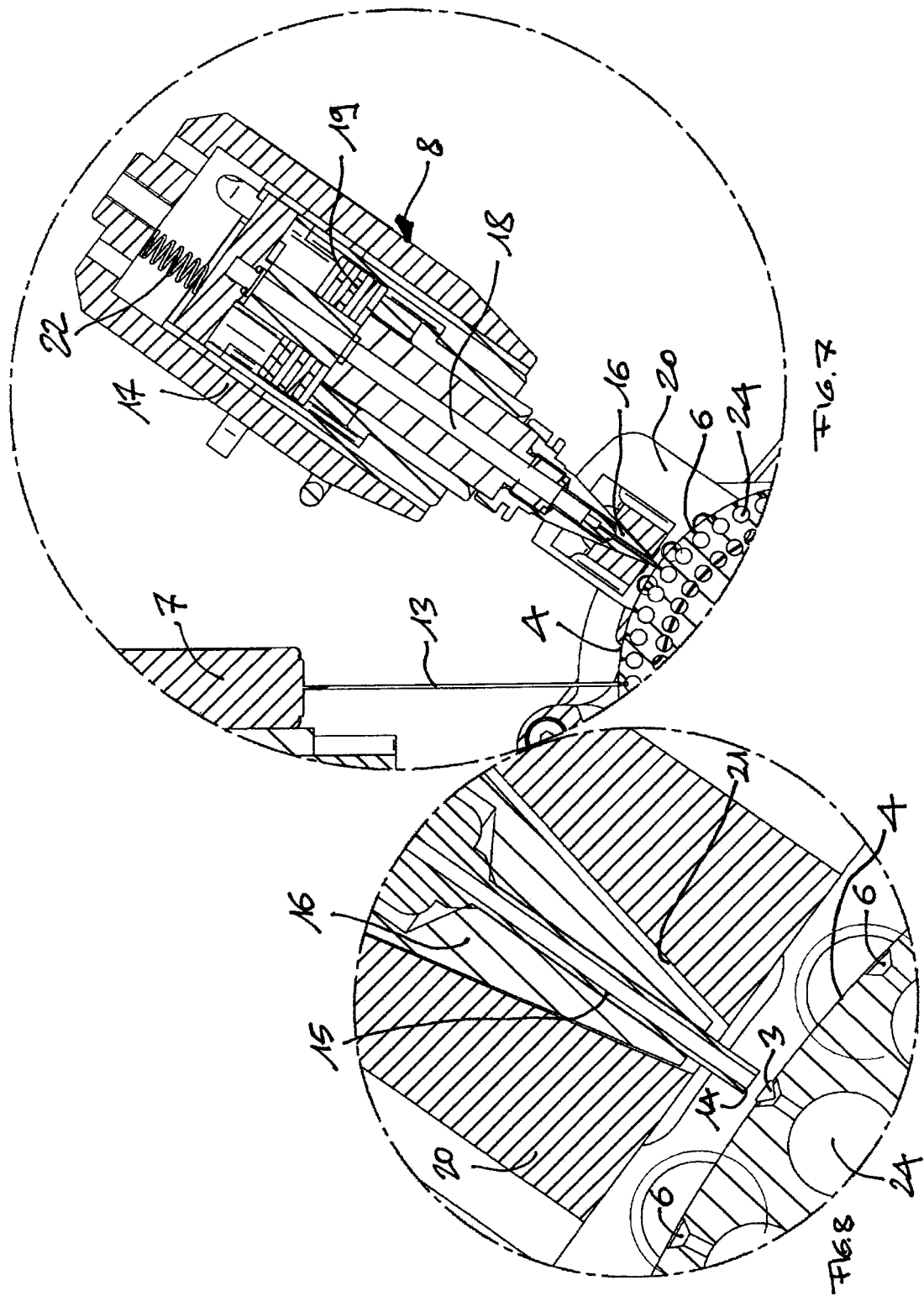


FIG. 3









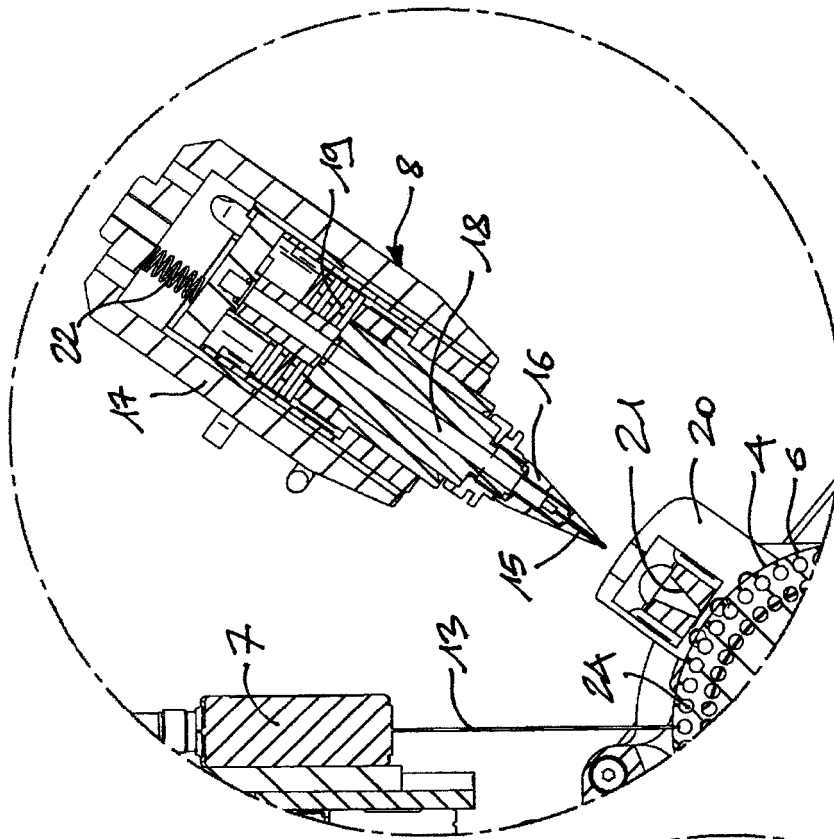


FIG. 9

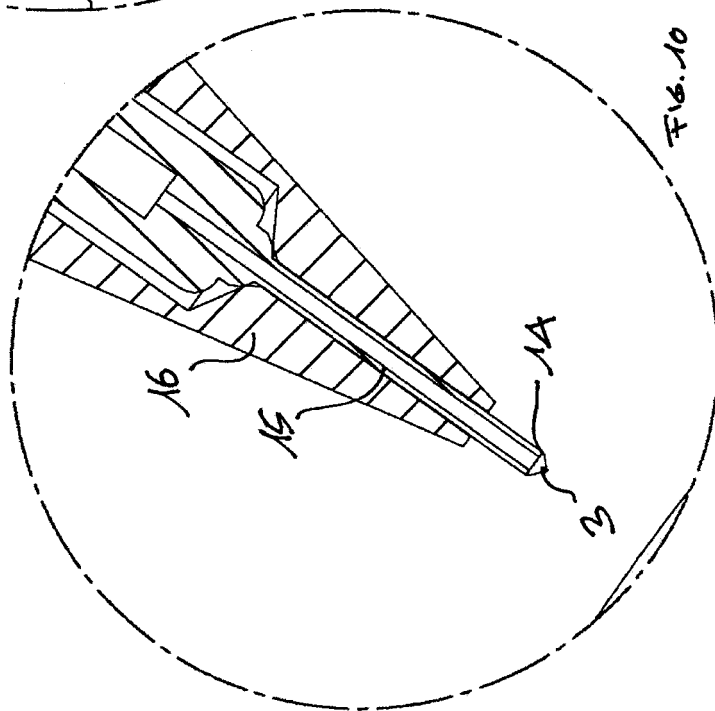
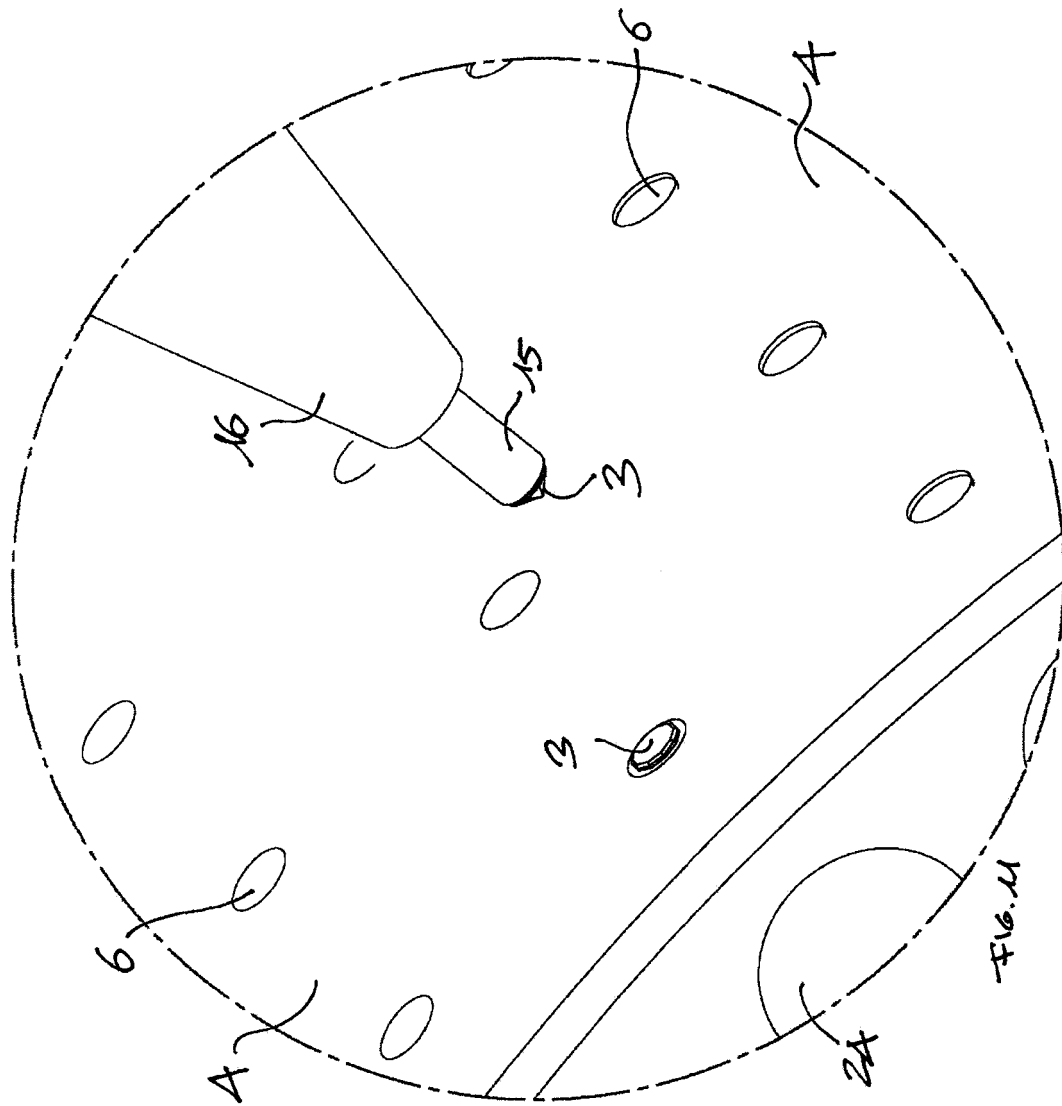
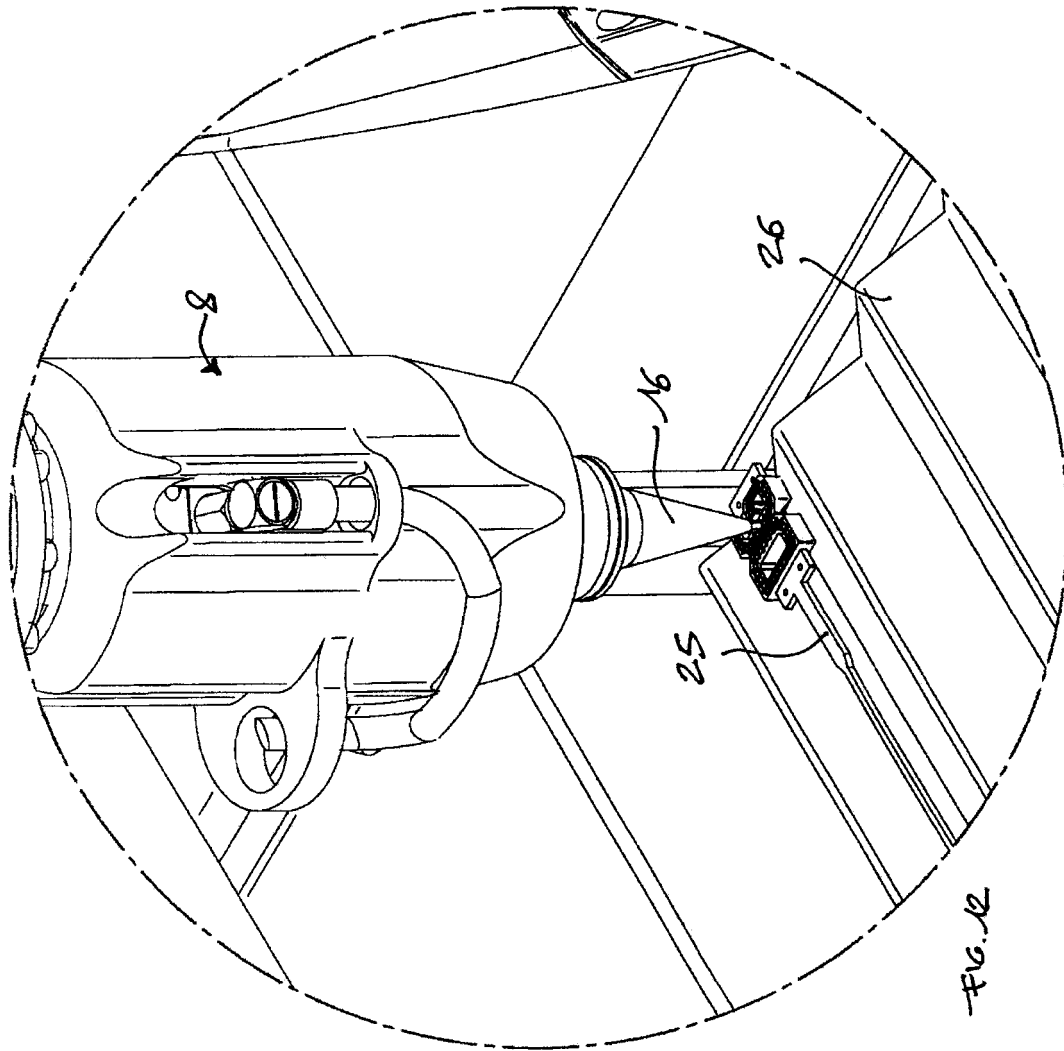


FIG. 10





INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/050506

A. CLASSIFICATION OF SUBJECT MATTER

INV. A44C17/00 B23P5/00 B65G47/74

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A44C B23P B65G H05K G06T G01N B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 5 350 269 A (AZUMA YUSAKU [JP] ET AL) 27 September 1994 (1994-09-27) the whole document	1,15,16, 25 2-14, 17-24
A	----- US 5 271 132 A (PEPPER JAMES T [US] ET AL) 21 December 1993 (1993-12-21) the whole document	1-25
A	----- JP 11 239925 A (MATSUSHITA ELECTRIC IND CO LTD) 7 September 1999 (1999-09-07) abstract	1-25
A	----- DE 197 05 564 A1 (AISIN SEIKI [JP]) 6 November 1997 (1997-11-06) abstract	4-8
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Date of the actual completion of the international search

31 October 2008

Date of mailing of the international search report

18. 12. 2008

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2008/050506

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