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(54) Device and method for assembling industrial packaging

(57) The invention relates to a device (1) and method for assembling industrial packaging which in use has a polygonal cross-section, comprising supply means for supplying a package sleeve from a storage area to an assembly area, tilting means for tilting the package sleeve, unfolding means for unfolding the package sleeve to a position in which the package sleeve has a polygonal cross-section, discharge means for discharging the unfolded package sleeve to a collection area, wherein said means are formed by a robot arm (2) in combination with a receiving unit.

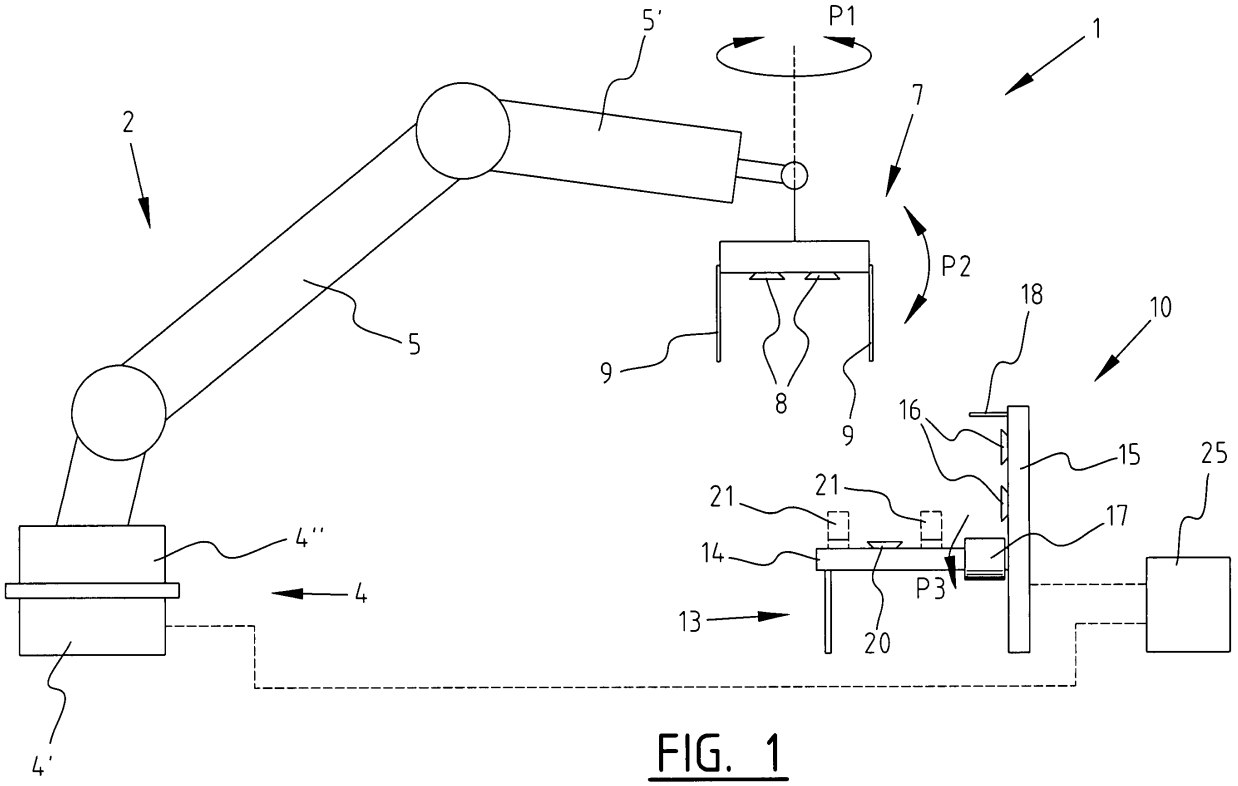

FIG. 1

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Description

[0001] The present invention relates to a method and device for assembling industrial packaging.

[0002] For the transport and further storage of bulk products such as powders or grains, mainly for the chemical, plastics and food industries, packaging boxes with eight side wall panels are used. In the situation of use these packaging boxes have an octagonal shape. The octagonal packaging boxes, also referred to as "octabins", are supplied in a folded, flat position and can therefore be stored without taking up much space.

[0003] When the packaging boxes have to be used, they are unfolded and provided with one or more bases, for instance a base on the underside and a base (lid) on the top side. The octagonal shape of the packaging box provides optimization of the available space when the octagonal box is transported on a pallet in combination with a rigid construction, so that the products remain well protected.

[0004] It is possible to distinguish octagonal packaging boxes with a regular and an irregular shape. In the case of regularly formed octagonal boxes the side walls have an equal width, while in an irregularly formed box the width of the side walls can vary. As stated above, the packaging boxes are generally constructed from a package sleeve and one or two separate bases which can be arranged in unfolded position on the package sleeve. Embodiments are however also known (such as, among others, the so-called "ready for use" octabin of applicant) in which the package sleeve is provided with a base which folds out simultaneously with unfolding of the package sleeve.

[0005] For assembly of the above stated industrial packagings assembly machines are known which are built up of a number of sections, wherein each section performs one or more predetermined operations. In a first section the package sleeves are for instance supplied, in a second section the package sleeves are unfolded to some extent, in a third section the packaging is unfolded further, in a subsequent section the package sleeve is tilted, and so on. Such known assembly machines have large dimensions (length and width of several tens of metres) and are expensive.

[0006] Owing to the complex construction of such machines they are furthermore sensitive to malfunction, which necessitates extensive technical service support.

[0007] A further drawback of the known assembly machines is that the package sleeves are subjected to relatively great forces and shocks during the assembly, which adversely affects the quality of the packaging. Some sections of the known assembly machines thus engage the packaging boxes at a number of positions simultaneously and then perform physical operations on the packaging box. Stresses hereby occur in the packaging box, which can affect the structural strength of the packaging box.

[0008] Finally, the known assembly machines are suitable for one determined type of packaging box. When packaging boxes of different types have to be assembled, other assembly machines must be used, or the existing machines must be considerably modified.

[0009] An object of the present invention is to provide a device and method in which the above stated drawbacks are obviated.

[0010] According to a first aspect of the invention, this object is achieved in a device for assembling industrial packaging which in use has a polygonal cross-section, comprising:

- supply means for supplying a package sleeve from a storage area to an assembly area;
- tilting means for tilting the package sleeve;
- unfolding means for unfolding the package sleeve to a position in which the package sleeve has a polygonal cross-section;
- discharge means for discharging the unfolded package sleeve to a collection area;

wherein the supply means, tilting means, unfolding means and discharge means are formed by:

- an articulated arm, wherein the arm is provided with at least one first gripper element with which the outer side of a package sleeve can be gripped, and the arm takes a pivotable form to be able to displace an gripped package sleeve from the supply area to the assembly area, and from the assembly area to the collection area;
- a stationary receiving element which is positioned in the assembly area and to which a package sleeve gripped by the first gripper element can be displaced, wherein the receiving element is provided with at least one second gripper element for gripping a package sleeve placed on the receiving element;
- control means for controlling the articulated arm, the first gripper element and the second gripper element for the purpose of supplying, tilting, unfolding and discharging a package sleeve.

[0011] The supply means, unfolding means and discharge means are herein combined to form a single, articulated (robot) arm and stationary receiving element. The robot arm is provided with a gripper element with which the package sleeve can be picked up, tilted and placed on a receiving unit. The package sleeve can be unfolded in co-action with a second gripper element provided on the receiving unit. The same arm with gripper unit is then used to carry the unfolded package sleeve to a desired position in the collection area, where further operations can take place. Practically the whole assembly of the package sleeve can therefore be performed with a minimum number of components, thus enabling an extremely compact and low-maintenance setup.

[0012] In practice, the area occupied by the device (assembly area), as well as the storage area (area in which

the package sleeves and bases are stored and the pallets are optionally collected) and the collection area to which the assembled packages and optionally the pallets are taken, need only cover an area of ten by ten metres or less. Because the device further exerts as many natural movements as possible on the package sleeve, there are (practically) no physical impacts on the packages.

[0013] According to a preferred embodiment of the invention, the device comprises base arranging means for arranging at least one base part in the unfolded package sleeve. These base arranging means can be provided as an additional unit, but in a further embodiment the base arranging means are formed by the above stated arm,
wherein the control means are adapted to displace the first gripper unit to a supply of base parts, to grip a base part, to displace a base part to the unfolded package sleeve and to slide the base part into the unfolded package sleeve. The assembly construction can be further simplified by making use of the components already applied for assembly of the package sleeve.

[0014] According to a preferred embodiment, the first and/or second gripper unit are provided with one or more suction mouths with which a package sleeve can be suctioned fixedly onto the arm or the receiving element. This manner of gripping the package sleeve, and optionally a package base, prevents the surface thereof being damaged.

[0015] According to a further preferred embodiment, the first gripper unit is also provided with engaging means for engaging a pallet. It is hereby possible, with the same arm with which the package sleeves are picked up, to also displace the associated pallet from the storage area to the correct collection area.

[0016] With a correct design of the control means the arm, and in particular the first gripper unit thereof, can be displaced to a supply of pallets, wherein the gripper unit engages and then displaces the pallet to the collection area. The pallet is then ready for placing of an assembled packaging thereon.

[0017] According to a further preferred embodiment, the receiving unit is provided with an aligning provision for placing in the correct lateral position a package sleeve placed on the receiving unit.

[0018] The receiving unit is preferably provided with a number of, preferably four or more, pivot arms which are displaceable between a position releasing the package sleeve and a position resting against the inside of the unfolded package sleeve when it is placed on the receiving unit, for the purpose of placing the package sleeve in the correct unfolded position, for instance when the first gripper unit is released from the package sleeve in order to pick up for instance a base part.

[0019] Already stated above is that package sleeves are known which are already provided beforehand with an fold-out base. When the package sleeve is unfolded by the first and second gripper unit, the base automatically comes to lie in a more or less flat position. In order to position the base exactly in the correct position, the receiving unit is provided according to a preferred embodiment with a third gripper unit, preferably provided with one or more suction mouths, for the purpose of gripping the base and displacing the base to the correct, unfolded position. This ensures that, in such a packaging provided with an fold-out base, the base is always placed in the correct position after assembly.

[0020] According to another aspect of the invention there is provided a method for assembling industrial packaging which in use has a polygonal cross-section, comprising of:

a) supplying a package sleeve using a first gripper unit,
b) tilting the package sleeve,
c) placing the tilted package sleeve on a receiving unit,
d) gripping the package sleeve with a second gripper unit,
e) moving the first and second gripper units apart in order to fold out the package sleeve,
f) the second gripper unit releasing the unfolded package sleeve,
g) discharging the package sleeve to a collection area.

[0021] The package sleeve is further embodied such that a polygon is defined in an unfolded position, wherein the number of corners equals eight, which results in an octagonal box. The number of corners can however also be a multiple of eight. The packaging is preferably manufactured from corrugated board with a thickness between five and twenty-five millimetres, preferably between ten and fifteen millimetres. Such a material in combination with said material thickness provides a sufficiently strong construction, which can furthermore be readily processed and can be recycled after use. The height of the box typically varies between one and two metres, and the volume thereof varies between two and three thousand litres.

[0022] Further advantages, features and details are elucidated on the basis of the description of the preferred embodiment of the invention. Reference is made in the description to the annexed figures, in which:

Figure 1 shows a schematic representation of a preferred embodiment of the device according to the invention; and
Figures 2a-21 show photos of the preferred embodiment of figure 1 in successive stages of the assembly process.

[0023] The assembly device 1 shown in figure 1 is constructed from a robot arm 2 and a separate receiving unit 10. Robot arm 2 comprises a foot 4 arranged on a ground surface and consisting of a lower part 4' and an upper part 4" rotatable relative thereto. An articulated arm 5,5'

is arranged on foot 4. Arm 5,5' can be displaced up and downward in known manner by the drive means (not shown). Rotatable part 4" of the foot can likewise be rotated with drive means (not shown) so that the arm can rotate relative to the ground surface. Other embodiments of a robot arm can also be envisaged.

[0024] The outer end of arm 5' is provided with a gripper unit 7. Gripper unit 7 is herein mounted on arm 5' such that using drive means (not shown) the gripper unit is rotatable relative to the arm (P_1) and also pivotable relative to arm 5' (P_2).

[0025] Robot arm 2 is connected to a remotely placed control unit 25 with which the different components of robot arm 2 can be controlled. Owing to this embodiment of robot arm 2 the gripper unit can be guided under the influence of control unit 25 to any desired position within a predetermined radius from foot 4 in order to lift and displace a random object.

[0026] Gripper unit 7 is provided on the underside with a number of suction cups 8 connected to a compressor (not shown). The compressor can provide an underpressure such that an object is suctioned fixedly onto gripper unit 7. Using suction cups 8 the object can be fixed to gripper unit 7 without the surface of the object herein being damaged, which enhances the quality of the packaging product. In the present case the suction cups are used to pick up relatively light objects in the form of a package sleeve and/or a package base. In order to pick up heavier objects such as a pallet, gripper unit 7 is provided with four gripping arms 9 (two of which are shown in figure 1). These gripping arms 9 take a pivotable form so that these can engage a pallet two by two.

[0027] Assembly device 1 further comprises a receiving unit 10 which is constructed from a frame 13 on which a lying part 14 and a standing part 15 are arranged. Arranged close to the connection of the standing part and the lying part 14 is an endless conveyor belt 17 on which a package sleeve can be placed. Further provided on a lateral side of standing part 15 is a rod 18 which extends transversely thereof and which functions as a stop for a package sleeve arranged on conveyor belt 17. Also provided in standing part 15 is a number of suction cups 16 which are connected to a generator (not shown) in similar manner as the above stated suction cups 8. Analogously to suction cups 8 of gripper unit 7, suction cups 16 can suction a package sleeve fixedly to the standing part 15 of receiving unit 10.

[0028] In the shown embodiment there is arranged in the lying part of frame 13 an additional suction cup 20 with which a base of a special packaging, provided with a base, can optionally be fixed in a correct position. When such a type of packaging does not need to be assembled, suction cup 20 can be omitted.

[0029] Two retaining members 21 are finally shown. Four or more retaining members will in practice be provided on lying part 14. Retaining members 21 are embodied so as to be pivotable relative to lying part 14. In the starting position (full line) the retaining members extend substantially horizontally, while in the retaining position (broken lines) the retaining members are rotated upward into a vertical position. In this position they can hold a folded-open package sleeve in the opened position, as further set forth below.

[0030] Figure 1 further shows that receiving unit 10 is connected to the above mentioned control unit 25 with which the different components of the receiving unit can be controlled together with the components of robot arm 2.

[0031] Figures 2a to 21 show the embodiment of figure 1 in the different stages of the assembly of the packaging. Figure 2a shows the initial stage in which arm 5 of robot arm 2 is displaced to a pallet supply. It can be seen in figure 2a that the pallet gripping arms 9 have pivoted outward so as to be able to engage two mutually opposite edges of the upper pallet (p). The pallet is thus engaged, lifted and displaced by rotation of robot arm 2 in order to set down the pallet at a different position, also referred to as collecting position (figure 2b). Once the pallet has been set down, arms 9 are pivoted inward once again, as shown clearly in figure 2b.

[0032] Gripper unit 7 of robot arm 2 is then moved to a supply of package sleeves (h) (figure 2c). The gripper unit is pressed against uppermost sleeve h, whereafter suction mouths 8 suction the relevant sleeve fixedly to gripper unit 7. The arm then lifts the fixedly suctioned package sleeve h, tilts it to a vertical position (figure 2d) and places it on receiving unit 10 (figure 2e).

[0033] The gripper unit places package sleeve h on endless belt 17 and releases the package sleeve. In this situation the package sleeve is enclosed between suction cups 8 of gripper unit 7 and suction cups 16 of receiving unit 10, but the intermediate distance is such that the package sleeve is free to move in lateral direction.

[0034] Endless belt 17 is driven (in direction P_3) and displaces the package sleeve in lateral direction until at a given moment it comes to lie against stop 18. The package sleeve is thus correctly aligned relative to receiving unit 10.

[0035] After suction mouths 8 have once again gripped package sleeves h, gripper unit 7 presses the packaging unit tightly against suction mouths 16 provided in the standing part 15 of receiving unit 10. Suction mouths 16 are then activated so that the package sleeve is held fast on two sides by the suction cups. On the left-hand side (in figure 1) the sleeve is held fast by suction mouths 8 of gripper unit 7, while on the right-hand side the sleeve is held fast by suction mouths 16 of receiving unit 10 (figure 2f).

[0036] The gripper unit is then displaced to the left, whereby the package sleeve is unfolded. Figure 2g shows the final position, in which the package sleeve is fully unfolded and the packaging has therefore obtained a form of octagonal cross-section. In order to hold the package sleeve in this unfolded form, the above mentioned retaining members 21 are pivoted upward under the control of control unit 25 until they come to lie against

the inner side of the walls of the package sleeve. When gripper unit 7 releases package sleeve h, it remains in the octagonal form as a result of retaining members 21.

[0037] Gripper unit 7 is then displaced to a supply of bases in the storage area and grips the uppermost base b by means of suction cups 8. The gripper unit displaces the base to a position above the package sleeve (compare figure 21) and subsequently pushes the base downward so that the base is displaced into the packaging from above.

[0038] In an embodiment of the invention that is not shown there are provided additional means with which the base can be placed at the correct position in the package sleeve, for instance in the form of a pusher which protrudes into the package sleeve at the top and which pushes the base downward further until it has reached roughly the bottom end of package sleeve h.

[0039] When the base has been arranged, retaining members 21 are no longer necessary to hold the package sleeve in the octagonal form. Retaining members 21 are therefore pivoted downward until they extend horizontally. Finally, gripper unit 7 once more grips the package sleeve provided with a base (compare figure 2j) and displaces it to the collection area where the previously placed pallet (p) is waiting, as shown in figure 2k. Gripper unit 7 places the package sleeve provided with a base on the pallet and releases itself from the sleeve in order to begin a subsequent cycle (figure 21). The combination of pallet and packaging is now ready to be transported to the filling space where the packaging can be filled with products.

[0040] As stated above, a base is arranged beforehand in some embodiments of the package sleeve. In this embodiment of the packaging the steps of picking up and arranging the separate base in the package sleeve are therefore unnecessary. The base will also automatically unfold after unfolding of a package sleeve. In an alternative embodiment, in order to now ensure that the base is positioned in the correct manner relative to the package sleeve, a number of extra suction mouths 20 are provided. These suction mouths are suctioned fixedly to the base of the packaging and displace it until the base is located in the correct position.

[0041] The invention is not limited to the above stated preferred embodiment thereof. The rights sought are rather defined by the following claims, within the scope of which many modifications can be envisaged.

Claims

1. Device for assembling industrial packaging which in use has a polygonal cross-section, comprising:

   - supply means for supplying a package sleeve from a storage area to an assembly area;
   - tilting means for tilting the package sleeve;
   - unfolding means for unfolding the package sleeve to a position in which the package sleeve has a polygonal cross-section;
   - discharge means for discharging the unfolded package sleeve to a collection area;

   wherein the supply means, tilting means, unfolding means and discharge means are formed by:

   - an articulated arm, wherein the arm is provided with at least one first gripper element with which the outer side of a package sleeve can be gripped, and the arm takes a pivotable form to be able to displace an gripped package sleeve from the supply area to the assembly area, and from the assembly area to the collection area;
   - a stationary receiving element which is positioned in the assembly area and to which a package sleeve gripped by the first gripper element can be displaced, wherein the receiving element is provided with at least one second gripper element for gripping a package sleeve placed on the receiving element;
   - control means for controlling the articulated arm, the first gripper element and the second gripper element for the purpose of supplying, tilting, unfolding and discharging a package sleeve.

2. Device as claimed in claim 1, also comprising base arranging means for arranging at least one base part in the unfolded package sleeve.

3. Device as claimed in claim 1 or 2, wherein the control means are adapted to displace the first gripper unit to a supply of base parts, to grip a base part, to displace the base part to the unfolded package sleeve and to slide the base part into the unfolded package sleeve.

4. Device as claimed in any of the foregoing claims, wherein the control means are adapted to supply a package sleeve, comprising of gripping a package sleeve from a supply of package sleeves in the supply area with the first gripper unit and displacing the package sleeve to the receiving unit, to tilt the package sleeve, to unfold the package sleeve comprising of placing the package sleeve on the receiving unit, gripping the package sleeve with the second gripper unit, and moving apart the first and second gripper unit so as to unfold the package sleeve, and to discharge the unfolded package sleeve comprising of releasing the unfolded package sleeve by the second gripper unit, gripping the package sleeve with the first gripper unit and displacing the unfolded package sleeve to the collection area.

5. Device as claimed in any of the foregoing claims, wherein the first and/or second gripper unit are pro-

vided with one or more suction mouths with which a package sleeve can be suctioned fixedly onto the arm or the receiving element.

6. Device as claimed in any of the foregoing claims, wherein the first gripper unit is also provided with engaging means for engaging a pallet.

7. Device as claimed in claim 6, wherein the engaging means comprise a number of pivotable gripper arms which are pivotable between a position releasing the pallet and a position holding the pallet.

8. Device as claimed in claim 6 or 7, wherein the control means are adapted to displace the first gripper unit to a supply of pallets, to engage a pallet and to displace the pallet to the collection area.

9. Device as claimed in any of the foregoing claims, wherein the receiving unit is provided with an aligning provision for placing in a correct lateral position a package sleeve placed on the receiving unit.

10. Device as claimed in claim 9, wherein the aligning provision comprises an endless conveyor belt and a stop, wherein the conveyor belt is adapted to displace the package sleeve until the sleeve lies against the stop.

11. Device as claimed in any of the foregoing claims, wherein the first gripper unit is arranged pivotally on the arm in order to tilt and be able to place the package sleeve upright on the receiving unit.

12. Device as claimed in any of the foregoing claims, comprising one or more pivot arms which are displaceable between a position releasing the package sleeve and a position resting against the inside of the unfolded package sleeve for the purpose of holding the package sleeve in the correct unfolded position.

13. Device as claimed in claim 12, wherein the control means are adapted to displace the first gripper unit to a supply of pallets, to have a pallet engaged by the pivot arms, to displace the pallet to the collection area, and the control means are also adapted to have the unfolded package sleeve placed by the arm on a pallet arranged in the collection area.

14. Device as claimed in any of the foregoing claims, wherein at least one unfoldable base is preformed on a package sleeve and wherein the receiving unit comprises a third gripper unit for gripping the base and displacing the base to a correct, predetermined position.

15. Method for assembling industrial packaging which in use has a polygonal cross-section, comprising of:

a) supplying a package sleeve using a first gripper unit,
b) tilting the package sleeve,
c) placing the tilted package sleeve on a receiving unit,
d) gripping the package sleeve with a second gripper unit,
e) moving the first and second gripper units apart in order to fold out the package sleeve,
f) the second gripper unit releasing the unfolded package sleeve,
g) discharging the package sleeve to a collection area.

16. Method as claimed in claim 15, wherein step a) comprises of gripping a package sleeve from a supply of package sleeves in the supply area with the first gripper unit and displacing the package sleeve to the receiving unit, and step g) comprises of releasing of the unfolded package sleeve by the second gripper unit, gripping the package sleeve with the first gripper unit and displacing the unfolded package sleeve to the collection area.

17. Method as claimed in claim 15 or 16, comprising of arranging at least one base part on the unfolded package sleeve after step e).

18. Method as claimed in claim 15, 16 or 17, comprising of displacing the first gripper unit to a supply of base parts, gripping a base part, displacing the base part to the unfolded package sleeve and sliding the base part into the unfolded package sleeve.

19. Method as claimed in any of the claims 15-18, comprising of displacing the first gripper unit to a supply of pallets, engaging a pallet and displacing the pallet to the collection area.

20. Method as claimed in any of the claims 15-19, wherein use is made of an articulated arm, which is provided with a gripper element with which the outer side of a package sleeve can be gripped and which takes a pivotable form to be able to displace an gripped package sleeve, and a stationary receiving element to which a package sleeve gripped by the gripper element can be displaced, wherein the receiving element is provided with one or more second gripper elements for gripping a package sleeve placed on the receiving element.

21. Method as claimed in any of the claims 15-20, wherein a device according to any of the claims 1-14 is applied.

22. Device or method as claimed in any of the foregoing

claims, wherein in unfolded position the package sleeve defines a polygon, wherein the number of corners is eight or a multiple thereof.

23. Device or method as claimed in any of the foregoing claims, wherein the packaging is manufactured from corrugated board with a thickness between 5 and 25 mm, preferably between 10 and 15 mm.

24. Device or method as claimed in any of the foregoing claims, wherein in unfolded position the packaging has a volume in the order of magnitude of 300-2000 l.

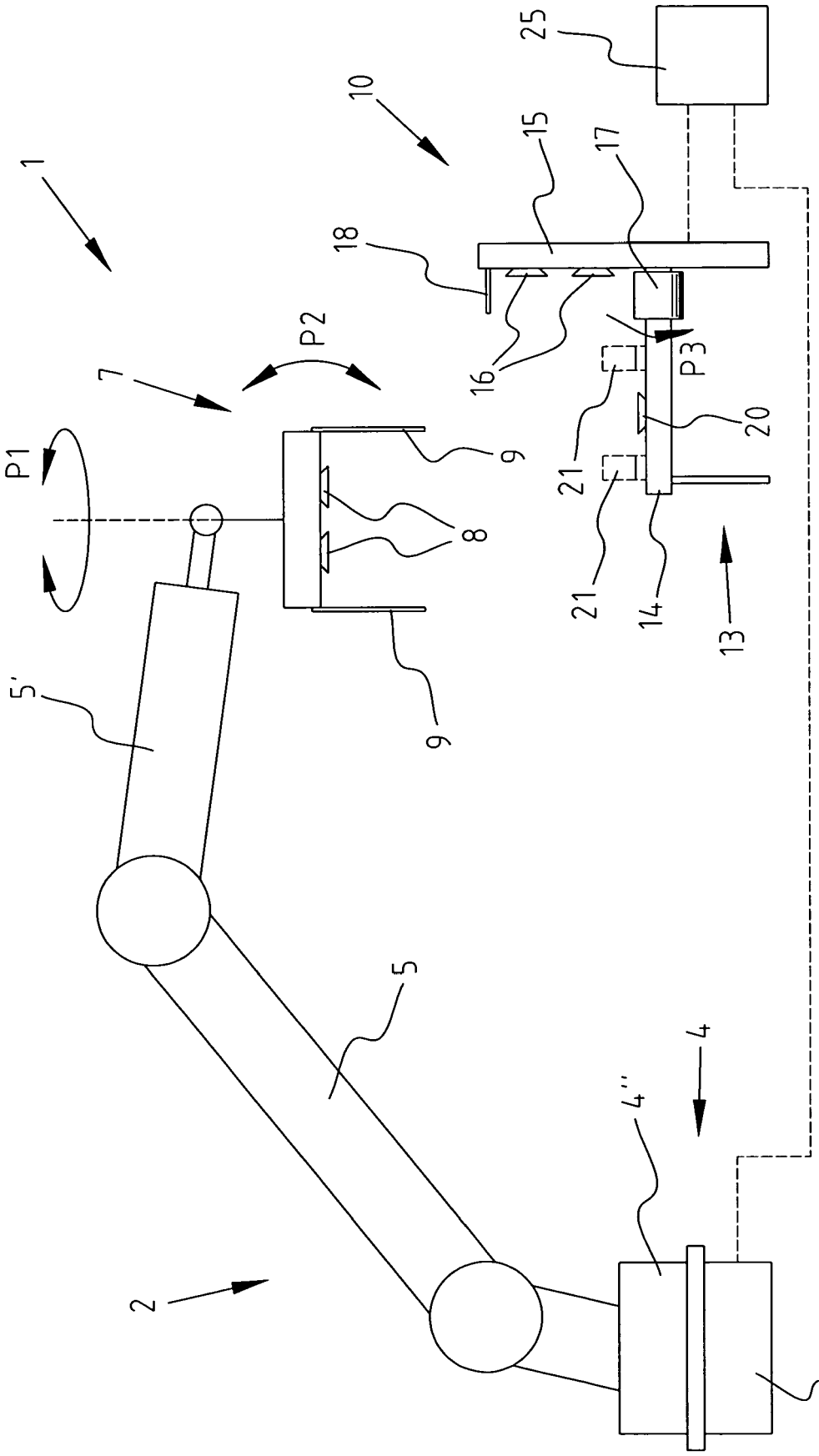

FIG. 1

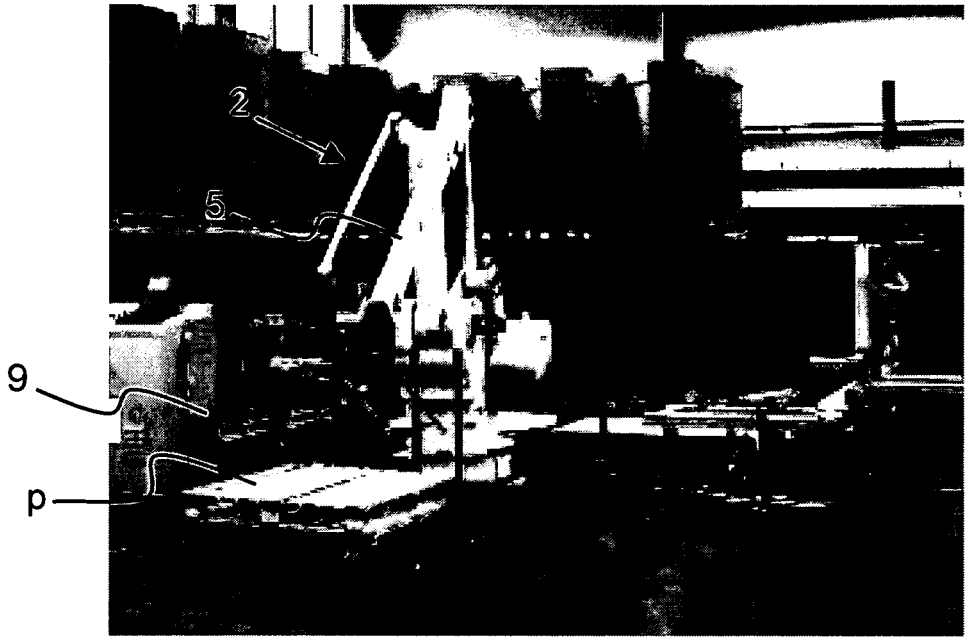

FIG 2A

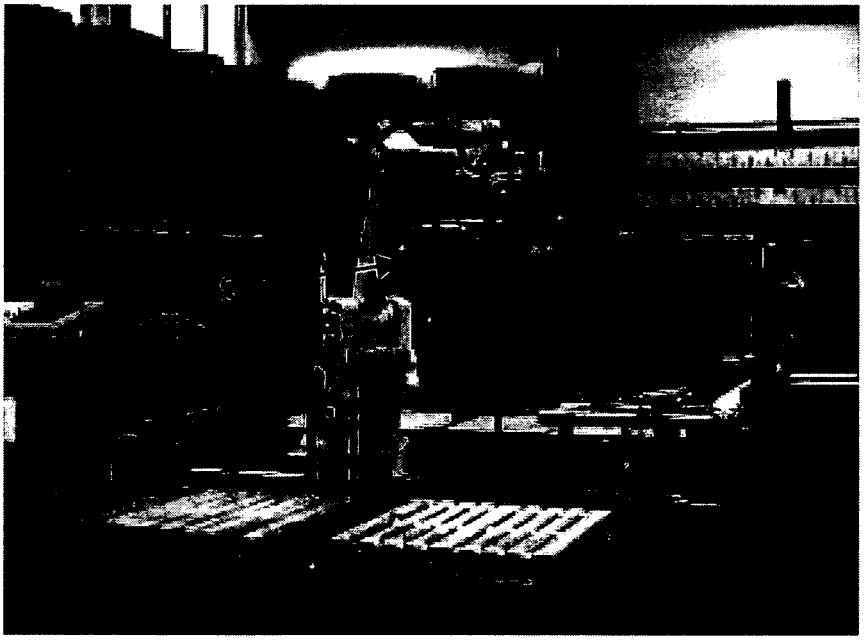

FIG 2B

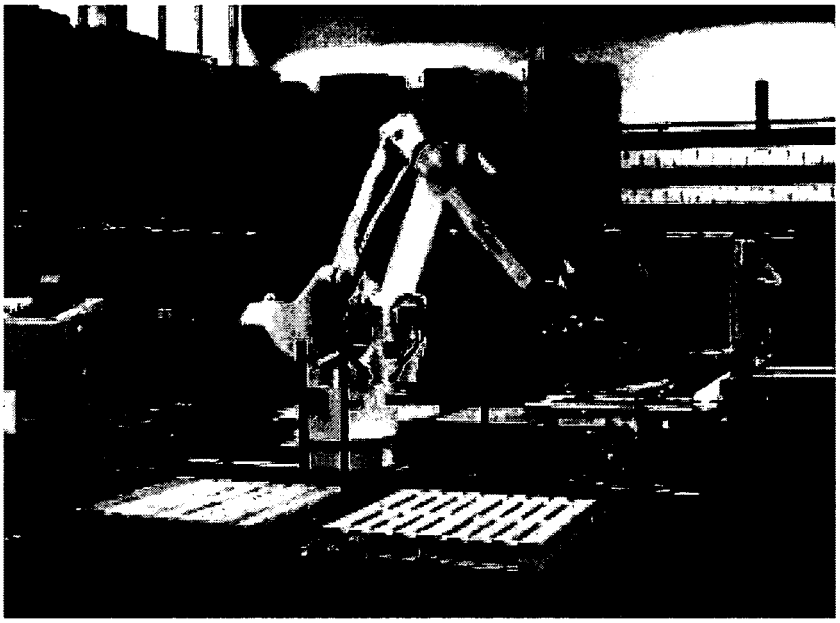

FIG 2C

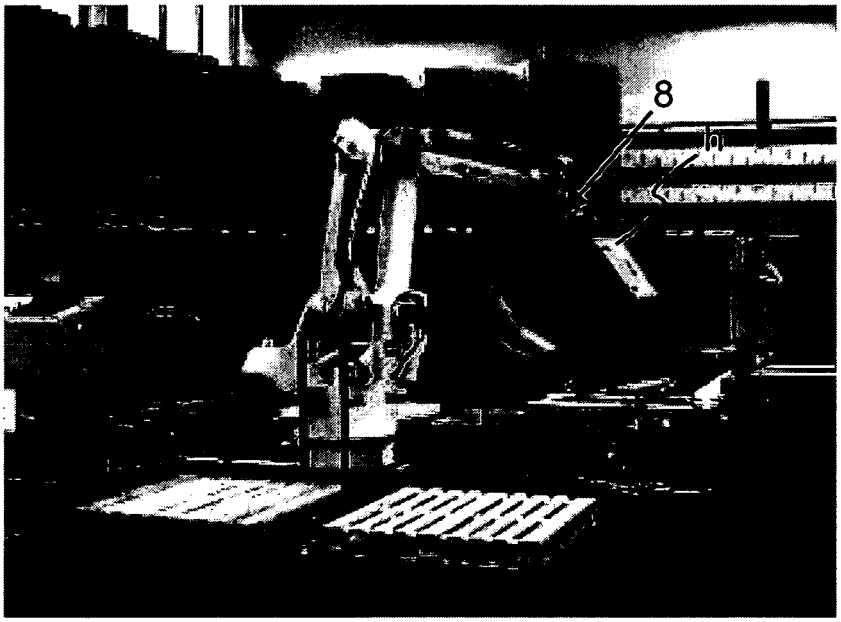

FIG 2D

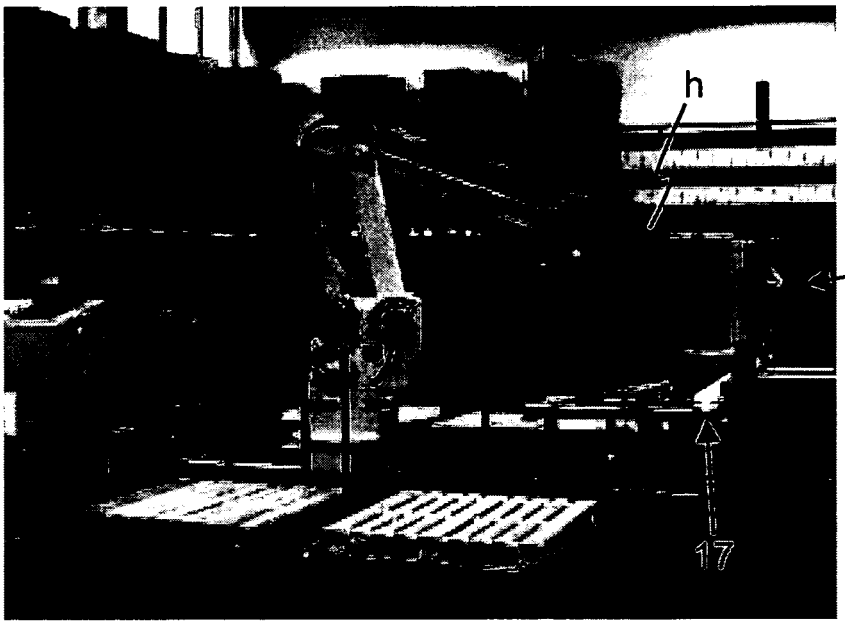

FIG 2E

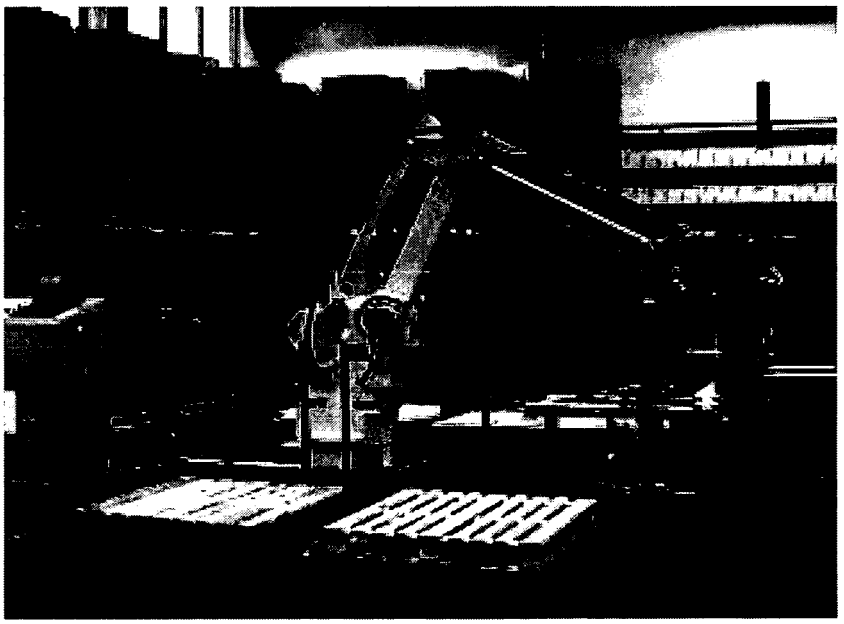

FIG 2F

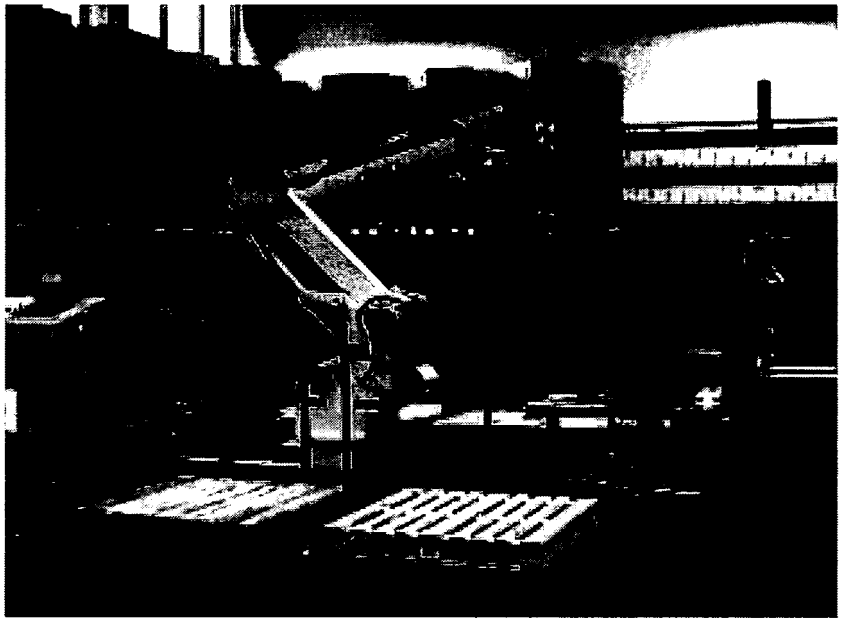

FIG 2G

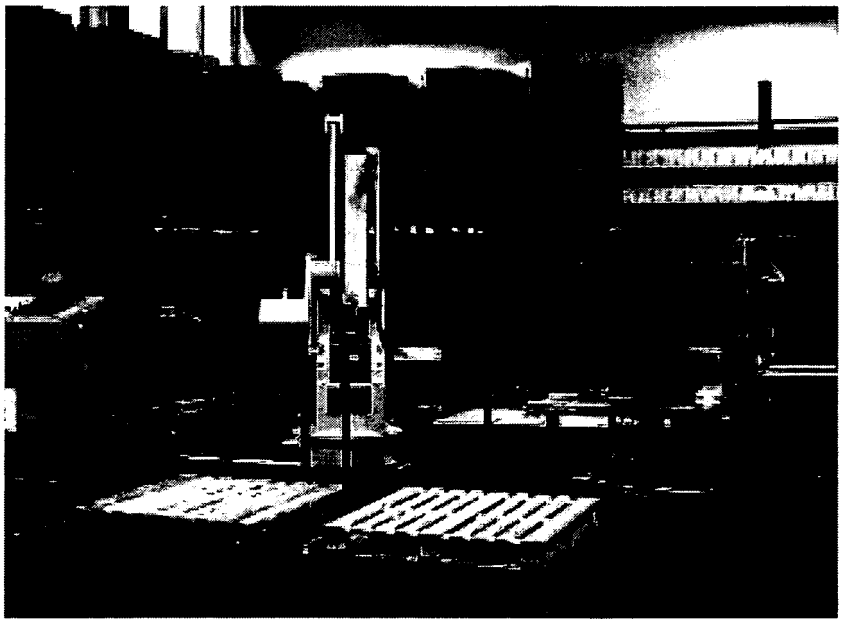

FIG 2H

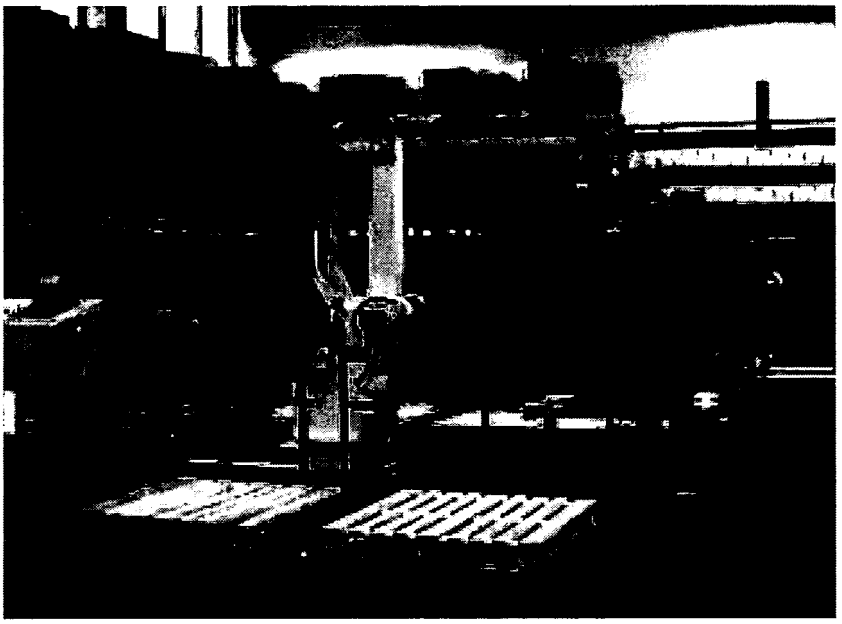

FIG 2I

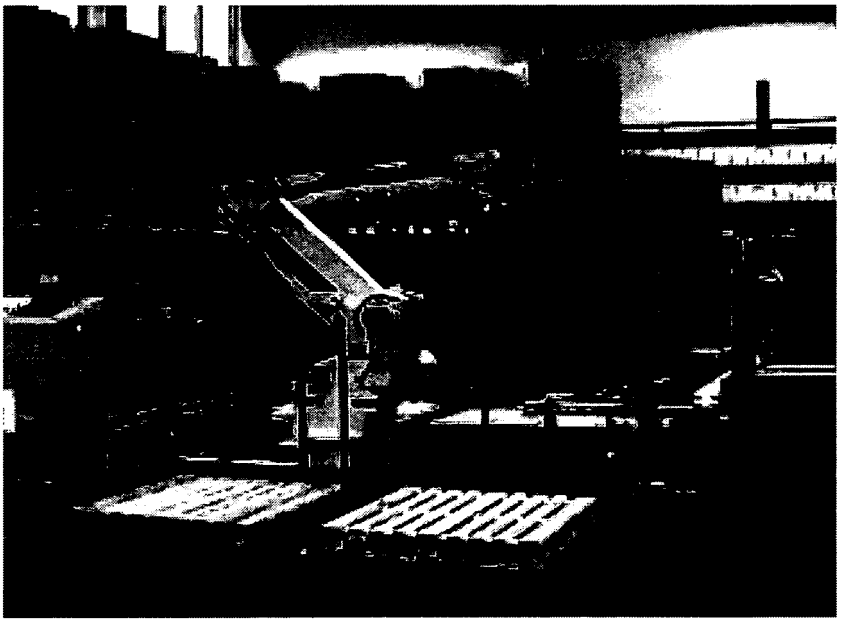

FIG 2J

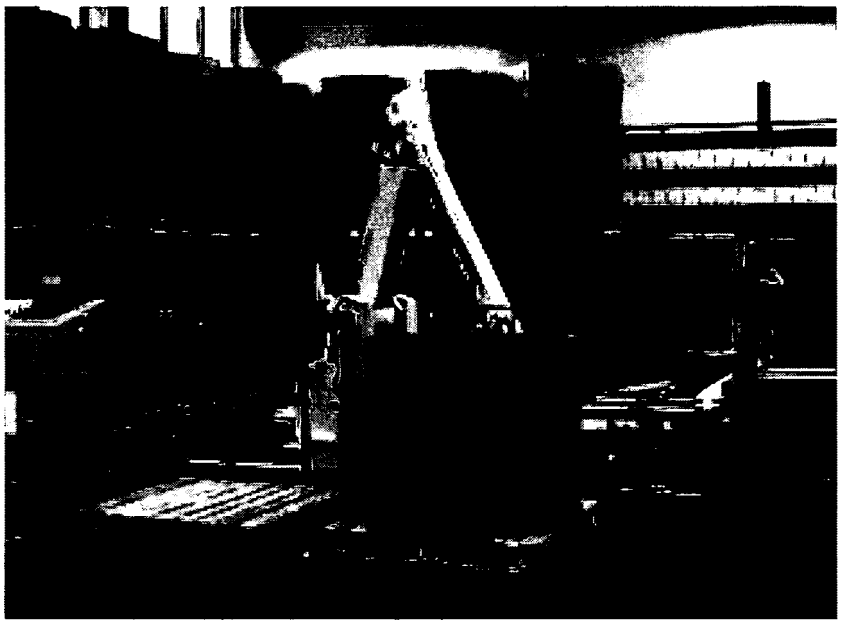

FIG 2K

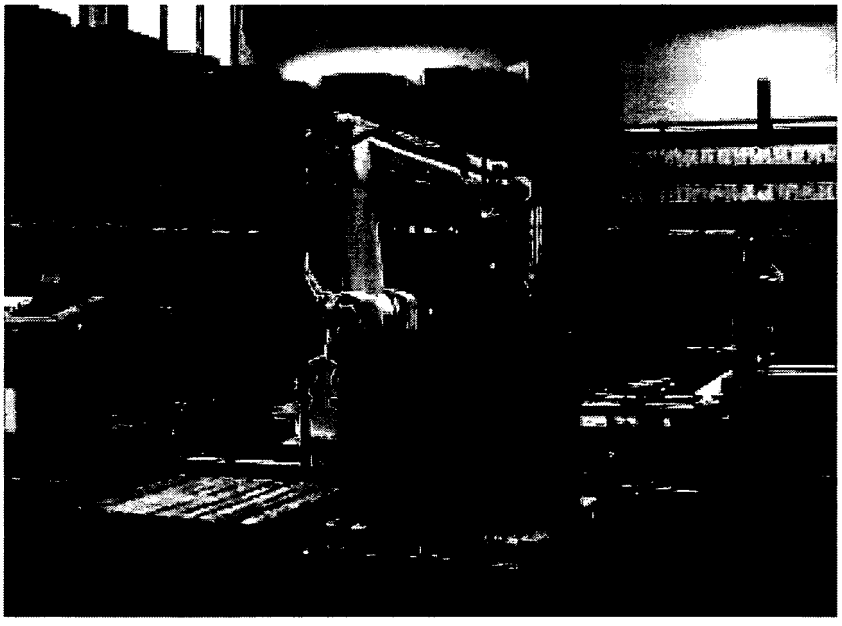

FIG 2L

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 07 7438

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X : particularly relevant if taken alone
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