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(54) **Device for rounding corners of panels**

Vorrichtung zum Abrunden von Plattenecken

Dispositif pour arrondir les coins de panneaux

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Description

[0001] The present invention relates to a device for rounding corners of panels in accordance with the preamble of claim 1. More specifically, the device in question is intended to perform an angular machining operation involving joining and rounding in the region of the four corners usually present in panels.

[0002] The device may advantageously be provided on modular machines, including those of very complex design, for edging panels, equipped with various working units arranged in-line and comprising for example, end-butting, milling, sanding, gluing, trimming or other units.

[0003] In the wood processing industry, in particular in the furniture industry, it is customary to finish panels by mounting edges which are then finished by rounding their corners with the desired profiles.

[0004] For many years the mounting of edges on the panels and subsequent finishing have been performed by means of individual dedicated machines which are separate from each other, the operators being obliged to transfer the panels from one machine to another and reposition them there correctly in order to complete all the machining steps.

[0005] In order to solve these problems, more recently devices for rounding corners of panels have been introduced onto the market, said devices being able to perform automatically complete rounding of the edges after these have been mounted.

[0006] At present, also known to exist on the market are various automatic devices which allow a milling tool to follow the panels along their displacement path between an entrance way and an exit way and perform angular rounding of the corners associated with the two end sides of the advancing panels.

[0007] In particular, an automatic panel rounding device is known from Italian patent application No. IT MI99A002342 (EP-A-1 099 523) in the name of the same Applicant, said device envisaging two separate milling tools able to perform machining of the front and rear edges of the panel, respectively, each tool being able to travel along an inclined surface so as to follow the panel during its displacement and rotate by means of a support rotatable through 180 degrees so as to allow complete machining of the edges of the panel.

[0008] In accordance with this known solution, synchronization means for coordinating the displacement and the rotation of each tool, advantageously comprising a connecting rod/crank mechanism hinged on one side to the rotating support of the tool and on the other side to the inclined surface, are envisaged.

[0009] The main drawback of this device is that it requires two separate milling tools, each provided with a separate drive system for performing complete 360° machining on the two end sides of the panel.

[0010] Another device is described in European Patent EP 750536, which envisages the use of a carriage supporting, mounted thereon, a single milling tool which per-

forms rounding of the corners on the front side and the rear side of the panel.

[0011] The carriage is operated so as to advance, guided in the direction of feeding of the panel, at the same speed as the latter. The milling tool is mounted on the carriage by means of a support rotating about a horizontal axis. When the carriage follows the panel, the milling tool performs a first machining operation on the corner of the front side of the panel, rotating through 180 degrees. Then, the carriage interrupts its travel movement and waits for the rear end side of the panel to pass by and then starts to follow it again so as to allow the milling tool to perform a second machining operation on the corner of the rear side of the panel, performing a further rotation through another 180 degrees.

[0012] The synchronization of the displacement movement and the rotational movement of the milling tool in order to allow the latter to follow the panel rotating about its end sides and thereby perform on its corners the required machining operations is ensured by the fact that the two movements are mechanically linked together and controlled by a single drive system.

[0013] The main drawback of this device consists in the fact that it is somewhat bulky, complicated to manufacture and difficult to maintain.

[0014] As is known, moreover in the panel production sector there is an increasingly widespread need to shape the profiles of the corners with forms which are especially designed to satisfy the most demanding aesthetic needs.

[0015] In order to provide these forms the milling tool is advantageously required to rotate about the front and rear sides of the panels at variable speeds depending on the angular position assumed, so as to follow in the most correct manner the progression of the profiles of the edges of the panels, performing milling thereof.

[0016] With the abovementioned device of the known type, it is not possible to perform in an optimum manner the required machining operations on the corners of the end sides of the panel since it mechanically constrains in an unchangeable manner the displacement and rotation of the tool around the panel.

[0017] In this situation, the main object of the present invention is therefore to overcome the drawbacks associated with the devices of the known type by providing a device for rounding corners of panels, which allows complex milling operations to be performed in an optimum manner on the corners of the panel sides.

[0018] Another object of the present invention is to provide a device which has small dimensions.

[0019] Another object of the present invention is to provide a device which is constructionally simple and operationally entirely reliable.

[0020] The above-mentioned objects are achieved by a device in accordance with claim 1.

[0021] The technical features of the invention and the advantages thereof will emerge more clearly from the detailed description which follows, provided with reference to the accompanying drawings, which show a purely

exemplary and non-limiting embodiment, in which:

- Figure 1 shows schematically a front view of a device for rounding corners of panels according to the invention;
- Figure 2 shows schematically a rear view of the device according to Figure 1, with some parts removed so that other parts are more clearly visible;
- Figure 3 shows schematically a side view of the device according to Figure 1.

[0022] With reference to the accompanying drawings, 1 denotes in its entirety the device for rounding corners of panels in particular made of wood according to the present invention.

[0023] The device 1 in question may be used individually or provided on complex machines for edging panels in series with other working units such as an end-butting unit, a milling unit, a sanding unit, a gluing unit, a trimming unit or other units.

[0024] The device 1 is rested on the ground by means of a support structure 2 which may therefore be in common with that of an edging machine equipped with other working units (not shown).

[0025] This structure 2 is provided with means for feeding a panel, in particular made of chipboard, MDF or the like (not shown), for example consisting of a tracked conveyor belt of a conventional type per se, able to cause feeding of the panels individually and in a horizontal position, in succession with respect to each other between an entrance way and an exit way of the device 1.

[0026] A mobile carriage 4 supporting a milling unit 3 is actuated so as to be displaced by a first motor 7, over a suitable displacement path S, with a direction of advancing movement Y parallel to the direction of the panel, along a guide 5 formed on the support structure 2.

[0027] For this purpose, the first motor 7 (preferably a worm gearmotor) is connected to the carriage 4 by means of flexible transmission means. The latter advantageously consist of a chain 6 wound endlessly around a driving wheel 8, a tensioning wheel 9 and two transmission wheels 10.

[0028] The first motor 7 advantageously consists of a normal asynchronous motor, which is therefore available on the market at a low cost. This motor 7 is controlled by an inverter connected to the PLC having an electronic positioning system by means of which it is possible to control the rotation of the rotor with the magnetic poles and therefore, ultimately, control the position of the carriage 4 and the milling unit 3 along the guide 5.

[0029] The movement of the panels is assisted by an encoder which is also connected to the PLC and is able to produce a pulsed signal capable of actuating the inverter of the first motor 7 so that the carriage moves perfectly in synchronism with the panels.

[0030] Consequently, the first motor 7 causes the displacement of the milling unit at the same speed as the panels and therefore this unit in terms of this displacement

may be regarded as being at a standstill with respect to the panels.

[0031] Alternatively, the first motor 7 may also be provided with an encoder connected to the PLC so as to ensure a greater precision during positioning of the milling unit 3 along its displacement path S.

[0032] Two mechanical end-of-travel safety stops 90 are in any case envisaged for limiting the displacement path of the milling unit 3.

[0033] The milling unit 3 is rotatably mounted on the carriage 4 by means of a shaft 12, about a transverse axis X at right angles to the direction of advancing movement Y of the mobile carriage 4.

[0034] In greater detail, this milling unit 3 comprises a second motor 13 with, keyed on its shaft, a milling tool 14 having a radial shape for performing a rounding operation on the corners of the edges along the panel sides.

[0035] The form of the shape to be imparted to the corners may be of any nature according to requirements or the rounding radius of the milling tool 14.

[0036] According to the idea forming the basis of the present invention, the milling unit 3 is operated so as to rotate about the shaft 12 with a transverse axis X by a third motor 15 integral with the carriage 4 and electrically coupled to the first motor 7 so as to synchronize, in accordance with predefined operating steps, the rotation of the milling unit 3 together with its displacement along the path S above the carriage.

[0037] The third motor 15 consists of a worm gearmotor controlled by means of an inverter connected to the PLC and provided with a pulsed positioning device for correct angular positioning of the milling unit 3. Preferably, this third motor 15 is provided with an encoder for ensuring greater precision during angular positioning of the unit 3.

[0038] More generally, the first motor and/or the third motor may also be controlled by other electrical actuating systems (actuating systems for brushless motors, of the DC type, etc.), without thereby departing from the scope of claim 1.

[0039] It should be noted that, differently from the solution of the prior art described and claimed in European Patent EP 750536 cited above, the displacement movement of the milling unit 3 is, according to the invention, mechanically independent of the rotational movement of the said unit.

[0040] In order to keep the tool 14, during milling of the edges of the panel, constantly at a precise distance from the latter, a frontal joining device 30 and a vertical joining device 31 are advantageously envisaged, the latter consisting of an idle disk which is free to rotate with its axis parallel to the axis of the tool 14.

[0041] Pneumatic actuators are envisaged for keeping the two joining devices 30 and 31 constantly pressed against the panel and thus ensure the correct working position of the tool 14.

[0042] In greater detail, the milling unit 3 is provided with a support 40 consisting of a plate with a frontally

disk-shaped form on which a milling head 42, which supports the tool 14 and the two joining devices 30 and 31, is slidably mounted along second guides 41.

[0043] A first pneumatic actuator 50 is then mounted as shown in Figure 1 on the support 40 and is actuated by the PLC so as to move the head 42 along the second guides 41 until it pushes the vertical joining device 31 up against the bottom surface of the panel.

[0044] This first pneumatic actuator 50 preferably operates under tensile load when it is arranged above the milling head 42 (as shown in the accompanying figures), during a first step involving machining of the front side of the panel, and is instead under no load when it is positioned underneath the milling head 42, during a second step involving machining of the rear side of the panel.

[0045] Switching of the air between the two operating conditions of the first actuator 50 is caused by actuation of a valve 51 which is mounted on the carriage 4 behind the disk-shaped support 40 and which supports an actuating stem carrying at the top a roller 52 kept resiliently in contact with a cam 53 consisting of an eccentric part keyed directly onto the rotating shaft 12 of the milling unit 3.

[0046] A second pneumatic actuator 60 is envisaged for displacing the milling head 42 transversely with respect to the direction of feeding X of the panel until the front joining device 30 is brought into contact against the side edge of the panel.

[0047] A third pneumatic actuator 70, which is actuated by a special switch, is able to exclude operation of the milling unit 3. For this purpose, this third actuator 70 causes the displacement of the milling head 42 between a raised working position, where it intercepts the panel and by means of the tool 14 performs rounding of its angular profiles, and a lowered disengaged position, where it does not interfere with the horizontal displacement of the panel.

[0048] Supplying of the air to the pneumatic actuators 50, 60, 70 is ensured by a pressure source connected to the said actuators by means of channels partly consisting of radial holes formed in the thickness of the disk-shaped support plate 40.

[0049] Functionally speaking, a photocell detects the arrival of the panel, signalling its passing movement through an entrance way to the PLC which activates the milling unit 3 which causes separate following of the carriage 4 with the milling unit on top as well as rotation of the latter in accordance with the two operating steps mentioned above.

[0050] Activation of the movement of the milling unit 3 in order to perform the second machining operation is obtained by means of a sensor connected to the PLC which detects the length of the panel and therefore is able to indicate when the latter has passed beyond the said milling unit.

[0051] The precise safe positioning of the milling unit 3 with respect to its two possible displacement and rotational movements is ensured by a plurality of sensors

consisting, for example, of proximity sensors able to detect the presence of reference points situated along the displacement path S of the milling unit 3 as well as on the disk-shaped support plate 40.

[0052] Mechanical safety means are in any case envisaged not only for horizontal displacement (end-of-travel device 90), but also for preventing uncontrolled rotation of the milling unit greater than 360°.

[0053] These means envisage preferably the use of a bolt system integral with the carriage 4 inside which a projecting part (for example a screw head) fixed to the rear surface of the disk-shaped support plate 40 engages with pressing contact inside two different opposite seats associated with the two possible directions of rotation of the unit 3.

[0054] A cable-holder chain, not shown in the accompanying figures, is envisaged for powering electrically the second motor 13 of the milling tool 14 and the sensors for controlling the angular position of the milling unit 3.

[0055] Advantageously the device 1 according to the invention is particularly compact, simple and inexpensive to manufacture and operationally entirely reliable.

[0056] A further advantage of the device 1 in question is that it allows independent management of the speed of displacement and speed of rotation of the milling unit 3.

[0057] Obviously, in addition the present invention may also assume, in its practical embodiment, forms and configurations different from that illustrated above without thereby departing from the present scope of protection as defined in the appended claims.

[0058] Moreover, all the details may be replaced by technically equivalent parts and the dimensions, the forms and the materials used may be of any nature according to requirements.

Claims

1. Device for rounding corners of panels, comprising:

- a support structure (2);
- feeding means mounted on said support structure and able to convey with a continuous movement at least one panel having two end sides, between at least one entrance way and at least one exit way of the device;
- a mobile carriage (4) mounted guidably on said support structure and moved by a first motor (7) so as to be displaced parallel to said panel and in synchronism with the latter in a direction of advancing movement (Y);
- a milling unit (3) rotatably mounted on said mobile carriage about a shaft with an axis (X) transverse to the direction of advancing movement (Y) of said carriage, said milling unit being provided with a second motor (13) having, keyed on its rotating shaft, a milling tool (14) for performing rounding of the angular profiles of the

end sides of the advancing panel;

characterized in that said milling unit (3) is actuated so to rotate about said shaft with a transverse axis (X) by a third motor (15) integral with the carriage and electrically coupled to said first motor (7) so as to synchronize in accordance with predefined operating steps said rotation of said milling unit (3) with its displacement above said mobile carriage.

2. Device according to Claim 1, **characterized in that** said first motor (7) and/or said third motor (15) are controlled by an electrical actuating system.

3. Device according to Claim 2, **characterized in that** said first motor (7) is controlled by an inverter.

4. Device according to Claim 2, **characterized in that** said third motor (15) is controlled by an inverter.

5. Device according to any one of the preceding claims, **characterized in that** said first and/or said third motor (7,15) are provided with an inverter.

6. Device according to Claim 1, **characterized in that** said milling unit comprises at least one frontal joining device (30) and at least one vertical joining device (31).

7. Device according to Claim 6, **characterized in that** said milling unit (3) comprises:

- a support (40) on which a milling head (42) supporting said milling tool and said joining devices is slidably mounted along second guides (41);
- a first pneumatic actuator (50) mounted on said support and able to displace said head (42) along said second guides so as to keep said vertical joining device (31) constantly pressed against said panel.

8. Device according to Claim 7, **characterized in that** said first pneumatic actuator (50) works under tensile load when it is arranged above said milling head (42) and is under no load when it is situated underneath said milling head.

9. Device according to Claim 8, **characterized in that** it comprises a valve (51) mounted on said carriage (4) and actuated by a cam (53) keyed onto said shaft (12) of said milling unit and able to activate the pressure of said first pneumatic actuator (50).

10. Device according to Claim 6, **characterized in that** said milling unit comprises:

- a support (40) on which a milling head (42)

supporting said milling tool and said joining devices is slidably mounted along said second guides;

- a second pneumatic actuator (60) mounted on said support and able to displace said head transversely with respect to the direction of feeding of said panel so as to keep said frontal joining device constantly pressed against said panel.

11. Device according to Claim 1, **characterized in that** said milling unit comprises a third pneumatic actuator (70) able to displace said milling head (42) between a working position, where it intercepts said panel and performs rounding of the angular profiles of its end sides by means of said milling tool, and a disengaged position where said panel does not intercept said milling head.

20 Patentansprüche

1. Vorrichtung zum Abrunden von Plattenecken mit:

einer Tragkonstruktion (2);

- einer Zuführungseinrichtung, die an der Tragkonstruktion montiert ist, und die mindestens eine Platte, die zwei Stirnseiten besitzt, mit einer kontinuierlichen Bewegung zwischen mindestens einem Eingang und mindestens einem Ausgang der Vorrichtung befördern kann;
- einem mobilen Fahrwagen (4), der lenkbar an der Tragkonstruktion montiert ist, und durch einen ersten Motor (7) bewegt wird, so dass er parallel zu der Platte und gleichzeitig mit letzterer in Vorwärtsbewegung (Y) verschoben wird;
- einer Fräsanlage (3), die drehbar an dem mobilen Fahrwagen um eine Welle mit einer Achse (X) quer zur Vorwärtsbewegung (Y) des Fahrwagens montiert ist, wobei die Fräsanlage einen zweiten Motor (13) besitzt, der verkeilt auf seiner Drehwelle ein Fräs- werkzeug (14) zur Durchführung des Abrundens der Winkelprofile der Stirnseiten der sich vorwärts bewegenden Platte aufweist;

dadurch gekennzeichnet, dass die Fräsanlage (3) derart betätigt wird, dass sie sich durch einen dritten, in den Fahrwagen integrierten Motor (15), der mit dem ersten Motor (7) elektrisch verbunden ist, mit einer Querachse (X) um die Welle dreht, so dass die Drehung der Fräsanlage (3) gemäß vorher festgelegten Arbeitsschritten mit ihrer Verschiebung über dem mobilen Fahrwagen synchronisiert wird.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der erste Motor (7) und/oder der dritte Motor (15) durch ein elektrisches Steuerungssystem gesteuert werden. 5
3. Vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** der erste Motor (7) durch einen Wechselrichter gesteuert wird.
4. Vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** der dritte Motor (15) durch einen Wechselrichter gesteuert wird. 10
5. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der erste und/oder der dritte Motor (7, 15) mit einem Wechselrichter ausgestattet sind. 15
6. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Fräsanlage mindestens eine frontale Verbindungsvorrichtung (30) und mindestens eine vertikale Verbindungsvorrichtung (31) besitzt. 20
7. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** die Fräsanlage (3) folgendes aufweist: 25
- eine Auflage (40), auf der ein Fräskopf (42), der das Fräswerkzeug und die Verbindungsvorrichtungen hält, entlang zweiten Führungen (41) verschiebbar montiert ist; 30
 - einen ersten pneumatischen Stellantrieb (50), der an der Auflage montiert ist, und den Kopf (42) den zweiten Führungen entlang verschieben kann, so dass die vertikale Verbindungsvorrichtung (31) konstant gegen die Platte gedrückt wird. 35
8. Vorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** der erste pneumatische Stellantrieb (50) unter Zugbelastung arbeitet, wenn er über dem Fräskopf (42) angeordnet ist, und keiner Belastung unterworfen ist, wenn er sich unter dem Fräskopf befindet. 40
9. Vorrichtung nach Anspruch 8, **dadurch gekennzeichnet, dass** sie ein Ventil (51) besitzt, das an dem Fahrwagen (4) montiert ist, und durch einen Nocken (53) betätigt wird, der mit der Welle (12) der Fräsanlage verkeilt ist, und den Druck des ersten pneumatischen Stellantriebes (50) aktivieren kann. 45
10. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** die Fräsanlage folgendes besitzt: 50
- eine Auflage (40), auf der ein Fräskopf (42), der das Fräswerkzeug und die Verbindungsvor-

richtungen hält, entlang zweiten Führungen verschiebbar montiert ist;

- einen zweiten pneumatischen Stellantrieb (60), der an der Auflage montiert ist, und den Kopf quer zu der Zuführungsrichtung der Platte verschieben kann, so dass die frontale Verbindungsvorrichtung konstant gegen die Platte gedrückt wird.

11. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Fräsanlage einen dritten pneumatischen Stellantrieb (70) besitzt, der den Fräskopf (42) zwischen einer Arbeitsposition, in der er die Platte abfängt, und das Abrunden der Winkelprofile ihrer Stirnseiten mittels des Fräswerkzeuges durchführt, und einer ausgekoppelten Position, in der die Platte den Fräskopf nicht abfängt, verschieben kann.

Revendications

1. DISPOSITIF POUR ARRONDIR LES ARÊTES DES PANNEAUX, comportant :

- une structure de soutien (2) ;
- un moyen d'alimentation monté sur la structure de soutien susdite et en état de convoyer par un mouvement continu au moins un panneau ayant deux côtés terminaux, entre au moins un couloir d'entrée et au moins un couloir de sortie du dispositif ;
- un chariot mobile (4) monté d'une manière glissante sur la structure de soutien susdite et laissé bouger par un premier moteur (7) de façon à être déplacé parallèlement au panneau susdit et en synchronisme avec ce-dernier dans une direction de mouvement d'avancement (Y) ;
- une unité de fraisage (3) montée rotativement sur le chariot mobile susdit autour d'un arbre avec un axe (X) transversal par rapport à la direction de mouvement d'avancement (Y) du chariot susdit, l'unité de fraisage susdite étant munie d'un second moteur (13) ayant, verrouillé sur son arbre tournant, un outil de fraisage (14) pour exécuter l'arrondissement des profils angulaires des côtés terminaux du panneau d'avancement ;

caractérisé en ce que l'unité de fraisage (3) susdite est actionnée de façon à tourner autour de l'arbre susdit avec un axe transversal (X) par un troisième moteur (15) faisant partie intégrante du chariot et électriquement couplé au premier moteur (7) susdit de façon à synchroniser conformément à des étapes de mise en fonctionnement prédéfinies la rotation susdite de l'unité de fraisage (3) susdite avec son déplacement par-dessus le chariot mobile susdit.

2. DISPOSITIF selon la revendication 1, **caractérisé en ce que** le premier moteur (7) susdit et/ou le troisième moteur (15) susdit sont commandés par un système d'actionnement électrique. 5
3. DISPOSITIF selon la revendication 2, **caractérisé en ce que** le premier moteur (7) susdit est commandé par un convertisseur. 10
4. DISPOSITIF selon la revendication 2, **caractérisé en ce que** le troisième moteur (15) susdit est commandé par un convertisseur. 15
5. DISPOSITIF selon n'importe quelle des revendications précédentes, **caractérisé en ce que** le premier et/ou le troisième moteur (7, 15) susdits sont munis d'un convertisseur. 20
6. DISPOSITIF selon la revendication 1, **caractérisé en ce que** l'unité de fraisage susdite comporte au moins un dispositif d'assemblage frontal (30) et au moins un dispositif d'assemblage vertical (31). 25
7. DISPOSITIF selon la revendication 6, **caractérisé en ce que** l'unité de fraisage (3) susdite comporte: 30
- un soutien (40) sur lequel une tête de fraisage (42) soutenant l'outil de fraisage susdit et les dispositifs d'assemblage susdits est montée d'une manière coulissante le long d'une seconde glissière (41); 35
 - un premier actionneur pneumatique (50) monté sur le soutien susdit et en état de déplacer la tête (42) susdite le long de la seconde glissière susdite, de façon à maintenir le dispositif d'assemblage vertical (31) susdit constamment comprimé contre le panneau susdit. 40
8. DISPOSITIF selon la revendication 7, **caractérisé en ce que** le premier actionneur pneumatique (50) susdit fonctionne sous effort de tension lorsqu'il est aménagé sur la tête de fraisage (42) susdite et qu'il n'est pas sous effort lorsqu'il se trouve sous la tête de fraisage susdite. 45
9. DISPOSITIF selon la revendication 8, **caractérisé en ce qu'il** comporte une vanne (51) montée sur le chariot (4) susdit et actionnée par une came (53) verrouillée sur l'arbre (12) susdit de l'unité de fraisage susdite et en état d'actionner la pression du premier actionneur pneumatique (50) susdit. 50
10. DISPOSITIF selon la revendication 6, **caractérisé en ce que** l'unité de fraisage susdite comporte : 55
- un soutien (40) sur lequel une tête de fraisage (42) soutenant l'outil de fraisage susdit et les dispositifs d'assemblage susdits est montée d'une manière coulissante le long de la seconde glissière susdite ;
 - un second actionneur pneumatique (60) monté sur le soutien susdit et en état de déplacer la tête susdite transversalement par rapport à la direction d'alimentation du panneau susdit de façon à maintenir le dispositif d'assemblage frontal susdit constamment comprimé contre le panneau susdit.
11. DISPOSITIF selon la revendication 1, **caractérisé en ce que** l'unité de fraisage susdite comporte un troisième actionneur pneumatique (70) en état de déplacer la tête de fraisage (42) susdite entre une position de travail, où il intercepte le panneau susdit et exécute l'arrondissage des profils angulaires de ses côtés terminaux moyennant l'outil de fraisage susdit, et une position dégagée où le panneau susdit n'intercepte pas la tête de fraisage susdite.

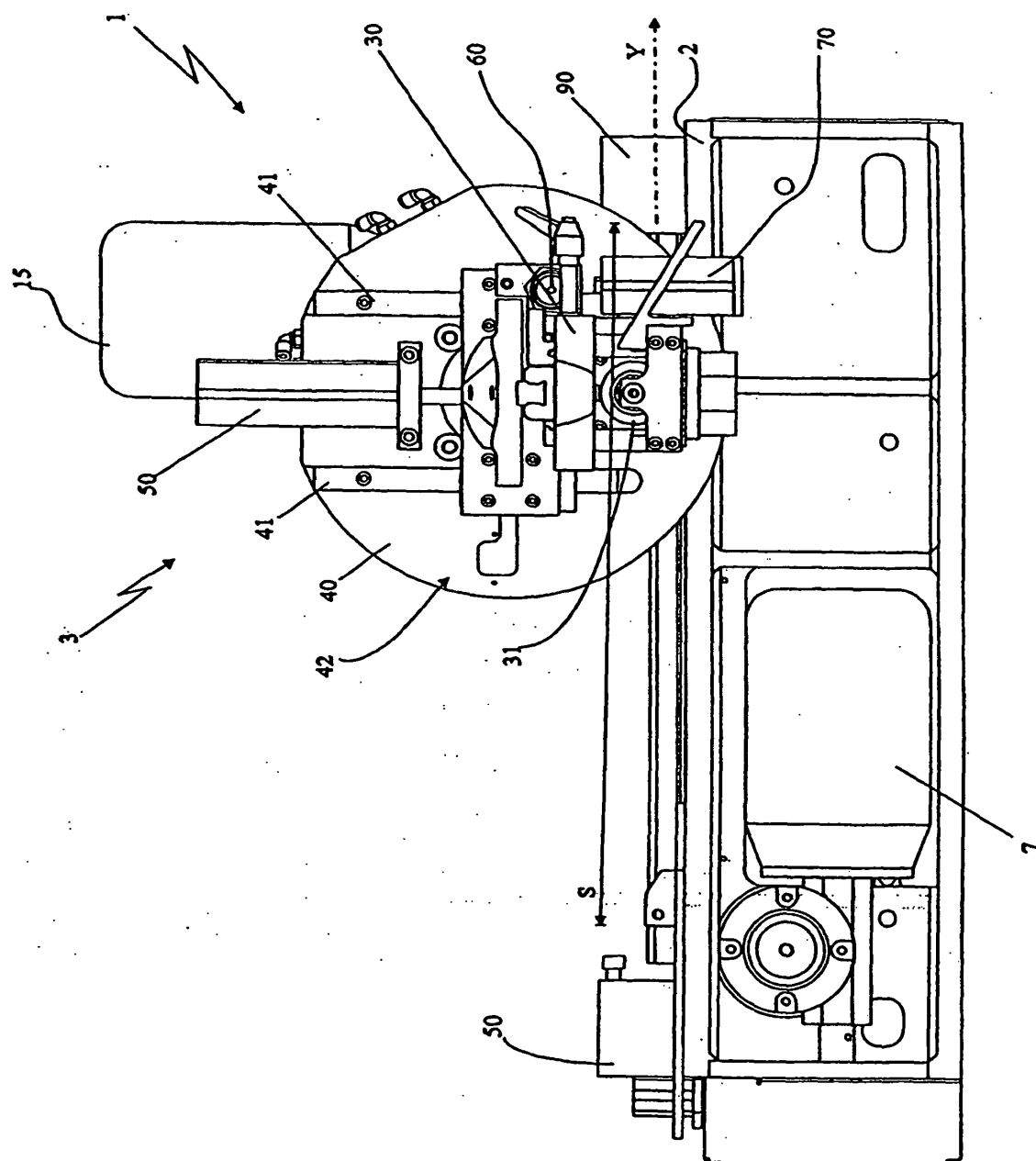


FIG. 1

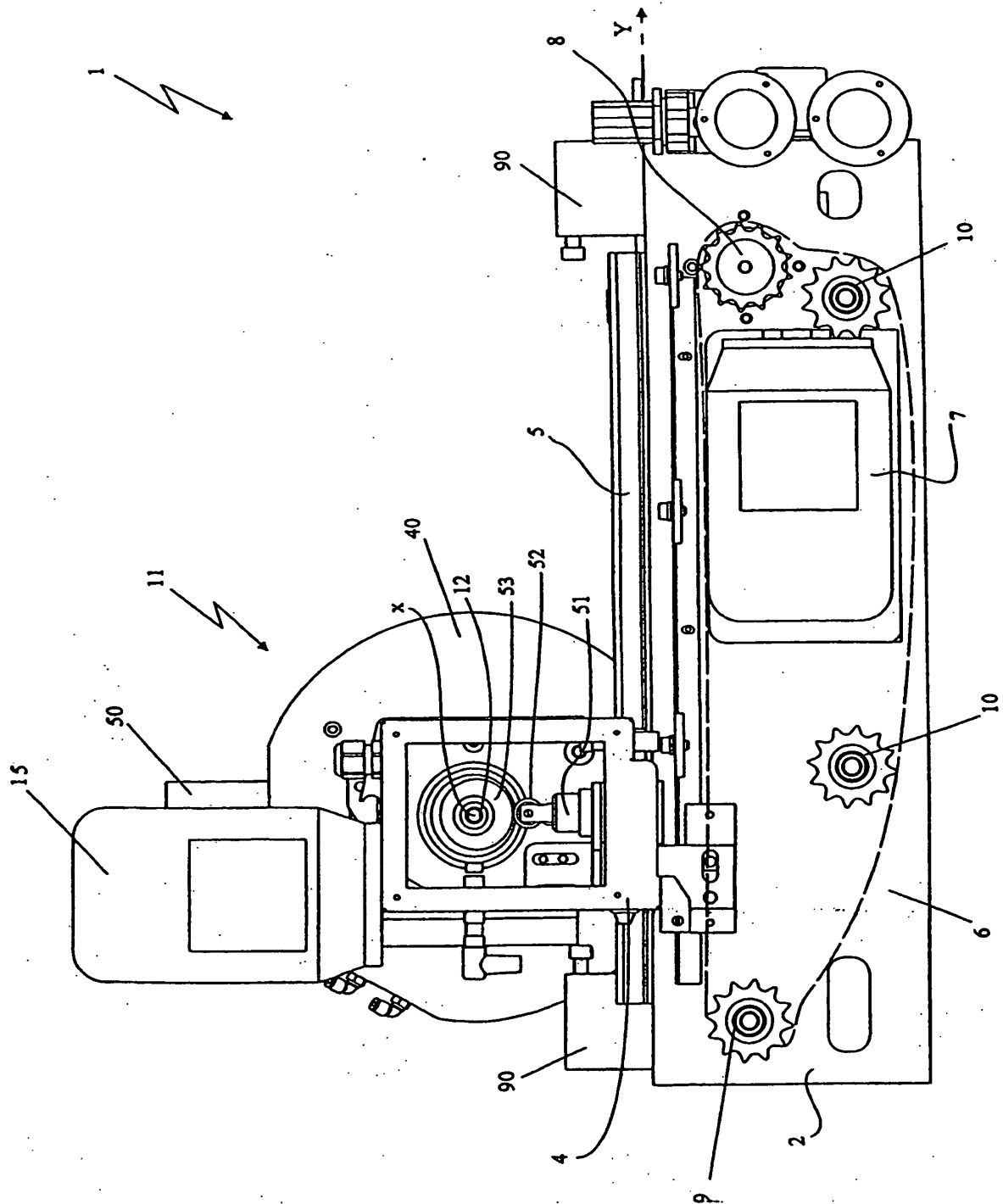


FIG. 2

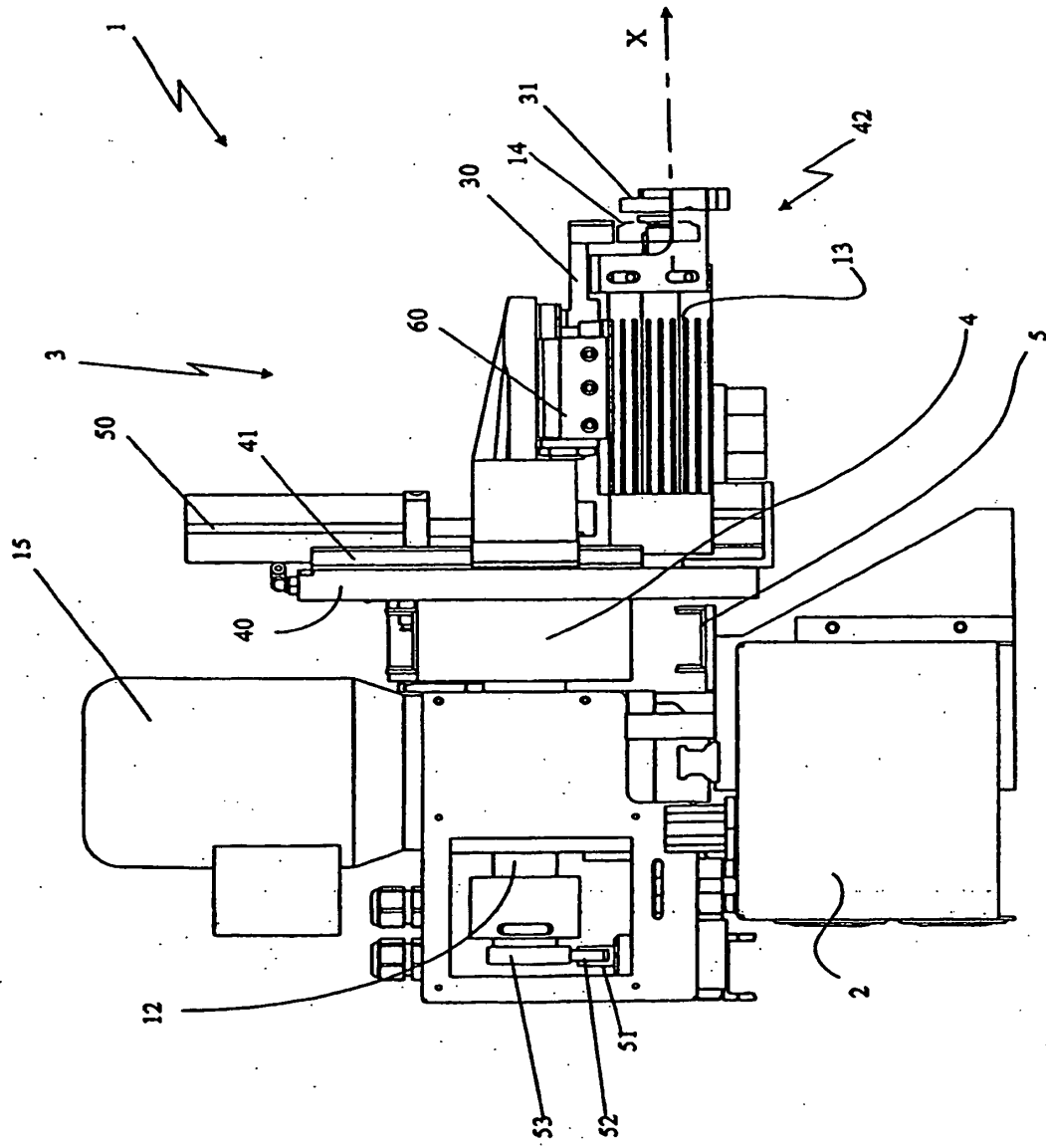


FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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