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(54) **A DEVICE FOR PICKING UP AND MANIPULATING SHEET-LIKE, FLEXIBLE OBJECTS,
PARTICULARLY EXPENSIVE FABRICS**

VORRICHTUNG ZUM GREIFEN UND HANDHABEN VON FLÄCHIGEN BOGENÄHNLICHEN
OBJEKTEN, INSBESONDERE TEURER TEXTILWARE

DISPOSITIF POUR SAISIR ET MANIPULER DES OBJETS SOUPLES EN FORME DE FEUILLES,
NOTAMMENT DES TISSUS COUTEUX

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A (TOKYO JUKI IND CO LTD), 20 May 1986 cited
in the application**

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Description

[0001] The subject of the present invention is a device for picking up and manipulating sheet-like, flexible objects, particularly expensive fabrics, according to the preamble to Claim 1.

[0002] The invention also relates to a method of picking up and manipulating sheet-like flexible objects utilizing the above-mentioned device.

Technical background

[0003] A device including the above-mentioned characteristics is known from published Japanese patent applications Nos. 61101351 and 61101343 in the name of Tokyo Iuki Ind. Co. Ltd.

[0004] These documents describe the use of gripping devices each comprising a first pneumatic suction gripping member which can adhere by contact to a face of an edge portion of fabric to be manipulated and a second gripping member which can press the fabric against the first gripping member and keep it pressed in a firmly gripped condition by acting on the opposite face of the edge portion.

[0005] With reference to the gripping devices of these documents, it should be noted that they operate in accordance with a relatively lengthy and labourious picking-up process which requires the fabric to be lifted to a certain height by means of the pneumatic suction device and to be restrained whilst awaiting the completion of three operations (lowering the second gripping member, rotating it in order to bring it beneath the fabric in the region of the suction device, and then raising it against the latter) in order for the fabric to be gripped. Moreover, once the fabric has been lifted, because of its own weight, the fabric in the region of the suction device undergoes a local deformation which tends to favour its detachment. Furthermore, it should be noted that the gripping device requires at least two independent actuators, of which one is subjected to two distinct operations, and the gripping device enables gripping to take place exclusively in peripheral regions of the piece of fabric and is not suitable for gripping in central regions of the piece. For this reason, it also takes up working space which may invade the space outside the piece to be manipulated.

[0006] It should also be noted that the solution proposed is designed predominantly for moving whole pieces of fabric and not for picking up individual cut pieces and removing them from the off-cuts.

[0007] Finally, the devices do not have any means which render them suitable for handling particularly delicate and expensive materials such as cashmere, silk and any materials which are liable to retain impression marks.

[0008] A device for picking up and manipulating plastics sheets is described in published European patent application No. 0111739. Since the manipulation of ma-

terials impermeable to air is involved, this device makes use of separate first and second gripping members of which the first gripping member is a pneumatic suction device and the second gripping member is a pincer device. The operation of the separate gripping members described cannot be proposed for the manipulation of fabrics, particularly for picking up and manipulating pieces which are highly permeable to air, especially if they are disposed between off-cuts.

Description of the invention

[0009] The problem upon which the present invention is based is that of providing a novel picking-up and manipulation device which is also capable of handling, with a firm but light grip, materials which may be quite difficult to pick up and manipulate, particularly expensive fabrics and cut portions thereof, at the same time preventing the problems complained of with reference to the acknowledged prior art.

[0010] This problem is solved by the invention by a picking-up and manipulation device formed in accordance with Claim 1.

[0011] Further advantages are achieved by the technical solutions of the subordinate claims.

Brief description of the drawings

[0012] The characteristics and advantages of the invention will become clearer from the following detailed description of a preferred embodiment thereof, described, by way of nonlimiting example, with reference to the appended drawings, in which:

Figure 1 is a schematic, perspective view of apparatus for the manipulation of flexible objects including a picking-up device formed in accordance with the present invention,

Figure 2 is a perspective view showing a detail of the apparatus of Figure 1, on an enlarged scale, Figures 3 and 4 are a perspective view and a front elevational view, respectively, of the picking-up device with which the apparatus of Figure 1 is equipped,

Figures 5 and 6 are a side elevational view and a perspective view, respectively, of a gripper with which the picking-up device of the preceding drawings is equipped,

Figure 7 is a perspective view of a detail of the device of Figures 5 and 6,

Figure 8 is a side elevational view of another detail of the device of Figures 5 and 6,

Figure 9 is a side elevational view of a further detail constituting alternative equipment of the gripper of Figures 5 and 6, and

Figures 10 to 12 are schematic views of the device of the invention in different operative stages.

Preferred method of implementing the invention

[0013] In Figure 1, an apparatus for manipulating flexible objects is generally indicated 1 and utilizes a picking-up device 2 disposed on a vertical slide 3 of a Cartesian robot 4 which, with regard to the aspects not expressly described, is of conventional type.

[0014] The picking-up device 2 comprises a cross member 3a (Figure 3) mounted on the slide 3 by means of a mechanical wrist 6 which can bring about angular orientations of the cross member about three (or more) axes X, Y, Z. The mechanical wrist is also of a type known to experts in the art.

[0015] A motor 8 controls the movement of two further slides 10a, 10b, by means of a geared transmission 11. The further slides 10a, 10b are driven by means of screws with recirculating balls or other equivalent mechanisms, also of conventional type, and serve to translate two grippers, both indicated 12 and each mounted on a respective slide 10a, 10b, away from and towards a central position beside the geared transmission 11.

[0016] Since the grippers are identical, only one of them will be described in detail. Each gripper 12 comprises a first gripping member 13 and a second gripping member 14 combined in the following manner. The second gripping member is formed as a pincer with a first, fixed jaw 15 and a second jaw 16 which is movable in accordance with a law of motion defined by an articulated parallelogram mechanism in which the first jaw is fixed to a fixed bar 18 of the parallelogram whereas the second jaw is fixed to a connecting rod 19 thereof. The fixed bar 18 and the connecting rod 19 are connected to one another by means of first and second rocker arms 20, 21, the rocker arm 20 being pivoted relative to the fixed bar 18 by a pneumatic jack 22.

[0017] The second jaw 16 is covered by a resilient pad 25 and, in the embodiment illustrated, has a substantially square shape in plan.

[0018] The first jaw 15 comprises a fork-shaped support 27 between prongs 27a, 27b and a base 28 of which an approximately square aperture 29 is formed and houses the first gripping member 13, preferably in a releasable, replaceable manner. In a preferred embodiment of the invention, the first gripping member 13 is, interchangeably, a pneumatic suction device 30 or a mechanical gripping device 33, for example, with needles, with an adhesive surface, or covered with hooks such as those typically present in pull fastenings of the type known by the registered trade mark VELCRO (TM). The pneumatic suction device 30 has appendages 30a, by means of which it is housed and guided between the prongs 27a, 27b, and a perforated suction surface 30b communicating with a manifold 30c connected to an air-suction hose. The mechanical gripping device 33 is preferably movable away from and towards the aperture 29, by means of a jack actuator 32, between an operative position in which the active surface of the device 33 is at the level of the lower surfaces of the prongs 27a, 27b

and a detachment position of the device 33 in which it is moved away from the prongs 27a, 27b which act as reaction members to favour the detachment of the fabric gripped from the above-mentioned active surface when the movable jaw 16 is closed onto the fixed jaw 15.

[0019] The vertical mobility of the mechanical gripping device, is superfluous, however, in the case of the pneumatic suction device since the fabric can readily be detached by the reversal of the air-flow through the suction device 30.

[0020] Finally, a photocell or other similar presence detector, indicated 34, is mounted on the first jaw 15 to detect the gripping between the jaws 15, 16 of the piece to be manipulated.

[0021] With reference to Figures 10 to 12, a piece of a garment cut to the desired shape on a cutting table is indicated 50. The piece 50 is to be removed from a fabric off-cut, indicated 51, if possible without moving the off-cut so that other cut pieces lying on the cutting table can be identified and found by the picking-up device of the invention solely with reference to their positions relative to an origin point stored by the cutting apparatus.

[0022] In order to grip and subsequently manipulate the piece 50, after the Cartesian robot 4 has been positioned, the picking-up device 2 is driven in a manner such that each gripper 12 is disposed above the piece to be gripped with the perforated surface of the pneumatic suction device 30 substantially parallel to the plane of the cutting table. The cross member 3a is then lowered until the pneumatic suction devices 30 contact the piece to be picked up. Upon activation of the pneumatic suction device, the piece adheres to the perforated active surface of the suction device 30 with the desired lightness of contact and is lifted, together with the cross member 3a. The lifting of the cross member 3a is coordinated with a rotary movement of the mechanical wrist 6 in the direction shown by way of example in Figure 11, that is, about an axis substantially parallel to the plane of closure of the second gripping member (the mutually facing surfaces of the jaws 15, 16) so as to orient the closure plane in a manner consistent with the deformation of the piece gripped due to its own weight and to its mechanical characteristics during its lifting. This minimizes the tendency of the gripped fabric to become detached and improves the firmness of the grip of the pneumatic suction device in comparison with a simple vertical lifting movement of the fabric, ensuring that the fabric is held correctly until the operation of the second gripping members is complete.

[0023] These second gripping members are operated at the moment at which the lifting permits the closure movement of the jaws 15, 16. The geometry selected for the articulated parallelogram mechanism permits a notably small travel of the movable jaw 16 in the direction perpendicular to the plane of the first fixed jaw 15, enabling the jaws to be closed after a very limited lifting of the piece. The jack 22 moves the rocker arm 20 so that the second jaw 16 is closed onto the first jaw 15. It

should be noted that the second jaw has a relatively extensive active surface so as not to damage the fabric being handled. The surface of the first jaw is also extensive, particularly if it is supplemented by the surface of the first gripper, so that even the most delicate fabrics can be manipulated with complete safety and with relatively low closure pressures between the jaws.

[0024] Once the pincer is closed and possibly detached from the piece, the mechanical gripping device 33 continues the desired movement by means of the jack 32, possibly with the subjection of the mechanical wrist 6 to a rotary-translational movement resulting in a rotary-translational movement of the two grippers 12, favouring the spontaneous detachment of the piece 50 from the offcut 51 without causing undesired displacements thereof.

[0025] With this technique for collecting the piece from the cutting table, the cut piece is advantageously detached from the production off-cut vertically, cancelling out the effect of entrainment of the piece and of the off-cut, which may assume a certain importance according to the material and the geometry of the cut piece.

[0026] Amongst the main advantages of the invention, the following should be noted:

- the first gripping member is required, before the intervention of the second gripping member, to lift only the edge of the piece gripped (that is, a minimal mass), every subsequent lifting effect being supported entirely by the second gripping member,
- the picking-up device is adaptable to various materials and different geometries by virtue of the interchangeability of the first gripping members and of the wide adaptability of the second gripping members,
- the movements of the device, in comparison with known devices with articulated arms, are compact and simple,
- control and coordination of the picking-up device is facilitated because the movements of several grippers mounted on the same cross-member can be coordinated,
- it is possible to pick up both large pieces with the use of several grippers spaced apart on the cross-member, and small pieces with the use even of a single device, or by moving the devices towards one another along the cross-member,
- it is possible simultaneously to pick up two or more pieces arranged symmetrically with respect to a line,
- the speed of closure of the jaws is increased and a minimum number of actuators is required for the operation of the gripper,
- a reliable grip is effected by virtue of the purely mechanical second gripping stage,
- a reliable grip is effected in the first gripping stage by virtue of the rotary-translational movement imparted to the picking-up device,

- it is possible to grip pieces even in their central regions, folding them into two portions one on top of the other.

Claims

1. A device for picking up and manipulating sheet-like, flexible objects, particularly expensive fabrics, including at least one gripper (12) comprising a first gripping member (13) which can adhere by contact to a face of the object to be picked up and a second gripping member (14) which can press the object gripped against the first gripping member (13) and keep it pressed in a firmly gripped condition by acting on the opposite face of the object to be picked up, **characterized in that** the second gripping member (14) is formed as a pincer with a first jaw (15) carrying the first gripping member and a second jaw (16) movable away from and towards the first jaw (15).
2. A device according to Claim 1 in which the second jaw (16) is associated with an actuator which can implement a predefined relative motion between the jaws (15, 16) comprising a translational movement and simultaneous progressive closure of the second jaw (16) onto the first (15), the jaws being kept substantially parallel to one another.
3. A device according to Claim 1 or Claim 2, in which the actuator comprises an articulated parallelogram mechanism, the first jaw (15) being stationary relative to a fixed bar (18) of the parallelogram and the second jaw (16) being mounted on a connecting rod (19) of the parallelogram.
4. A device according to one or more of the preceding claims, in which the at least one gripper (12) is guided on a cross-member (3a) so as to be translatable and adjustable along the cross-member, and translational drive means (8, 11) are provided for moving the at least one gripper (12) along the cross-member (3a).
5. A device according to Claim 4, in which two or more grippers (12) are provided on the same cross-member (3a).
6. A device according to one or more of the preceding claims, in which the at least one gripper (12) is mounted on a mechanical wrist (6) articulated about a first axis substantially parallel to the plane of closure of the jaws (15, 16), the wrist being driven for rotation about the said axis so as to orient the closure plane in a manner consistent with the deformation of the object gripped due to the object's own weight, during the lifting thereof.

7. A device according to one or more of the preceding claims, in which the first jaw (15) comprises an aperture (29) through which the first gripping member (13) acts. 5
8. A device according to Claim 7, in which the first jaw (15) comprises a fork-like element (27), between prongs (27a, 27b) of which the aperture (29) is defined. 10
9. A device according to Claim 7 or Claim 8, in which the first gripping member (13) is selected from a pneumatic suction device (30) and a mechanical gripping device (33), for example, with needles, with an adhesive surface, or the like. 15
10. A device according to Claim 9, in which the first gripping member (13) is associated releasably with the first jaw (15) and is, interchangeably, the mechanical gripping device (33) and the pneumatic suction member (30). 20
11. A device according to one or more of Claims 8 to 10, in which respective active surfaces of the first jaw, against which the second jaw is urged upon closure, are defined on at least one prong (27a, 27b) and a base of the fork-like element. 25
12. A method of picking up and manipulating sheet-like, flexible objects, particularly expensive fabrics, including the steps of causing a first gripping member (13) of at least one gripper (12) to adhere by contact to a face of the object to be gripped, lifting the object by means of the first gripping member and subsequently pressing the object gripped against the first gripping member (13) and keeping the object pressed in a firmly gripped condition by acting on the opposite face of the object to be picked up, **characterized in that** the lifting by means of the first gripping member (13) is limited purely to an edge of the object to be picked up, the remaining lifting and/or manipulation of the object being effected by the operation of a second gripping member (14). 30
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13. A method according to Claim 12, in which the at least one gripper (12) is mounted on a mechanical wrist (6) articulated about an axis substantially parallel to the plane of closure of the jaws (15, 16) of the second gripping member (14), **characterized in that**, during the lifting at least of the edge of the object to be picked up, the wrist (6) is rotated about the axis so as to orient the closure plane in a manner consistent with the deformation of the object gripped due to its own weight and/or to the mechanical characteristics of the object, during the lifting thereof. 45
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Patentansprüche

1. Vorrichtung zum Aufnehmen und Handhaben von bogenartigen, flexiblen Objekten, insbesondere von teuren Tuchen, mit wenigstens einem Greifer (12), umfassend ein erstes Greifelement (13), welches durch Kontakt mit einer Fläche des aufzunehmenden Objektes haften kann, und ein zweites Greifelement (14), welches das ergriffene Objekt gegen- ' das erste Greifelement (13) andrücken und dieses durch Einwirken auf die entgegengesetzte Fläche des aufzunehmenden Objektes in einem sicher ergriffenen Zustand angedrückt halten kann, **dadurch gekennzeichnet, daß** das zweite Greifelement (14) als eine Klemmvorrichtung ausgebildet ist mit einer ersten Klemmbacke (15), die das erste Greifelement trägt, sowie einer zweiten Klemmbacke (16), die von der ersten Klemmbacke (15) fort und zu dieser hin bewegbar ist.
2. Vorrichtung nach Anspruch 1, bei welcher der zweiten Klemmbacke (16) ein Stellantrieb zugeordnet ist, der eine vorbestimmte Relativbewegung zwischen den Klemmbacken (15, 16) bewirken kann, umfassend eine Translationsbewegung und gleichzeitige progressive Schließung der zweiten Klemmbacke (16) gegenüber der ersten (15), wobei die Klemmbacken im wesentlichen parallel zueinander gehalten werden.
3. Vorrichtung nach Anspruch 1 oder 2, bei welcher der Stellantrieb einen Gelenkparallelogramm-Mechanismus umfaßt, wobei die erste Klemmbacke (15) relativ zu einem festen Riegel (18) des Parallelogramms stationär ist, und die zweite Klemmbacke (16) an einer Verbindungsstange des Parallelogramms montiert ist.
4. Vorrichtung nach einem oder mehreren der vorangehenden Ansprüche, bei welcher der wenigstens eine Greifer (12) an einem Querträger (3a) so geführt ist, daß er entlang dem Querträger translatorisch verstellbar und einstellbar ist, und bei welcher Translations-Antriebsmittel (8, 11) vorgesehen sind, um den wenigstens einen Greifer (12) entlang dem Querträger (3a) zu bewegen.
5. Vorrichtung nach Anspruch 4, bei welcher zwei oder mehr Greifer (12) an dem gleichen Querträger (3a) angeordnet sind.
6. Vorrichtung nach einem oder mehreren der vorangehenden Ansprüche, bei welcher der wenigstens eine Greifer (12) an einer mechanischen Gelenkanordnung (6) montiert ist, die um eine erste, im wesentlichen parallel zu der Schließebene der Klemmbacken (15, 16) angeordnete Achse gelenkig gelagert ist, wobei die Gelenkanordnung zu einer Dre-

hung um die genannte Achse angetrieben wird, um die Schließebene in einer Weise zu orientieren, daß diese der Verformung des ergriffenen Objektes infolge des Eigengewichtes dieses Objektes während des Anhebens desselben entspricht.

7. Vorrichtung nach einem oder mehreren der vorangehenden Ansprüche, bei welcher die erste Klemmbacke (15) eine Öffnung (29) aufweist, durch die hindurch das erste Greifelement (13) wirksam wird. 10
8. Vorrichtung nach Anspruch 7, bei welcher die erste Klemmbacke (15) ein gabelartiges Element (27) umfaßt, zwischen deren Zinken (27a, 27b) die Öffnung (29) definiert ist.
9. Vorrichtung nach Anspruch 7 oder Anspruch 8, bei welcher als erstes Greifelement (13) eine pneumatische Saugvorrichtung (30) bzw. eine mechanische Greifvorrichtung (33) beispielsweise mit Nadeln, mit einer Haftfläche oder dergleichen gewählt wird.
10. Vorrichtung nach Anspruch 9, bei welcher das erste Greifelement (13) der ersten Klemmbacke (15) lösbar zugeordnet ist und in austauschbarer Weise durch die mechanische Greifvorrichtung (33) bzw. das pneumatische Saugelement (30) gebildet wird. 25
11. Vorrichtung nach einem oder mehreren der Ansprüche 8 bis 10, bei welcher jeweilige aktive Flächen der ersten Klemmbacke, gegen die zweite Klemmbacke beim Schließen angedrückt wird, an wenigstens einem Zinken (27a, 27b) und einer Basis des gabelartigen Elementes gebildet sind. 30
12. Verfahren zum Aufnehmen und Handhaben von bogenartigen, flexiblen Objekten, insbesondere von teuren Tuchen, umfassend die Schritte: Veranlassen eines ersten Greifelementes (13) eines Greifers wenigstens (12), durch Kontakt an einer Fläche des zu greifenden Objektes zu haften; Anheben des Objektes mittels des ersten Greifelementes und anschließendes Andrücken des ergriffenen Objektes gegen das erste Greifelement (13) sowie Halten des angedrückten Objektes in einem sicher ergriffenen Zustand durch Einwirken auf die entgegengesetzte Fläche des aufzunehmenden Objektes, **dadurch gekennzeichnet, daß** das Anheben mittels des ersten Greifelementes (13) auf lediglich eine Kante des aufzunehmenden Objektes 35 40 45 50 55
13. Verfahren nach Anspruch 12, bei welchem der wenigstens eine Greifer (12) an einer mechanischen Gelenkanordnung (6) montiert ist, die um eine Ach-

se gelenkig gelagert ist, die im wesentlichen parallel zu der Schließebene der Klemmbacken (15, 16) des zweiten Greifelementes (14) angeordnet ist, **dadurch gekennzeichnet, daß** während des Anhebens von wenigstens der Kante des aufzunehmenden Objektes die Gelenkanordnung (6) um diese Achse so verschwenkt wird, daß die Schließebene in einer Weise orientiert wird, daß diese der Verformung des ergriffenen Objektes infolge von dessen Eigengewicht und/oder der mechanischen Eigenschaften des Objektes während des Anhebens desselben entspricht.

15 Revendications

1. Appareil de prélèvement et de manipulation d'objets souples en forme de feuille, notamment d'étoffes coûteuses, comprenant au moins un dispositif de saisie (12) comprenant un premier organe de saisie (13) qui peut adhérer par contact à une face de l'objet à saisir, et un second organe de saisie (14) qui peut exercer une pression sur l'objet saisi contre le premier organe de saisie (13) et le maintenir poussé à un état fermement serré par action sur la face opposée de l'objet à saisir, **caractérisé en ce que** le second organe de saisie (14) est fo=6 par un organe de pincement ayant une première mâchoire (15) portant le premier organe de saisie et une seconde mâchoire (16) mobile afin qu'elle s'éloigne et se rapproche de la première mâchoire (15).
2. Appareil selon la revendication 1, dans lequel la seconde mâchoire (16) est associée à un organe de manoeuvre qui peut assurer un mouvement relatif prédéterminé entre les mâchoires (15, 16), ce mouvement comprenant un mouvement de translation et une fermeture progressive simultanée de la seconde mâchoire (16) sur la première (15), les mâchoires étant maintenues pratiquement parallèles l'une à l'autre.
3. Appareil selon la revendication 1 ou 2, dans lequel l'organe de manoeuvre comporte un mécanisme en parallélogramme articulé, la première mâchoire (15) étant fixe par rapport à une barre fixe (18) du parallélogramme et la seconde mâchoire (16) étant montée sur une tige (19) de liaison du parallélogramme.
4. Appareil selon l'une ou plusieurs des revendications précédentes, dans lequel un dispositif de saisie au moins (12) est guidé sur une traverse (3a) afin qu'il puisse être déplacé en translation et réglé le long de la traverse, et un dispositif (8, 11) d'entraînement en translation est destiné à déplacer le dispositif de saisie au moins (12) le long de la tra-

verse (3a).

5. Appareil selon la revendication 4, dans lequel au moins deux dispositifs de saisie (12) sont disposés sur la même traverse (3a). 5
6. Appareil selon une ou plusieurs des revendications précédentes, dans lequel le dispositif de saisie au moins (12) est monté sur un poignet mécanique (6) articulé autour d'un premier axe pratiquement parallèle au plan de fermeture des mâchoires (15, 16), le poignet étant entraîné en rotation autour dudit axe afin qu'il oriente le plan de fermeture d'une manière correspondant à la déformation de l'objet saisi sous l'action du propre poids de l'objet, pendant son soulèvement. 10 15
7. Appareil selon une ou plusieurs des revendications précédentes, dans lequel la première mâchoire (15) a un orifice (29) par lequel agit le premier organe de saisie (13). 20
8. Appareil selon la revendication 7, dans lequel la première mâchoire (15) comprend un élément en fourche de fourche (27) entre les dents (27a, 27b) duquel est délimité l'orifice (29). 25
9. Appareil selon la revendication 7 ou 8, dans lequel le premier organe de saisie (13) est sélectionné parmi un dispositif pneumatique d'aspiration (30) et un dispositif mécanique de saisie (33), par exemple ayant des aiguilles, une surface adhésive ou analogue. 30
10. Appareil selon la revendication 9, dans lequel le premier organe de saisie (13) est associé de façon amovible à la première mâchoire (15) et constitue de manière interchangeable le dispositif mécanique de saisie (33) et l'organe pneumatique d'aspiration (30). 35 40
11. Appareil selon une ou plusieurs des revendications 8 à 10, dans lequel des surfaces actives respectives de la première mâchoire, contre lesquelles la seconde mâchoire est poussée lors de la fermeture, sont délimitées sur au moins une dent (27a, 27b) et une base de l'élément en forme de fourche. 45
12. Procédé de prélèvement et de manipulation d'objets souples en forme de feuille, notamment d'étoffes coûteuses, comprenant les étapes suivantes : l'adhérence d'un premier organe de saisie (13) d'un dispositif de saisie (12) par contact avec une face de l'objet à saisir, le soulèvement de l'objet à l'aide du premier organe de saisie, puis l'application d'une pression à l'objet saisi contre le premier organe de saisie (13) et le maintien de l'objet poussé à un état fermement serré par action sur la face opposée de 50 55

l'objet à saisir, **caractérisé en ce que** le soulèvement par le premier organe de saisie (13) est purement limité à un bord de l'objet à saisir, le soulèvement et/ou la manipulation restant de l'objet étant réalisé par manœuvre d'un second organe de saisie (14).

13. Procédé selon la revendication 12, dans lequel le dispositif de saisie au moins (12) est monté sur un poignet mécanique (6) articulé autour d'un axe pratiquement parallèle au plan de fermeture des mâchoires (15, 16) du second organe de saisie (14), **caractérisé en ce que**, pendant le soulèvement du bord de l'objet à saisir au moins, le poignet (6) est tourné autour de l'axe afin qu'il oriente le plan de fermeture d'une manière correspondant à la déformation de l'objet saisi sous l'action de son propre poids et/ou aux caractéristiques mécaniques de l'objet, pendant le soulèvement de celui-ci.









