



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.08.2020 Bulletin 2020/35

(51) Int Cl.:
D06H 7/00 (2006.01) **B26D 5/00 (2006.01)**
D06H 7/24 (2006.01)

(21) Application number: **19158072.9**

(22) Date of filing: **19.02.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR
 Designated Extension States:
BA ME
 Designated Validation States:
KH MA MD TN

(71) Applicant: **Comelz S.p.A.**
27029 Vigevano (IT)
 (72) Inventor: **CORSICO PICCOLINO, Alessandro**
27029 Vigevano (PV) (IT)
 (74) Representative: **Botti, Mario**
Botti & Ferrari S.r.l.
Via Cappellini, 11
20124 Milano (IT)

(54) **APPARATUS FOR CUTTING OF SHEET MATERIAL WITH ENHANCED CUTTING HEADS' DISPLACEMENT SYSTEM**

(57) Apparatus (1) for cutting at least one sheet (2) of material, comprising:

- conveying means (6) adapted to feed the sheet (2) into a cutting area (C) along a longitudinal direction;
- a crosspiece (18) above said cutting area (C);
- at least one first cutting head (8a) and one second cutting head;
- a cutting heads' displacement system (8a; 8b) above the cutting area (C), comprising at least:
- one first upper carriage (19a) for the first cutting head

(8a) and one second upper carriage for the second cutting head (8b), the first and the second upper carriages (19a) being both supported by said crosspiece (18) and translatable with respect thereto along a transversal direction; the first upper carriage (19a) being constrained to one or more first guides (24a; 24'a) of the crosspiece (18); the second upper carriage being constrained to one or more second guides (24b; 24'b) of the crosspiece (18); said first guides (24a; 24'a) being parallel and distinct with respect to said second guides (24b; 24'b).

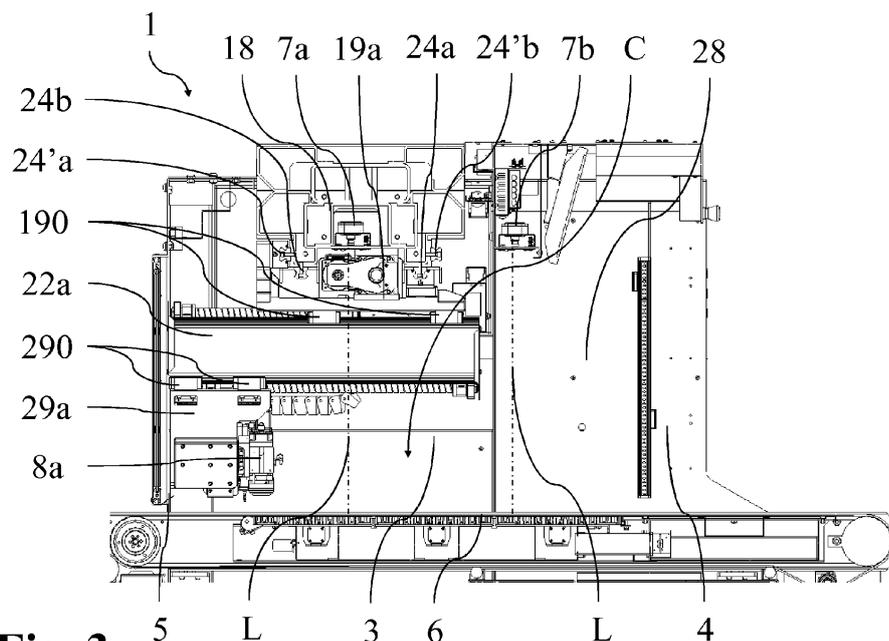


Fig. 3

Description

Field of application

[0001] The present invention relates to an apparatus for cutting sheet material, for instance for cutting fabrics for clothing and hide goods, footwear items, automotive and furnishing articles or hides, non-woven fabrics, synthetic materials and the like, and the following description is made with reference to this application field with the only purpose of simplifying the exposition thereof.

Prior art

[0002] As it is well known in this technical field, there are apparatuses capable of performing the automated cutting of sheets of material according to a predefined cutting pattern, the material to be cut may be for instance hide, a fabric, a non-woven fabric, a synthetic material and the like.

[0003] These apparatuses are equipped with a conveyor belt capable of moving the sheet to be cut through a cutting area, above which one or more movable cutting heads work.

[0004] Said movable cutting heads, electronically controlled to obtain the desired cutting pattern, may generally be translated both along a sheet-forward longitudinal axis X and along a transversal axis Y; furthermore, they may be lowered and raised along a vertical axis Z.

[0005] The cutting heads' displacement system may take up different conformations: for instance, it may take advantage of a crosspiece, which is movable along the forward axis, or it may be provided with an assembly having drives along the three axes which is entirely suspended from a fixed crosspiece.

[0006] However, the cutting apparatuses known to date, although substantially meeting the industry needs, have some drawbacks not solved so far, which are mainly linked to the dimensions of the cutting heads' displacement system and to the working area reachable by the latter.

[0007] One of said drawbacks derives from the use of two or more cutting heads, both supported by a unique crosspiece and movable along the extension thereof. Although advantageous for the working speeds it allows, said configuration limits the possibility of relative approaching between the heads, due to the interference between the respective support carriages mounted on the upper crosspiece.

[0008] A further drawback is the large dimensions and considerable weight of the displacement system, especially when the design choice of the fixed crosspiece is preferred - for instance for making a cutting apparatus with closed cutting tunnel or chamber.

[0009] Another drawback relates to the extension along the longitudinal axis of the working area of the cutting heads. If the cutting head is enclosed in a cutting chamber or in a closed tunnel, considering the dimen-

sions of the head itself, indeed it is not possible to reach at least one of the ends of the chamber with the cutting tool.

[0010] Still with reference to closed-chamber cutting apparatuses, another drawback derives from the positioning of the possible artificial vision system upstream of said chamber, to avoid interferences with the cutting heads and their displacement system inside the chamber. By the way, the upstream detection of the material image, although acceptable in most applications, however, introduces a margin of error in the successive cutting operations. The conveyor belt, while conveying the material into the chamber, in fact inevitably causes minimal deformations and/or slippage of the material with respect to the belt itself, so that the surface whereon the cutting is performed is slightly different from the preliminarily acquired one.

[0011] Therefore, the technical problem of the present invention is to provide an apparatus for cutting sheets which solves at least some of the prior art drawbacks, and which in particular allows displacing the cutting heads in a large working area through a robust mechanical system of limited weight and dimensions.

Summary of the invention

[0012] The above technical problem is solved by an apparatus for cutting at least one sheet material, comprising:

- conveying means adapted to feed the sheet into a cutting area along a longitudinal direction;
- a crosspiece above said cutting area;
- at least one first cutting head and one second cutting head;
- a cutting heads' displacement system above the cutting area, comprising at least:
 - one first upper carriage for the first cutting head and one second upper carriage for the second cutting head, the first and the second upper carriages being both supported by said crosspiece and translatable with respect thereto along a transversal direction; the first upper carriage being constrained to one or more first guides of the crosspiece; the second upper carriage being constrained to one or more second guides of the crosspiece; said first guides being parallel and distinct with respect to said second guides.

[0013] The solution idea underlying the present invention thus derives from the adoption of a load-bearing crosspiece which supports the cutting heads and the displacement system thereof, wherein the elements directly supported by the crosspiece - i.e. the upper carriages - although sharing the same trajectory, slide on distinct

rails or guides. In this way it is possible to provide a partial interpenetration of the two upper carriages in their transversal movement. The approaching of the carriages with partial interpenetration allows the cutting heads, thereby supported, to be substantially side by side to each other, without weakening the support structure, i.e. without giving up the necessary transversal extension of the attachment sliders of the upper carriages.

[0014] Preferably, in fact said first and said second upper carriages comprise at least one first slider constrained to the at least one first guide and at least one second slider constrained to the at least one second guide.

[0015] The sliders may be constrained to the guides through dovetail counter-shaped profiles or other analogous profiles; preferably, but not necessarily, the guides are rail-shaped, i.e. they provide the male portion of the profile, whereas the sliders provide the female portion of the profile.

[0016] As previously mentioned, for reasons of structural solidity, at least one of said first and second sliders may develop at least partially in a protruding manner, along the transversal direction, with respect to a main body of the respective upper carriage; said first and second upper carriages being configured so that, in a position in which they are relatively side by side to each other, the protruding development of the slider overlaps transversally - i.e.: it slides side by side without interfering on the longitudinal plane - the main body of the other upper carriage.

[0017] Preferably, the sliders are mounted at the two opposite ends of transversal supports and completely or mostly protrude with respect to the below main body of the carriage.

[0018] Preferably, the first guides are at least two; and the second guides are at least two. The choice of at least two guides gives the drive structural solidity and allows a correct download of the suspended masses without generating torques that could cause a warping of the guides and/or of the sliders.

[0019] Preferably, the first guides and the second guides are alternated to each other along a longitudinal direction. Thus, each upper carriage will have at least one slider constrained to an internal guide - i.e. arranged between other two guides - and at least one slider constrained to an outer guide. In the configuration in which the carriages are side by side to each other, the internal slider will be able to insert into a volume suitable left free in the structure of the other carriage; instead, the outer slider will preferably arrange at the side of the other carriage.

[0020] In a preferred embodiment, said first guides comprise a first horizontal guide and a first vertical guide, said second guides comprise a second horizontal guide and a second vertical guide; the first and second horizontal guides being associated with a lower face of the crosspiece; the first and second vertical guides being associated with opposite side faces of the crosspiece.

[0021] Conversely, the sliders associated with the guides will also be vertical and horizontal; thus, each slider may advantageously be L-shaped, with a horizontal base on which the at least one horizontal slider is mounted and a short end vertical wall, on which the at least one vertical slider is mounted.

[0022] The displacement of the first and of the second upper carriages with respect to the crosspiece is preferably actuated by screw/nut screw systems comprising a transversal screw which is fixed with respect to the crosspiece and a first and a second rotary nut, both engaged to said transversal screw, placed on the first and second upper carriages, respectively.

[0023] The cutting heads' displacement system may comprise, in addition to the above upper carriages: a first arm and a first lower carriage which define, together with said first upper carriage, a kinematic structure for the displacement of the first cutting head; a second arm and a second lower carriage which define, together with said second upper carriage, a kinematic structure for the displacement of the second cutting head.

[0024] Said first and second arms are preferably mounted below the first and second upper carriages, respectively, and are translatable with respect thereto along a longitudinal direction, whereas said first and second lower carriages are mounted below the first and second arms, respectively, and are translatable with respect thereto along the same longitudinal direction.

[0025] In this way, the displacement along the longitudinal axis Y of the cutting head is defined by the sum of two displacements, the one of the arm with respect to the upper carriage and the one of the lower carriage with respect to the arm. Said expedient allows an overall travel of the cutting head along the longitudinal axis Y which is significantly greater than the longitudinal length of the arm.

[0026] Said first and second arms preferably have a prevalent extension along the longitudinal direction and comprise upper longitudinal guides and lower longitudinal guides engaged with lower sliders of the upper first and second carriages and with upper sliders of the lower first and second carriages, respectively.

[0027] The transversal movements of the first and second arms with respect to the upper first and second carriages and of the lower first and second carriages with respect to the first and second arms are preferably actuated by means of screw/nut screw systems.

[0028] Cable bundles are also preferably provided, which are suitably inserted in drag chains and which connect the upper carriage, the arm and the lower carriage.

[0029] The first and second lower carriages define support shelves for the first and second cutting heads respectively; a drive is provided along the vertical axis Z which allows the head to be lowered in the working position and to be raised in the rest position.

[0030] Furthermore, it can be provided that at least one of said lower carriages - preferably both - may be alternatively positioned in a first configuration, in which the

cutting head faces towards a sheet-feeding inlet, and in a second configuration, in which the cutting head faces towards the opposite direction.

[0031] Thanks to said expedient it is possible to select according to the needs a different working area for the cutting head, close to the inlet or close to the outlet.

[0032] The re-positioning of the lower carriage may be carried out manually by the operator, for instance by extracting the element in the direction of the lower longitudinal guides and re-inserting it in the inverted position. The crosspiece is preferably a fixed crosspiece with respect to the frame of the cutting apparatus. Still preferably, the apparatus comprises a cutting chamber - i.e. a closed and delimited volume at least laterally and above - within which the cutting area is defined.

[0033] The cutting apparatus according to the invention may further optionally comprise an artificial vision system intended for the acquisition of an image of the sheet in order to plan the cutting operations thereon; said artificial vision system may advantageously comprise at least one image acquisition device housed in an area inside said crosspiece and facing the below cutting area.

[0034] In this case the load-bearing crosspiece, in addition to performing the support function of the entire cutting assembly, becomes an ideal support for the image acquisition devices inside the cutting chamber.

[0035] The crosspiece may conveniently be made of a metal section, itself hollow, in which suitable holes are made to arrange the image acquisition devices.

[0036] The arrangement of the image acquisition devices inside the crosspiece takes advantage of the fact that the below cutting assembly, although moving below the crosspiece in the working configuration itself and inevitably hindering a sight line between the image acquisition device and a cutting area, can be brought back to a rest configuration - specifically: with the carriages positioned in respective and opposite lateral end-stroke positions - in which said sight line is not obstructed.

[0037] Preferably, the image acquisition devices are in a number greater than two, for example five, aligned along the transversal direction.

[0038] The artificial vision system may further comprise an upstream image acquisition device, still placed within said cutting chamber, for instance associated with the upper part of a front portion of the cutting chamber. The artificial vision system may still comprise one or more image acquisition devices upstream of the cutting chamber, in combination or alternatively to those arranged in the front portion of the chamber.

[0039] The upstream devices are preferably a plurality, in a number and configuration equal to the downstream image acquisition devices.

[0040] Therefore, the various image acquisition devices are advantageously arranged as a grid or matrix and may thus cover a rectangular surface which ranges and substantially corresponds to the perimeter dimension of the cutting chamber.

[0041] It is noted that the upstream devices may co-

operate with the downstream devices to realize a detailed and complete image of the below sheet to be cut; anyway, an advantageous independent use thereof is not excluded, for instance to perform an image acquisition during the cutting operations which interfere with the vision field of the downstream devices.

[0042] The image acquisition devices, be they downstream or upstream, may be a video camera or camera of the digital type, for instance of the CCD type. Moreover, they may incorporate a processor adapted to process a file of image data in a format processable by a control unit of the apparatus.

[0043] The features and advantages of the apparatus according to the invention will become apparent from the following description of an embodiment thereof given by way of non-limiting example with reference to the accompanying drawings.

Brief description of the drawings

[0044] In those drawings:

- figure 1 shows a perspective view of the apparatus according to the present invention in an operating configuration;
- figure 2 shows a perspective view of the apparatus of figure 1, sectioned along a longitudinal plane thereof;
- figure 3 shows a sectional side view of the apparatus of figure 1;
- figure 4 shows an enlarged detail of figure 3, relating to a crosspiece of the apparatus and to a carriage therewith associated;
- figure 5 shows a perspective view of two movable carriages of the apparatus of figure 1, in a first relative configuration;
- figure 6 shows a top view of the other one of the two movable carriages in the configuration of figure 4;
- figure 7 shows a perspective view of the two movable carriages of figure 4, in a second relative configuration;
- figure 8 shows a top view of the two movable carriages in the configuration of figure 6;
- figure 9 shows a perspective view of the two movable carriages of figure 4, with an alternative mounting of the lower carriage which supports the cutting head.

Detailed description

[0045] With reference to those figures, an apparatus

according to the present invention is globally and schematically indicated with the reference number 1.

[0046] It is worth noting that, in the figures, the different elements are depicted in a schematic manner, their shape varying depending on the application desired. It is further noted that in the figures the same reference numbers refer to elements that are identical in shape or function.

[0047] The positional references used in the present description, including indications such as lower or upper, below or above, or similar phrases, always refer to the operating configuration shown in figure 1, and in no case must they be assigned a limiting value.

[0048] To facilitate the following description of the apparatus 1, three orthogonal directions corresponding to the three working axes of the cutting heads 8a; 8b of the machine are further identified by reference: a transversal direction X; a longitudinal direction Y - parallel to the forward direction of the sheet 2 inside the apparatus 1; finally, a vertical direction Z.

[0049] In its more general form, the apparatus 1 is adapted to process, and in particular to automatically cut, folding or flexible sheets 2 of materials, for instance fabrics for clothing items, leather goods, footwear items, automotive and furnishing articles or non-woven fabrics, hides, synthetic materials and the like.

[0050] In the context of the present invention, the term "sheet" indicates any element of any shape and material, having a substantially two-dimensional size and a certain thickness (generally reduced), which must be cut through the apparatus 1.

[0051] It is further noted that the apparatus may perform the cutting of a plurality of sheets stacked on top of each other, as it is known in the relevant field of the invention.

[0052] The apparatus 1 is thus a numerical control machine equipped with data and program memories. In particular, the apparatus 1 comprises a control unit including said memories and suitably programmed and responsible for the management and automatic control thereof. The control unit may be for instance an integrated computerized unit or may be external to the apparatus 1 and operatively connected thereto. Furthermore, the control unit may be a unique central unit or may comprise a plurality of local units.

[0053] In general, as illustrated in figure 1, the apparatus 1 of the present invention comprises a frame F, made for example of a metal material, which supports and encloses the main components of thereof.

[0054] More particularly, said frame F comprises a bed 25 above which two flanks 26 and a covering 27 rise; these enclose a cutting chamber or working room 3 inside which the processing of the sheet 2 occurs. The cutting chamber 3 extends in the longitudinal direction Y between an inlet 4, through which the sheet 2 is fed, and an outlet 5, from which the cut portions of said sheet 2 are recovered 2.

[0055] Furthermore, the frame F defines a raised por-

tion 28 of the cutting chamber 3, arranged at the inlet 4. In the present description and in the enclosed claims the cutting chamber 3 must be considered as that area or that area portion within which the successively defined cutting means evolve. In the present embodiment, the cutting heads 8a; 8b may displace and work in the entire cutting chamber 3, including the raised portion 28.

[0056] Furthermore, the apparatus 1 comprises a conveyor belt 6 which crosses in the longitudinal direction Y the cutting chamber 3 from the inlet 4 to the outlet 5 and is adapted to feed and carry the sheet 2 into said cutting chamber 3. Above the conveyor belt 6 and at the cutting chamber 3 a cutting area C, within which the cutting operations of the sheet 2 are performed, is defined.

[0057] Inside the cutting chamber 3 cutting means for cutting the sheet 2 are operating, said means not being limited to a particular type. By way of example, the cutting may occur through a blade, laser, water jet or in any other suitable way, even if cutting through a blade is the preferred option.

[0058] In particular, the cutting means comprise two cutting heads 8a; 8b, which are movable inside the cutting chamber 3 according to the axes defined by the above transversal, longitudinal and vertical directions X, Y and Z and specifically responsible for cutting the sheet 2. The number of the cutting heads may vary according to the specific processing needs of the apparatus.

[0059] It is noted that the above-mentioned frame F comprises a fixed portal having a load-bearing function, around which a non-load-bearing part, which defines the casing of the cutting chamber 3, develops. The fixed portal comprises two side shoulders and an upper crosspiece 18, which connects the two shoulders in the transversal direction X and is above the cutting chamber 3.

[0060] The two cutting heads 8a; 8b are therefore suspended, with interposition of a kinematic structure necessary for their displacement along the three Cartesian axes, to said crosspiece 18.

[0061] The two cutting heads 8a; 8b and the respective kinematic structures which support them are substantially identical and differ from each other just in the relative position - on the right side and on the left side, respectively - in which they are attached to the crosspiece 18.

[0062] It is noted that the same elements, relating to the first and second kinematic structures, are consistently identified in this document with the adjective 'first' or 'second', and take a final 'a' or 'b' respectively in their numerical reference.

[0063] In the following description, where a term is generally referred to the first or second kinematic structure, the ordinal adjective is omitted and both numerical references relating to the first and second structures are given.

[0064] The kinematic structure thus comprises, for each cutting head 8a; 8b: an upper carriage 19a; 19b associated below the crosspiece 18 and translatable with respect thereto along a transversal direction X; an arm 22a; 22b associated below the upper carriage 19a; 19b

and translatable with respect thereto along a longitudinal direction Y; and a lower carriage 29a; 29b translatable below the arm 22a; 22b along the longitudinal extension thereof (i.e., once again in the longitudinal direction Y). The cutting head 8a; 8b is supported by the lower carriage 29a; 29b, which acts as a support shelf and may be translated with respect thereto along the vertical axis Z.

[0065] The motion transmission to the different elements above described may occur in any known way; in the preferred embodiment herein described, screw and nut screw systems with or without ball recirculation are used, as it will become apparent from the following detailed description.

[0066] The upper carriage 19a; 19b comprises a base 30a; 30b, on which a rotary nut is arranged 32a; 32b which receives the motion, by belt drive, from an electric motor 31a; 31b side by side thereto. The rotary nut 32a; 32b engages above a transversal screw 33 which connects the two shoulders of the cutting chamber 3 and which runs below the crosspiece 18.

[0067] It is noticed that the transversal screw 33 is arranged in a spaced position with respect to a vertical median plane of the crosspiece 18 (in this case: downstream; but it could also be arranged upstream), for reasons which will become more apparent in the rest of the description.

[0068] The base 30a; 30b of the upper carriage 19a; 19b is supported by sliders 23a; 23'a; 23b; 23'b which are integral with and arranged at the two side ends of the base 30a; 30b itself. For each upper carriage 19a; 19b two pairs of sliders 23a; 23'a; 23b; 23'b are provided; the sliders of each pair are aligned to each other and mounted at the sides of a single transversal support associated with the base 30a; 30b. The transversal supports develop along the transversal direction X and extend in said direction, from both sides, even beyond the dimension of the base 30a; 30b.

[0069] The above sliders 23a; 23'a; 23b; 23'b are arranged to slidingly engage within respective guides 24a; 24'a; 24b; 24'b that are integral with the crosspiece 18.

[0070] It is worth noting that the first sliders 23a; 23'a and the second sliders 23b; 23'b slide above distinct first guides 24a; 24'a and second guides 24b; 24'b, even if the two upper carriages 19a; 19b move along the same path defined by the crosspiece 18.

[0071] The four guides 24a; 24'a; 24b; 24'b run parallel along the crosspiece 18, the first guides 24a; 24'a; being alternated with the second guides 24b; 24'b. The first upper carriage 19a is thus associated with the first and third guides, in order of longitudinal position, the second upper carriage 19b is associated with the second and fourth guides.

[0072] The use of different guides 24a; 24'a; 24b; 24'b allows bringing the bases 30a; 30b of the two upper carriages 19a; 19b in the transversal direction X into direct contact: in fact, as visible in the enclosed figures 7 and 8, the first sliders 23a, 23'a may be partially side by side to the second sliders 23b; 23'b, so that the side projec-

tions of the two elements do not interfere with each other.

[0073] In particular, in the preferred embodiment herein described, the bases 30a; 30b of the upper carriages 19a; 19b have L-conformations which are specular to each other, with a prevalent horizontal section and a short vertical section directed upwards. The transversal supports whereon the sliders 23a; 23'a; 23b; 23'b are mounted are thus horizontal and vertical, respectively. The sliders 23a; 23b, mounted on the horizontal support are hereinafter defined horizontal sliders 23a; 23b; as for the sliders 23'a; 23'b, mounted on the vertical support, are herein after defined vertical sliders 23'a; 23'b.

[0074] The guides 24a; 24'a; 24b; 24'b associated with the crosspiece 18 also have two different orientations: two horizontal guides 24a; 24b are mounted parallel below the crosspiece 18, whereas two vertical guides 24'a; 24'b are mounted on the two opposite side faces of the crosspiece 18. The sliders 23a, 23b of each single upper carriage 19a; 19b are associated with a horizontal guide 24a and with the vertical guide 24b respectively on the opposite face of the crosspiece 18.

[0075] In the preferred embodiment herein described, the sliders 23a; 23'a; 23b; 23'b and the guides 24a; 24'a; 24b; 24'b have dovetail female and male profiles respectively.

[0076] The arm 22a; 22b arranged below the upper carriage 19a; 19b has a substantially parallelepiped dimension with prevalent extension along the longitudinal direction Y. It has some upper guides 220 and some lower guides 221 adapted to allow the relative movement both of the upper carriage 19a; 19b - mounted on lower sliders 190 - and of the lower carriage 29 - mounted on upper sliders 290.

[0077] The upper guides 220 and the lower guides 221 are both two in number, and on each guide two sliders, which are aligned to each other, are inserted.

[0078] Both movements are obtained through a recirculating ball screw/nut screw system.

[0079] Power and signal cables connecting the various elements of the kinematic structure are provided, said cables being housed in a drag chain 35 which runs parallel to the arm 22a; 22b and forms, at the two opposite ends, a loop directed to the upper carriage 19a; 19b and a loop directed to the lower carriage 29a; 29b.

[0080] The lower carriage 29a; 29b of the kinematic structure, as previously mentioned, acts as support shelf for the cutting head 8a; 8b. It therefore carries said cutting head in a front or rear position with respect to the longitudinal direction Y.

[0081] Advantageously, to modify the working area of the cutting head 8a; 8b, it is possible to modify the orientation of said lower carriage 29a; 29b; the two alternative configurations are shown in figure 5 and in figure 9.

[0082] The orientation modification occurs by disassembly and subsequent reassembly of the lower carriage 29a; 29b with respect to the arm 22a; 22b.

[0083] The apparatus, in its preferred embodiment herein described, comprises an optional artificial vision

system which allows acquiring an image of the surface of the sheet 2 whereon the cutting operations are performed.

[0084] In particular, said artificial vision system comprises a plurality of image acquisition devices 7a, 7b arranged at the top and facing towards the sliding surface of the sheet 2 above the conveyor belt 6.

[0085] Specifically, the image acquisition devices 7a, 7b are cameras or video cameras configured to capture high resolution images of the sheet 2 surface.

[0086] In the embodiment herein described, the image acquisition devices 7a, 7b are divided into downstream image acquisition devices 7a, arranged in a portion downstream of the cutting chamber 3, and upstream image acquisition devices 7b, arranged in the raised portion 28 of the cutting chamber 3. All of the image acquisition devices face towards the cutting area C.

[0087] The downstream 7a and upwards 7b image acquisition devices cooperate to define a unique detailed image of the sheet 2 surface.

[0088] The image acquisition devices 7a, 7b are video cameras or cameras of the digital type, for instance CCD, and incorporate therein a processor that transforms and immediately makes an image data file available in a processable format by the control unit, for instance a JPEG format or the like.

[0089] It is noteworthy that the downstream image acquisition devices 7a are advantageously placed in an internal area 20 of the crosspiece 18 that supports the cutting assembly.

[0090] Indeed, as better visible in the detail of figure 4, the crosspiece 18 is at least centrally made of metal profiles, within which the internal area 20, which houses a suitable attachment box 34 for the downstream image acquisition devices 7a, is defined. On the lower face of the profile, which directly faces above the cutting chamber 3, a visual access opening 21 is provided, in the form of a simple drilling of the sheet, which opens a line of sight L from the respective acquisition device to the cutting area C.

[0091] The line of sight L of the downstream image acquisition device 7a is not hindered by the transversal screw 33, which runs downstream thereof.

[0092] Instead, the upper carriages 19a; 19b may obstruct the line of sight L of the cutting assembly, which are slidingly movable below the crosspiece 18. However, at least one rest position of the cutting assembly is advantageously provided, for instance with the upper carriages 19a; 19b positioned at the two transversal end-stroke positions respectively, in which the lines of sight L of all of the downstream image acquisition devices 7a are free.

[0093] The downstream image acquisition devices 7a - which, in the preferred embodiment herein described, are five in number - are aligned and distributed equidistant along the crosspiece 18.

[0094] The upstream image acquisition devices 7b are also housed in an area, suitably made from sheet metal

above the raised portion 28 of the cutting chamber 3. In the preferred embodiment herein described, the upstream devices 7b are five in number, aligned with each other and in transversal positions corresponding to that of the downstream devices 7a.

[0095] An advantage of the present invention lies in the extreme compactness, limited weights, constructive simplicity and robustness of the apparatus.

[0096] A related advantage is linked to the extreme versatility of the apparatus according to the present invention, which is able to perform each type of application, both those requiring high cutting speeds, and those requiring high precision, as well as being able to cut single hides, multilayered materials, and performing cuts such as the so-called trimming of already cut portions, and the like.

[0097] Still another advantage derives from the large working area reachable by the cutting heads and from the possibility of putting two heads side by side to each other at a relatively short distance, approximately less than 10 centimeters.

[0098] Still another advantage derives from the possibility of re-configuring the cutting heads by modifying the orientation thereof, so as to vary the working area by adopting the apparatus to different cutting needs.

[0099] Obviously, a skilled in the art, in order to meet particular needs and specification, can carry out several changes and modifications to the apparatus described above, all included in the protection scope of the invention as defined by the following claims.

Claims

1. Cutting apparatus (1) for cutting at least one sheet (2) of material, comprising:

- conveying means (6) adapted to feed the sheet (2) into a cutting area (C) along a longitudinal direction (Y);
- a crosspiece (18) above said cutting area (C);
- at least one first cutting head (8a) and one second cutting head (8b);
- a cutting heads' displacement system (8a; 8b) above the cutting area (C), comprising at least:
 - one first upper carriage (19a) for the first cutting head (8a) and one second upper carriage (19b) for the second cutting head (8b), the first and second upper carriages (19a; 19b) being both supported by said crosspiece (18) and translatable with respect thereto along a transversal direction (X); the first upper carriage (19a) being constrained to one or more first guides (24a; 24'a) of the crosspiece (18); the second upper carriage (19b) being constrained to one or more second guides (24b; 24'b) of the crosspiece (18); said first guides (24a; 24'a) being parallel and distinct with respect to said second guides

- (24b; 24'b).
2. Cutting apparatus (1) according to claim 1, wherein said first and second upper carriages (19a; 19b) comprise at least one first slider (23a; 23'a) constrained to the at least one first guide (24a; 24'a) and at least one second slider (23b; 23'b) constrained to the at least one second guide (24b; 24'b), respectively.
 3. Cutting apparatus (1) according to claim 2, wherein at least one of said first and second sliders (23a; 23'a; 23b; 23'b) develops at least partially in a protruding manner, along the transversal direction (X), with respect to a main body of the respective upper carriage (19a; 19b); said first and second upper carriages (19a; 19b) being configured in such a way that, in a position in which they are relatively side by side to each other, the protruding development of the slider (23a; 23'a; 23b; 23'b) transversally overlaps the main body of the other upper carriage (19a; 19b).
 4. Cutting apparatus (1) according to claim 3, wherein said first guides (24a; 24'a) are at least two; and wherein said second guides (24b; 24'b) are at least two.
 5. Cutting apparatus (1) according to claim 4, wherein said first guides (24a; 24'a) and said second guides ((24b; 24'b) are alternated to each other along the longitudinal direction (Y).
 6. Cutting apparatus (1) according to claim 5, wherein said first guides (24a; 24'a) comprise a first horizontal guide (24a) and a first vertical guide (24'a), said second guides (24b; 24'b) comprise a second horizontal guide (24b) and a second vertical guide (24'b); the first and second horizontal guides (24a; 24b) being associated with a lower face of the crosspiece (18); the first and second vertical guides (24'a; 24'b) being associated with opposing side faces of the crosspiece (18).
 7. Cutting apparatus (1) according to any one of the previous claims, wherein the displacement of the first and second upper carriages (19a; 19b) with respect to the crosspiece (18) is actuated by screw/nut screw systems comprising a transversal screw (33) which is fixed with respect to the crosspiece (18) and a first and a second revolving nuts (32a; 32b), both engaged to said transversal screw (33), arranged on the first and second upper carriages (19a; 19b), respectively.
 8. Cutting apparatus (1) according to one of the previous claims, wherein said cutting heads' displacement system further comprises: a first arm (22a) and a first lower carriage (29a) which define, together with said first upper carriage (19a), a kinematic structure for the displacement of the first cutting head (8a); a second arm (22b) and a second lower carriage (29b) which define, together with said second upper carriage (19b), a kinematic structure for the displacement of the second cutting head (8b).
 9. Cutting apparatus (1) according to claim 8, wherein said first and second arms (22a; 22b) are mounted below the first and the second upper carriages (19a; 19b), respectively, and are translatable with respect thereto along the longitudinal direction (Y), and wherein said first and second lower carriages (29a; 29b) are mounted below the first and second arms (22a; 22b), respectively, and are translatable with respect thereto along the same longitudinal direction (Y).
 10. Cutting apparatus (1) according to claim 9, wherein said first and second arms (22a; 22b) have a prevalent extension along the longitudinal direction (Y), and comprise upper longitudinal guides (220) and lower longitudinal guides (221) which are engaged with lower sliders (190) of the first and second upper carriages (19a; 19b) and with upper sliders (290) of the first and second lower carriages (29a; 29b), respectively.
 11. Cutting apparatus (1) according to one of claims 9-10, wherein the transversal movements of the first and second arms (22a; 22b) with respect to the first and second upper carriages (19a; 19b) and of the first and second lower carriages (29a; 29b) with respect to the first and second arms (22a; 22b) are actuated by means of screw/nut screw systems.
 12. Cutting apparatus (1) according to one of claims 8-11, wherein the first and second lower carriages (29a; 29b) define support shelves for the first and for the second cutting heads (8a; 8b) respectively, at least one of said lower carriages (29a; 29b) is alternatively arrangeable in a first configuration, in which the cutting head (8a; 8b) faces towards a sheet (2)-feeding inlet (4), and in a second configuration, in which the cutting head (8a; 8b) faces towards the opposite direction.
 13. Cutting apparatus (1) according to one of the previous claims, wherein said crosspiece (18) is a fixed crosspiece with respect to a frame (F) of the cutting apparatus (1).
 14. Cutting apparatus (1) according to claim 13, comprising a cutting chamber (3) within which the cutting area (C) is defined.
 15. Cutting apparatus (1) according to claim 14, further

comprising an artificial vision system intended to take an image of the sheet (2) for planning the cutting operations thereon; said artificial vision system comprising at least one image acquisition device (7a) housed in an area (20) inside said crosspiece (18) and facing towards the below cutting area (C).

10

15

20

25

30

35

40

45

50

55

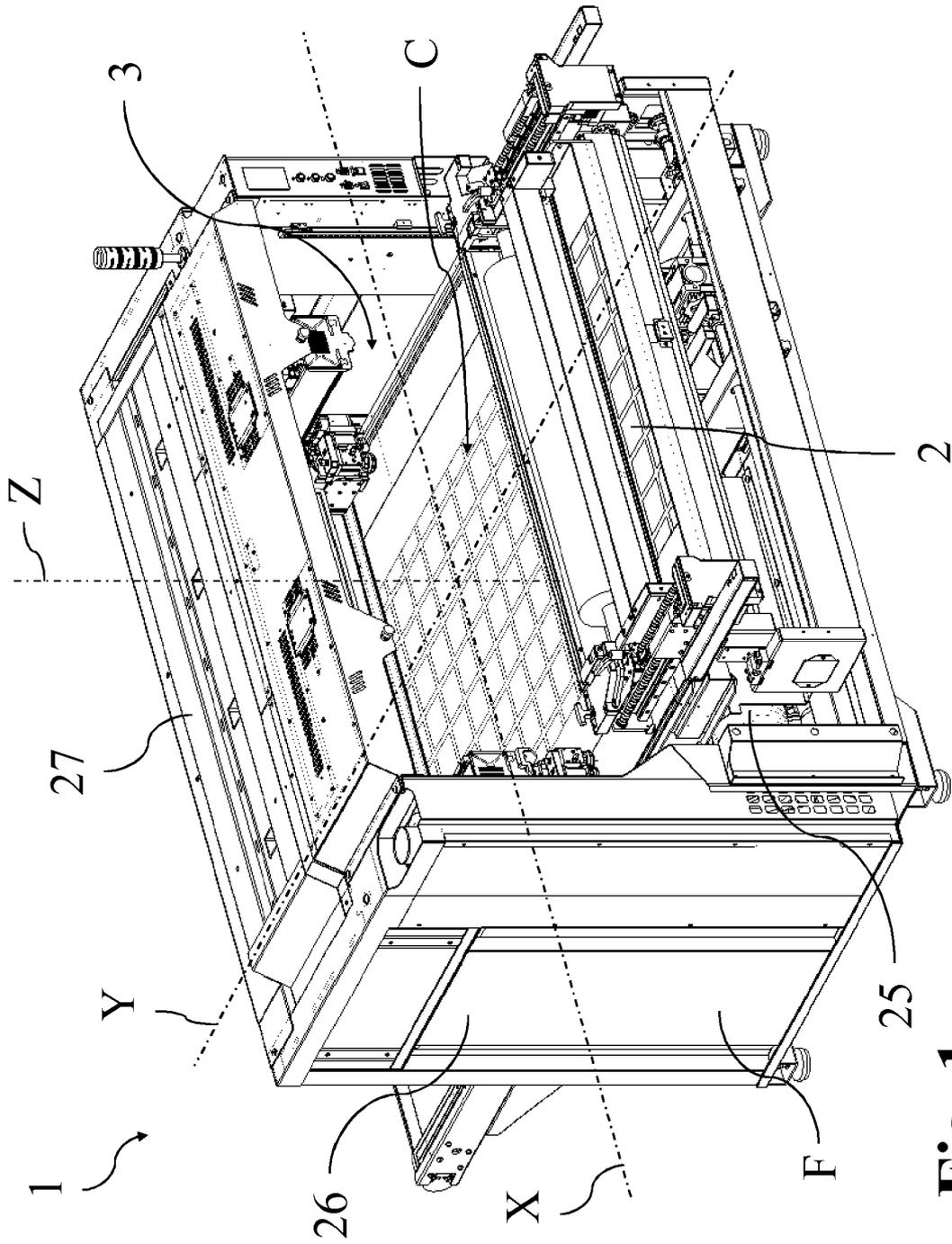


Fig. 1

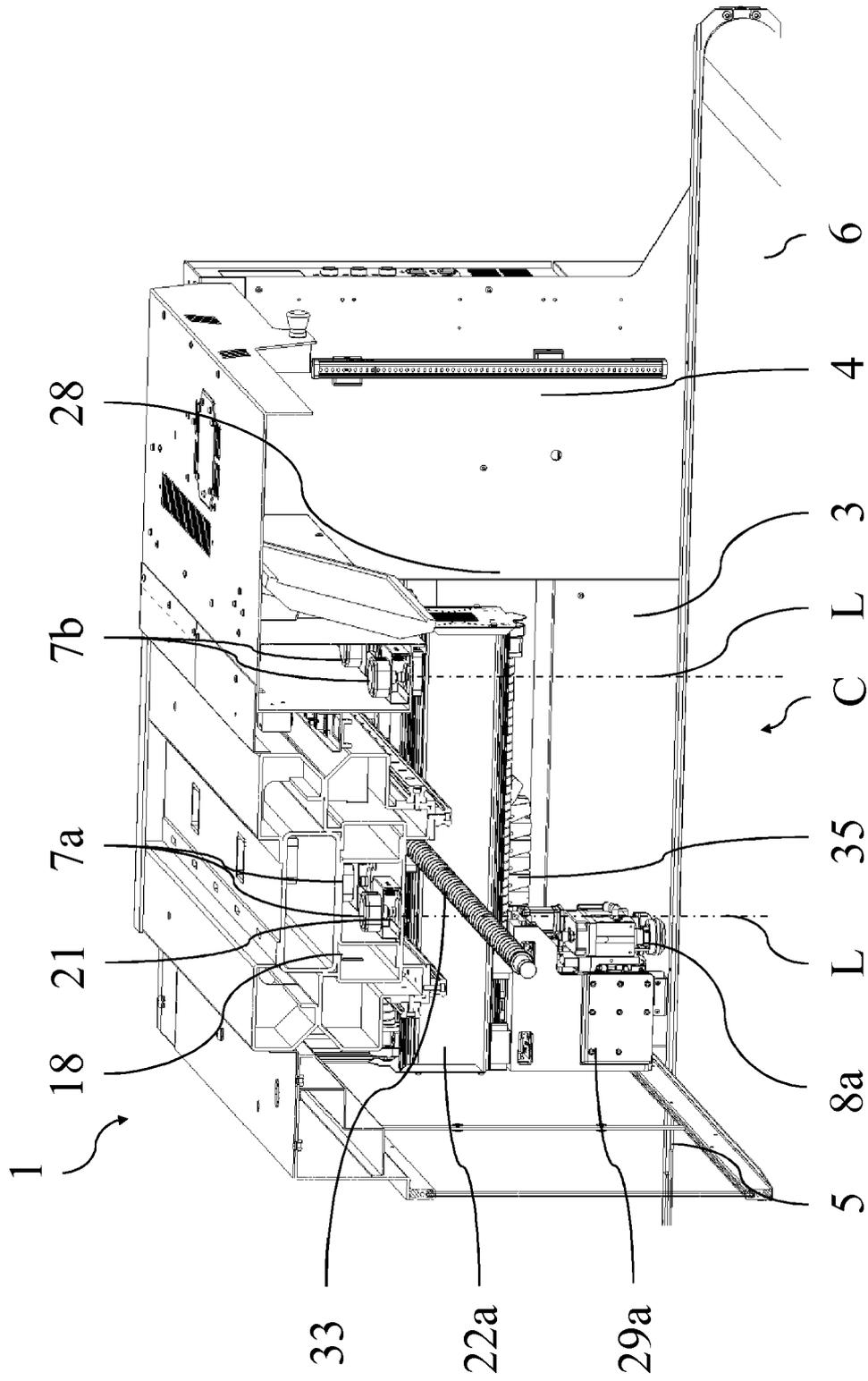


Fig. 2

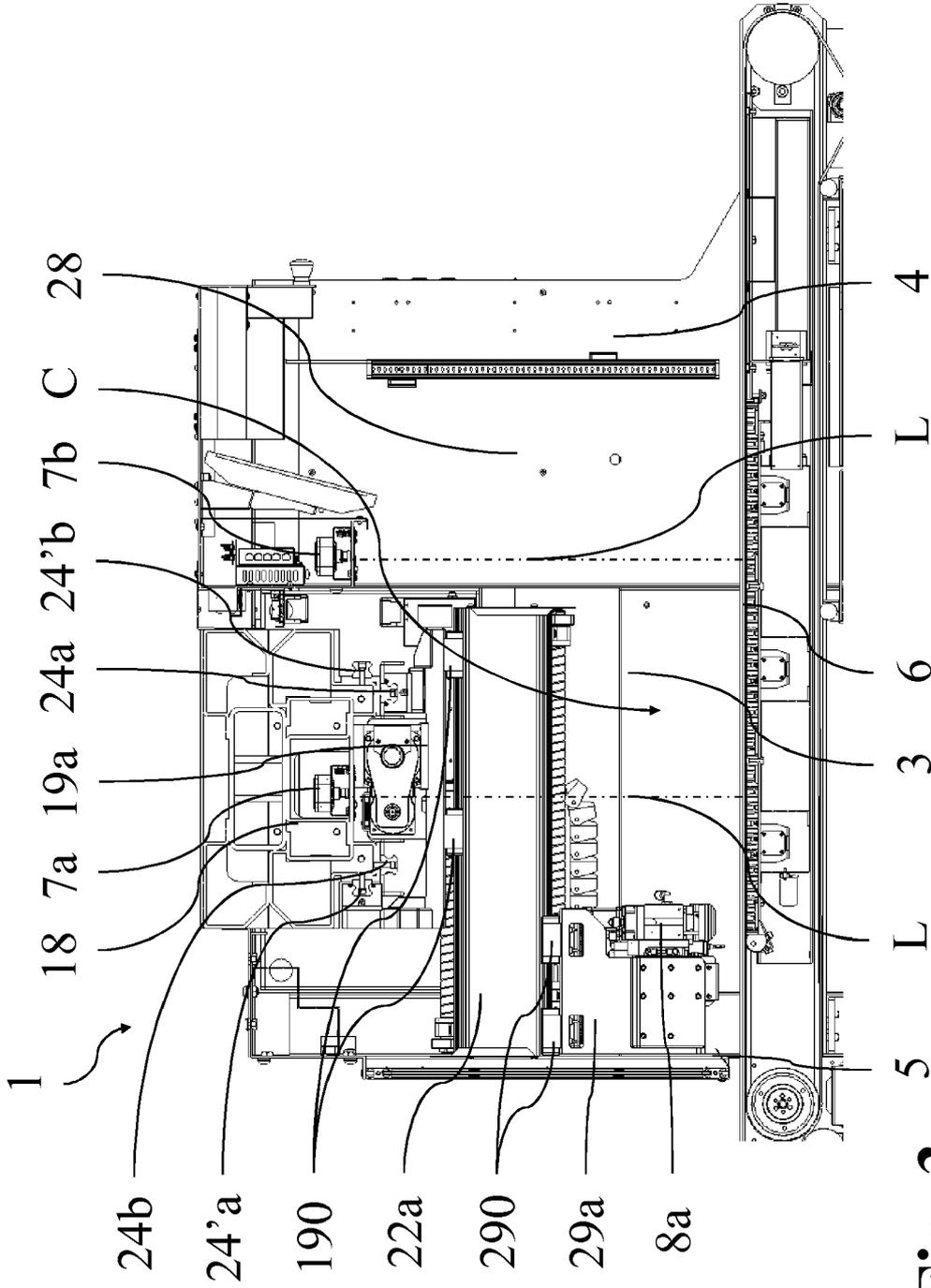


Fig. 3

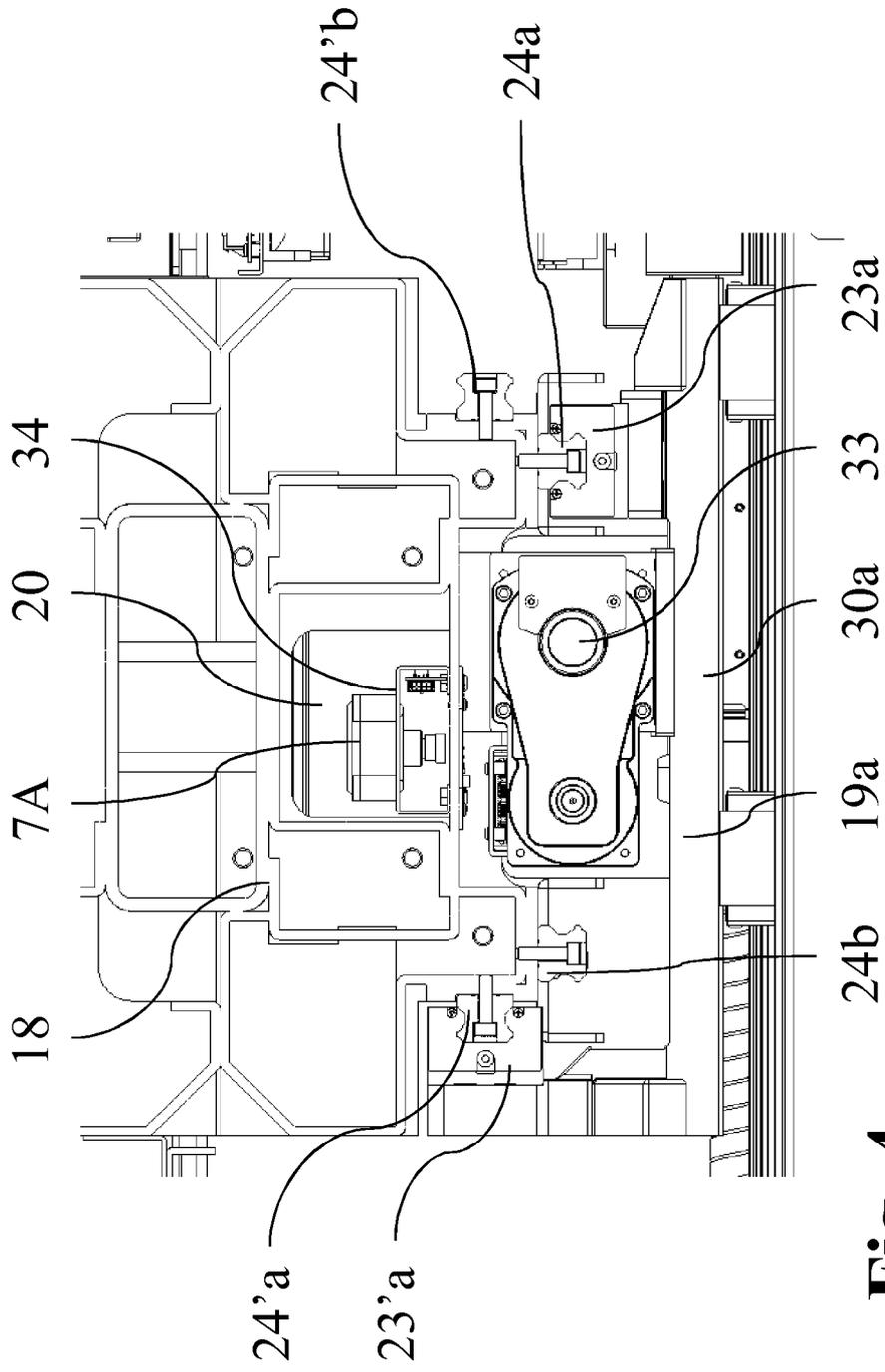


Fig. 4

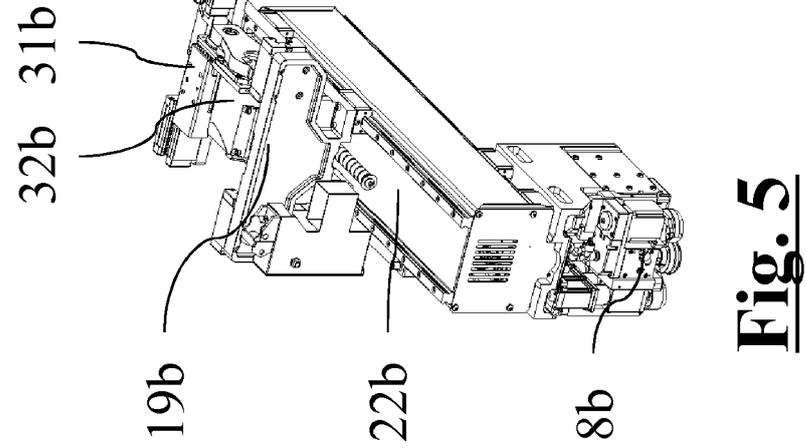
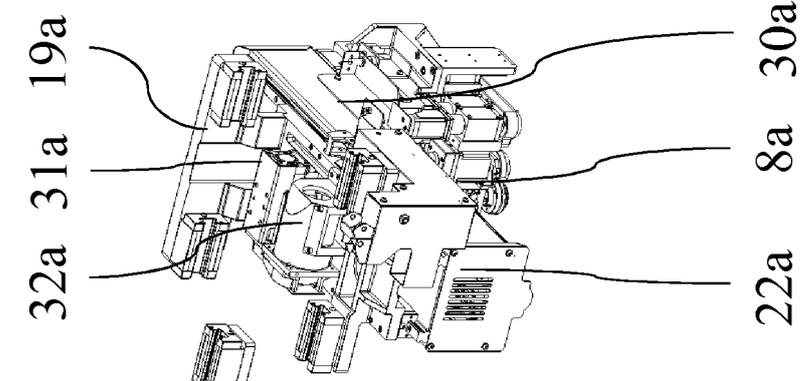
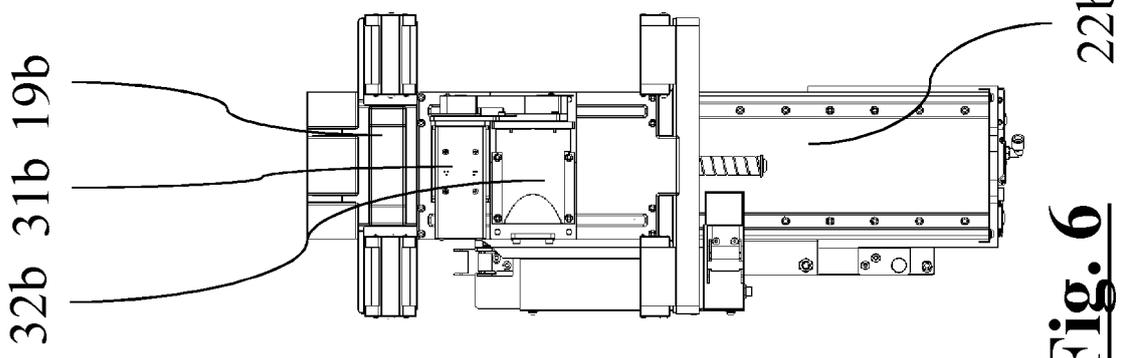
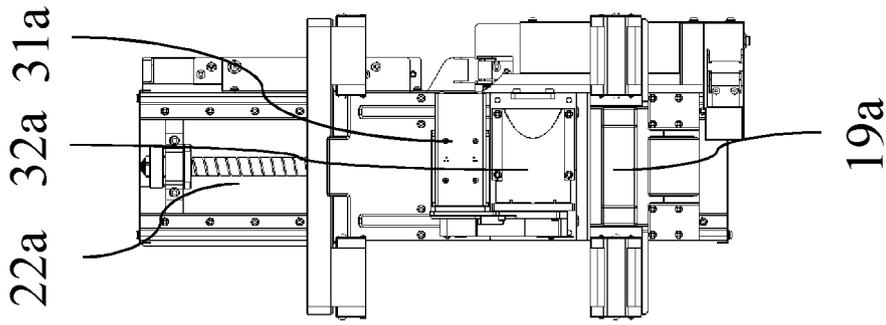


Fig. 5

Fig. 6

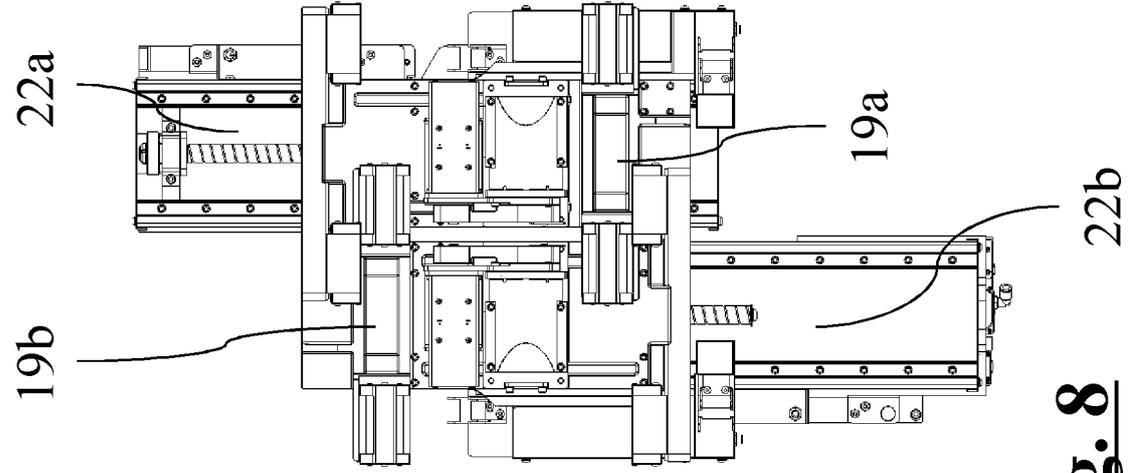


Fig. 7

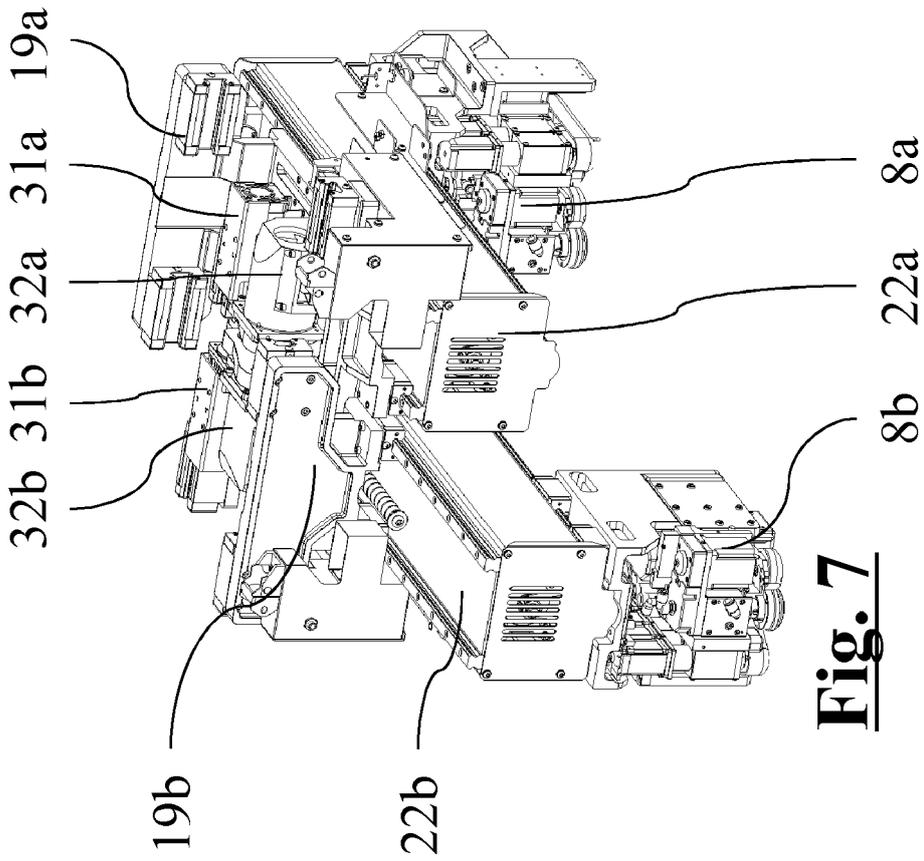
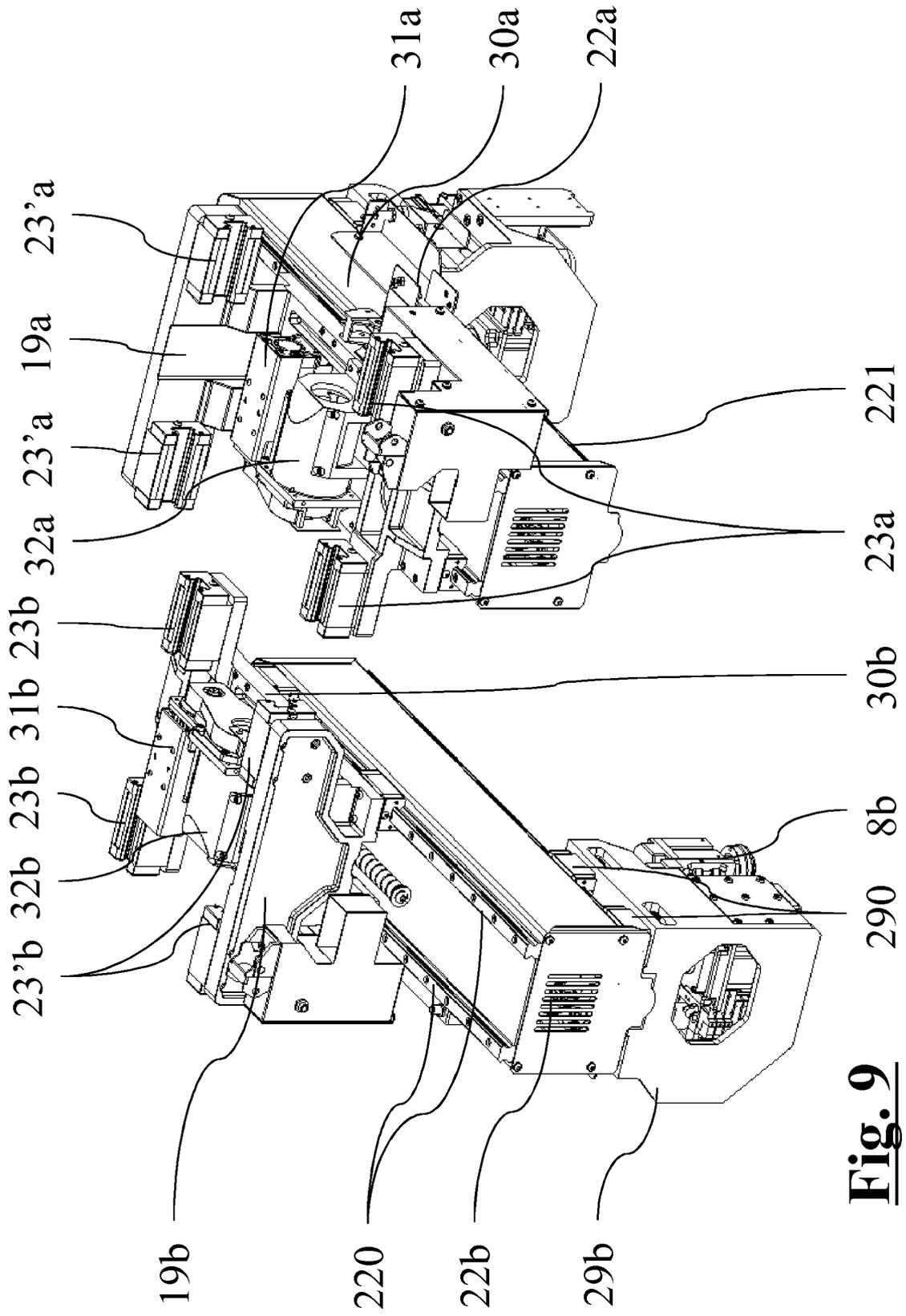


Fig. 8





EUROPEAN SEARCH REPORT

Application Number
EP 19 15 8072

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2018/210180 A1 (GBOS LASER INC [CN]) 22 November 2018 (2018-11-22) * paragraphs [0015], [0026], [0028], [0033]; figures 1-5 * -----	1-15	INV. D06H7/00 B26D5/00 D06H7/24
X	WO 2008/120096 A1 (COMELZ SPA [IT]; ZORZOLO ALESSANDRO [IT]; ZORZOLO STEFANO [IT]) 9 October 2008 (2008-10-09) * figure 1 * -----	1	
X	EP 3 354 427 A1 (COMELZ SPA [IT]) 1 August 2018 (2018-08-01) * figures 1-4 * -----	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06H B26F B26D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 September 2019	Examiner Iamandi, Daniela
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/02 (P04/C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 19 15 8072

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-09-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2018210180 A1	22-11-2018	CN 106930092 A WO 2018210180 A1	07-07-2017 22-11-2018

WO 2008120096 A1	09-10-2008	AT 496725 T BR PI0810627 A2 CN 101678518 A EP 2131997 A1 ES 2359285 T3 US 2010043501 A1 WO 2008120096 A1	15-02-2011 04-08-2015 24-03-2010 16-12-2009 20-05-2011 25-02-2010 09-10-2008

EP 3354427 A1	01-08-2018	BR 102018001481 A2 CN 108340208 A EP 3354427 A1 US 2018207761 A1	06-11-2018 31-07-2018 01-08-2018 26-07-2018
