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(54) **System for satin finishing of sheet metal by means of mechanically fixed flap wheels**

Vorrichtung zum Satinieren von Metallplatten mittels mechanisch befestigter Lamellenschleifscheiben

Dispositif pour la finition satinée de feuilles en métal avec des meules à lamelles fixées mécaniquement

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Description

[0001] The present invention refers in general to a system for satin finishing of sheet metal.

[0002] For finishing (satin finishing and/or polishing) of sheet metal, systems with abrasive cloths are currently used, in which each finishing station comprises a pair of opposed finishing heads, each of which comprises a ring of abrasive cloth carried by a drive roller and by a roller which holds the abrasive cloth in contact with the surface to be processed.

[0003] The finishing heads are positioned vertically and machine simultaneously the two opposite sides of a sheet metal fed in a per se known manner between the finishing heads.

[0004] These known systems present numerous limits and drawbacks, amongst which:

- the abrasive cloths wear out very rapidly, drastically reducing their removal capacity and no longer guaranteeing the initial standard of finishing: it is therefore necessary to stop the system often to replace the worn-out cloths, which can sometimes be reused in the finishing heads that carry out rougher finishing;
- the heat produced during processing of sheet metal by means of the abrasive cloths makes it necessary to cool the sheets of metal with water, which results in the formation of sludge which must be removed.

[0005] WO 03/092956 discloses a sanding machine whose sanding unit includes a closed ring winding element supporting a plurality of abrasive elements, spaced one from another and provided with abrasive surface(s) coming in contact with the surface to be processed.

[0006] US-A-5 921 848 discloses a system for finishing a workpiece comprising, *inter alia*, abrasive drums composed of synthetic fibres embedded in a resinous backing material.

[0007] The workpiece moves between a bed of driven rollers and a pinch roller, i.e. between a bed of motorized rollers and an idle roller.

[0008] US-A-3 645 049 discloses a flap wheel comprising a plurality of abrasive packets secured about the periphery of a hub and separated from each other by a free space, each packet comprising a plurality of abrasive sheets and being attached to a flexible securing root in turn affixed within a peripheral opening of the hub.

[0009] Also known to the art are systems for satin finishing of pipes by means of flap wheels, whose performance is nevertheless conditioned by the limitations inherent in the flap wheels traditionally used in these systems, since it has been found experimentally that during satin finishing (also because of the heat that develops through friction between the flaps and the surface to be satin finished) the temperature of a conventional flap wheel (and in particular of its hub) reaches such high values as (to be able) to cause a physical alteration in the components used to make the conventional flap wheel, degrading in

particular the binding and cohesive characteristics of the material (normally a resin) used as adhesive to fix the flaps to the hub.

[0010] This fact, together with the high speed of the wheel (which can reach 30 - 35 m./s) means that the material used as adhesive loses (or can lose) its ability to retain the flaps in place, overcoming the centrifugal force acting on said flaps. It has in fact been found experimentally that the flaps gradually become detached from the wheel hub and consequently the life of the flap wheel and of its ability to remove material from the surface to be processed is reduced.

[0011] The drawbacks and limitations inherent in conventional flap wheels have not thus far allowed flap wheel systems capable of satin finishing sheet metal with satisfactory results to be produced.

[0012] In fact it has been found experimentally that the length of conventional flap wheels cannot exceed about 10 cm: to satin finish sheets of metal with a greater width it would be necessary to use two or more conventional flap wheels side by side but the satin finished sheet metal would have lines coinciding with the gaps that are inevitably present between the side-by-side flap wheels.

[0013] Flap wheels of new design are currently available on the market, referred to in the present description as "mechanically fixed flap wheels", in which the flaps are fixed mechanically to the hub: these mechanically fixed flap wheels are free from the drawbacks and limitations inherent in conventional flap wheels.

[0014] Mechanically fixed flap wheels are known, for example, from patent EP 1 704 967 A1.

[0015] A system for satin finishing of pipes by means of mechanically fixed flap wheels is disclosed, for example, by the European Patent EP 1 350 600.

[0016] Object of the present invention is to overcome the above-mentioned limits and drawbacks presented by satin finishing systems for sheet metal with sand belts and those with conventional flap wheels, allowing sheet metal to be satin finished -- with a uniformly even surface finish -- with a single mechanically fixed flap wheel, which has proved to be strong enough to be able to have the same width as the sheet metal to be satin finished.

[0017] This object is achieved by means of a satin finishing system according to the present invention, which has the features of claim 1; further advantageous characteristics of the invention form the subject matter of the dependent claims.

[0018] Further characteristics of the invention will be made clearer by the detailed description that follows, referring to a purely exemplifying and therefore non-limiting embodiment, illustrated in the appended drawings, wherein:

- Figure 1 is a diagrammatic perspective view of a satin finishing system according to the invention;
- Figure 2 is a diagrammatic side view of one of the satin finishing stations of Figure 1, in which the inner parts have been shown "in transparency";

- Figure 3 is a diagrammatic head-on rear view of the satin finishing station of Figure 2.

[0019] In the appended figures like elements will be identified by the same reference numerals.

[0020] Figure 1 shows diagrammatically a perspective view of the satin finishing system 1 according to the invention which comprises, in combination with each other:

- a bed of rollers 2 with horizontal axes, mounted idly and carried by a support 3, on which a sheet metal 4 slides: the roller bed 2, the support 3 and the sheets of metal 4 will not be described because they are per se known;
- at least one satin finishing station 5 (better described with reference to Figures 2 and 3), equipped with at least one flap wheel 6 and with means 7 (not shown in Figure 1) adapted to set in rotation the at least one flap wheel 6; in Figure 1 six satin finishing stations 5 are shown, which carry out an increasingly high standard of satin finishing;
- feed means 8 (not shown in figure 1), adapted to feed the sheet metal 4 along the roller bed 2 and through the at least one finishing station 5.

[0021] A characterising feature of the satin finishing system forming the subject matter of the present invention is that the flaps 9 of each flap wheel 6 are fixed mechanically to the hub 10 of said wheel.

[0022] In the embodiment described herein each satin finishing station 5 comprises a mechanically fixed flap wheel 6 but, without departing from the scope of the invention, each satin finishing station 5 can comprise two or more mechanically fixed flap wheels 6, parallel to each other, and made to rotate by means 7.

[0023] The feed means are advantageously present at the beginning and at the end of the roller bed 2 and between two adjacent satin finishing stations 5.

[0024] Furthermore, since the heat produced during processing of the sheet metal by means of the mechanically fixed flap wheels 6 is less than that produced during processing by means of abrasive cloths or conventional flap wheels, during processing the sheet metal can be cooled by means of jets of air coming from delivery nozzles (omitted in the figures because they are per se known and in any case outside the scope of the present invention) placed upstream of each satin finishing station 5. The use of water as a cooling means with the consequent formation of sludge is thus avoided and it is possible to use a dust suction system, omitted in the figures because it is per se known and in any case outside the scope of the invention.

[0025] For the sake of simplicity of the graphic representation, only one satin finishing station 5, the mechanically fixed flap wheel 6 belonging to the station 5, and the flaps 9 and the hub 10 belonging to said mechanically fixed flap wheel have been identified by the relative reference numerals in Figure 1.

[0026] Figure 2 shows diagrammatically a side view of one of the satin finishing stations 5 of Figure 1, whose inner parts are shown "in transparency".

[0027] The satin finishing station 5 of Figure 2 comprises a supporting structure 11, rocking around pivots 14 carried - in a per se known manner - by the support 3, inside which are placed at least:

- a mechanically fixed flap wheel 6,
- means 7 (per se known), adapted to make the mechanically fixed flap wheel 6 rotate and consisting, in the embodiment described herein, of at least one electric motor connected in a per se known manner to the mechanically fixed flap wheel 6;
- means 8 (per se known), adapted to feed the sheet metal 4 through the satin finishing station 5 and consisting, in the embodiment described herein, of at least one motorised roller acting on the sheet metal 4.

[0028] In the embodiment described herein the supporting structure 11 consists of two side plates 12 (connected to each other by side members 13) which carry at least the mechanically fixed flap wheel 6, the means 7 adapted to make the mechanically fixed flap wheel 6 rotate, and the means 8 adapted to feed the sheet metal 4 through the at least one satin finishing station 5.

[0029] In Figure 2 the ends of the two side members 13 can be seen, one of which can be seen in Figure 3.

[0030] To compensate for wear on the mechanically fixed flap wheel 6 and to keep its peripheral speed and removal pressure constant, each satin finishing station 5 advantageously further comprises adjustment means adapted to modify the speed of rotation of the flap wheel 6 and move it vertically.

[0031] For example, the adjustment means (not described in detail because they are per se known) comprise at least one sensor adapted to detect the current absorbed by the means 7 and a logic unit which, in response to a change in the current absorbed, modifies the intensity of the current supplied to the means 7 to keep the speed of rotation of the flap wheel 6 constant and controls means 15 adapted to move the supporting structure 11 vertically to keep the removal pressure of the flap wheel 6 constant; in the embodiment described herein, the means 15 consist of a hydraulic or pneumatic cylinder having one end connected to a side member 13 of the supporting structure 11 and the other to a bar 17 integral with the support 3.

[0032] If the width of the sheet metal 4 is less than the length of the mechanically fixed flap wheels 6, each satin finishing station 5 further comprises means (indicated as a whole with reference numeral 16 and not described herein because they are per se known) adapted to swing the satin finishing station 5 cyclically in a transverse direction with respect to the direction of feed of the sheet metal 4 to spread the wear on the mechanically fixed flap wheel 6 belonging to the satin finishing station 5 evenly along the whole length of said flap wheel.

[0033] Figure 3 shows diagrammatically a head-on rear view of the satin finishing station 5 of Figure 2; visible in Figure 3 are the roller bed 2, the means 7 adapted to set in rotation the mechanically fixed flap wheel 6 (not visible in figure 3), the supporting structure 11 comprising the side plates 12 carried by the pivots 14 and connected by at least one side member 13, the means 15 adapted to move the supporting structure 11 vertically and the means 16 adapted to swing the satin finishing station 5 cyclically in a direction transversal to that of feeding of the sheet metal 4.

[0034] Without departing from the scope of the invention, as defined by the appended claims, a person skilled in the art can make to the satin finishing system previously described all the changes and improvements suggested by normal experience and/or by the natural evolution of the art.

Claims

1. A system (1) for satin finishing, by means of flap wheels (6), of sheet metal (4) moving on a bed of idle rollers (2) with a horizontal axis carried by a support (3), which comprises in combination with each other:

- at least one satin finishing station (5) equipped with at least one flap wheel (6) having its axis at right angles with the longitudinal axis of the metal sheet (4) and with means (7) adapted to cause the at least one flap wheel to rotate (6);
- feed means (8), adapted to feed the sheet metal (4) along the roller bed (2) and through the at least one satin finishing station (5),

characterised in that the at least one flap wheel (6) is a mechanically fixed flap wheel whose flaps (9) are **disposed around the whole periphery of a hub (10)** in a regular **pattern and are** mechanically fixed to the hub (10) **and further characterised in that** said feed means (8) consist of at least one motorized roller acting on the sheet metal (4) **moving on the bed of idle rollers (2)**.

2. A satin finishing system (1) as in claim 1, **characterised in that** each satin finishing station (5) comprises a supporting structure (11), rocking around pivots (14) carried by the support (3), inside which is placed at least one mechanically fixed flap wheel (6), means (7) adapted to make the mechanically fixed flap wheel (6) rotate, and means (8) adapted to feed the sheets of metal (4) through the satin finishing station (5).
3. A satin finishing system (1) as in claim 2, **characterised in that** the supporting structure (11) consists of two side plates (12) connected to each other by

means of the side member (13) and **in that** the at least one mechanically fixed flap wheel (6), the means (7) adapted to make the at least one flap wheel rotate and the means (8) adapted to feed the sheets of metal (4) through the satin finishing station (5) are carried by the side plates (12).

4. A satin finishing system (1) as in claim 2, **characterised in that** the means (7) adapted to cause the at least one mechanically fixed flap wheel (6) to rotate consist of at least one electric motor connected to the at least one mechanically fixed flap wheel (6).
5. A satin finishing system (1) as in claim 1, **characterised in that** each satin finishing station (5) further comprises adjustment means adapted to change the speed of rotation of the at least one mechanically fixed flap wheel (6) and move it vertically.
6. A satin finishing system (1) as in one of the preceding claims for satin finishing of sheets of metal (4) having a width smaller than the length of the at least one mechanically fixed flap wheel (6), **characterised in that** each satin finishing station (5) further comprises means (16) adapted to swing the satin finishing station (5) cyclically in a direction transversal to the direction of feed of the sheet metal (4) to spread the wear of the at least one mechanically fixed flap wheel (6) belonging to the satin finishing station (5) evenly along the whole length of said flap wheel.

Patentansprüche

1. System (1) zur satinierenden Nachbearbeitung von Metallblechen (4) mittels Lamellenschleifrädern (6), wobei die Bleche sich auf einer Bahn aus antriebslosen Tragrollen (2) fortbewegen, welche eine horizontale Achse aufweisen, die von einem Träger (3) unterstützt wird, wobei das System die folgenden, miteinander kombinierten Elementen umfasst:

- mindestens einen Posten (5) zur satinierenden Nachbearbeitung, der mit mindestens einem Lamellenschleifrad (6) ausgerüstet ist, dessen Achse mit der Längsachse des Metallblechs (4) sowie mit Mitteln (7), die dazu geeignet sind, das mindestens eine Lamellenschleifrad (6) in eine Drehbewegung zu versetzen, rechte Winkel bildet;
- Zuführungsmittel (8), die dazu geeignet sind, das Metallblech (4) entlang der Tragrollenbahn (2) und durch den mindestens einen Posten (5) zur satinierenden Nachbearbeitung zu führen,

dadurch gekennzeichnet, dass es sich bei dem mindestens einen Lamellenschleifrad (6) um ein mechanisch befestigtes Lamellenschleifrad handelt,

dessen Lamellen (9) gemäß einem regelmäßigen Muster rund um den gesamten Randbereich einer Nabe (10) angeordnet sind und mechanisch an der Nabe (10) befestigt sind, und weiterhin **dadurch gekennzeichnet, dass** die Zuführungsmittel (8) aus

2. System zur satinierenden Nachbearbeitung (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** jeder der Posten (5) zur satinierenden Nachbearbeitung eine Tragstruktur (11) umfasst, die kippbar um Drehzapfen (14) gelagert ist, welche von dem Träger (3) unterstützt werden, wobei darin mindestens ein mechanisch befestigtes Lamellenschleifrad (6) angeordnet ist, sowie Mittel (7), die dazu geeignet sind, das mechanisch befestigte Lamellenschleifrad (6) in eine Drehbewegung zu versetzen, und Mittel (8), die dazu geeignet sind, Bleche aus Metall (4) durch den Posten (5) zur satinierenden Nachbearbeitung zu führen.
3. System zur satinierenden Nachbearbeitung (1) nach Anspruch 2, **dadurch gekennzeichnet, dass** die Tragstruktur (11) aus zwei Seitenplatten (12) besteht, die durch ein seitliche Bauglied (13) miteinander verbunden sind, und dadurch, dass das mindestens eine mechanisch befestigte Lamellenschleifrad (6), die Mittel (7), die dazu geeignet sind, das mindestens eine Lamellenschleifrad in eine Drehbewegung zu versetzen, und die Mittel (8), die dazu geeignet sind, die Bleche aus Metall (4) durch den Posten (5) zur satinierenden Nachbearbeitung zu führen, von den Seitenplatten (12) unterstützt werden.
4. System zur satinierenden Nachbearbeitung (1) nach Anspruch 2, **dadurch gekennzeichnet, dass** die Mittel (7), die dazu geeignet sind, das mindestens eine mechanisch befestigte Lamellenschleifrad (6) in eine Drehbewegung zu versetzen, aus mindestens einem Elektromotor bestehen, der mit dem mindestens einen mechanisch befestigten Lamellenschleifrad (6) verbunden ist.
5. System zur satinierenden Nachbearbeitung (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** jeder der Posten (5) zur satinierenden Nachbearbeitung darüber hinaus Stellmittel umfasst, die dazu geeignet sind, die Drehgeschwindigkeit des mindestens einen mechanisch befestigten Lamellenschleifrads (6) zu verändern und es in vertikaler Richtung zu bewegen.
6. System zur satinierenden Nachbearbeitung (1) nach einem der vorhergehenden Ansprüche zur satinie-

renden Nachbearbeitung von Blechen aus Metall (4), deren Breite geringer als die Länge des mindestens einen mechanisch befestigten Lamellenschleifrads (6) ist, **dadurch gekennzeichnet, dass** jeder der Posten (5) zur satinierenden Nachbearbeitung darüber hinaus Mittel (16) umfasst, die dazu geeignet sind, den Posten (5) zur satinierenden Nachbearbeitung zyklisch schwingend in einer Querrichtung zur Zuführungsrichtung des Metallblechs (4) zu bewegen, um die Abnutzung des mindestens einen mechanisch befestigten Lamellenschleifrads (6), welches Bestandteil des Postens (5) zur satinierenden Nachbearbeitung ist, gleichmäßig über die gesamte Länge des Lamellenschleifrads zu verteilen.

Revendications

1. Système (1) pour une finition satinée, au moyen de roues à lamelles (6), d'une feuille métallique (4) se déplaçant sur un lit de galets (2) avec un axe horizontal porté par un support (3), qui comprend en combinaison l'une avec l'autre :

- au moins une station de finition satinée (5) équipée d'au moins une roue à lamelles (6) ayant son axe en angle droit avec l'axe longitudinal de la feuille métallique (4) et de moyens (7) adaptés pour amener l'au moins unique roue à lamelle à tourner (6) ;
- des moyens d'alimentation (8), adaptés pour alimenter la feuille métallique (4) le long du lit de rouleaux (2) et à travers l'au moins unique station de finition satinée (5),

caractérisée en ce que l'au moins unique roue à lamelles (6) est une roue à lamelles dont les lamelles (9) sont disposées tout autour de la périphérie d'un moyeu (10) selon un motif régulier et sont fixées mécaniquement au moyeu (10) et **caractérisée en outre en ce que** lesdits moyens d'alimentation (8) sont constitués d'au moins un rouleau motorisé agissant sur la feuille métallique (4) se déplaçant sur le lit de galets (2).

2. Système de finition satinée (1) selon la revendication 1, **caractérisé en ce que** chaque station de finition satinée (5) comprend une structure de support (11), basculant autour de pivots (14) portée par le support (3), à l'intérieur duquel est placée une roue à lamelles fixée mécaniquement (6), des moyens (7) adaptés pour faire tourner la roue à lamelles fixée mécaniquement (6), et des moyens (8) adaptés pour alimenter les feuilles de métal (4) à travers la station de finition satinée (5).
3. Système de finition satinée (1) selon la revendication

- 2, **caractérisée en ce que** la structure de support (11) est constituée de deux plaques latérales (12) reliée l'une à l'autre au moyen de l'élément latéral (13) et **en ce que** l'au moins unique roue à lamelles fixée mécaniquement (6), les moyens (7) adaptés pour faire tourner l'au moins unique roue à lamelles et les moyens (8) adaptés pour alimenter les feuilles métalliques (4) à travers la station de finition satinée (5) sont portés par les plaques latérales (12).
4. Système de finition satinée (1) selon la revendication 2, **caractérisée en ce que** les moyens (7) adaptés pour amener l'au moins unique roue à lamelles fixée mécaniquement (6) à tourner sont constitués d'au moins un moteur électrique connecté à l'au moins unique roue à lamelles fixée mécaniquement (6).
5. Système de finition satinée (1) selon la revendication 1, **caractérisé en ce que** chaque station de finition satinée (5) comprend en outre des moyens de réglage adaptés pour changer la vitesse de rotation de l'au moins unique roue à lamelles fixée mécaniquement (6) et la bouger verticalement.
6. Système de finition satinée (1) selon la revendication précédente pour la finition satinée de feuilles métalliques (4) ayant une largeur inférieure à la longueur de l'au moins unique roue à lamelles fixée mécaniquement (6), **caractérisé en ce que** chaque station de finition satinée (5) comprend en outre des moyens (16) adaptés pour faire pivoter la station de finition satinée (5) de façon cyclique dans une direction transversale à la direction d'alimentation de la feuille métallique (4) pour répandre l'usure de l'au moins unique roue à lamelles' fixée mécaniquement (6) appartenant à la station de finition satinée (5) de manière uniforme sur toute la longueur de ladite roue à lamelles.

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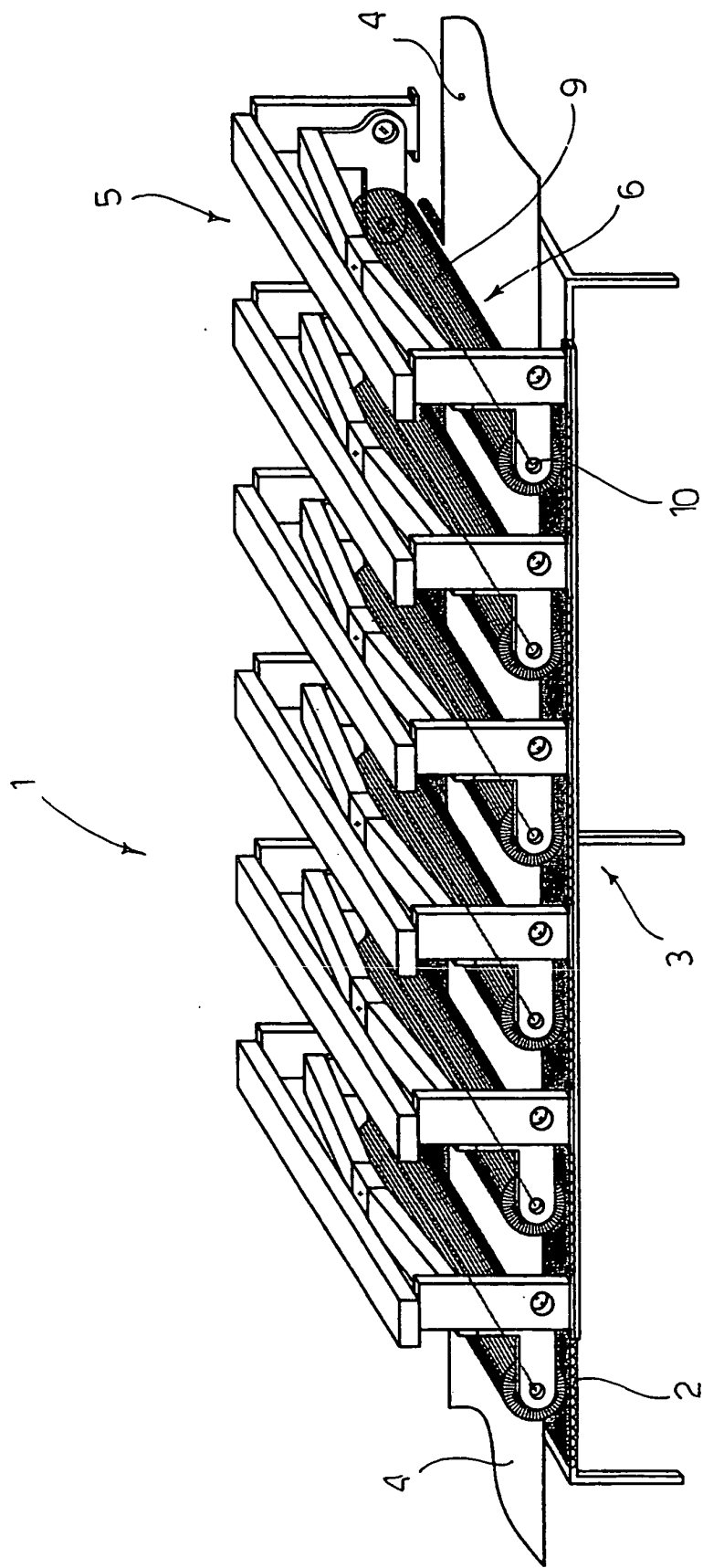


FIG. 1

FIG. 2

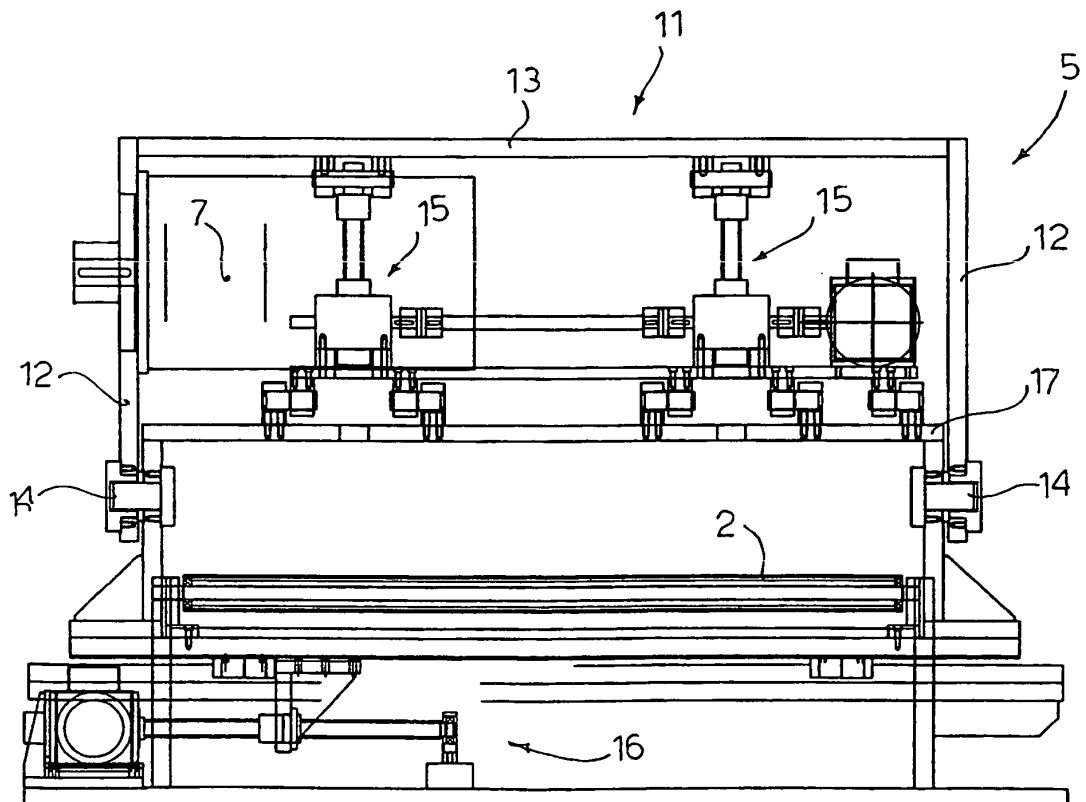
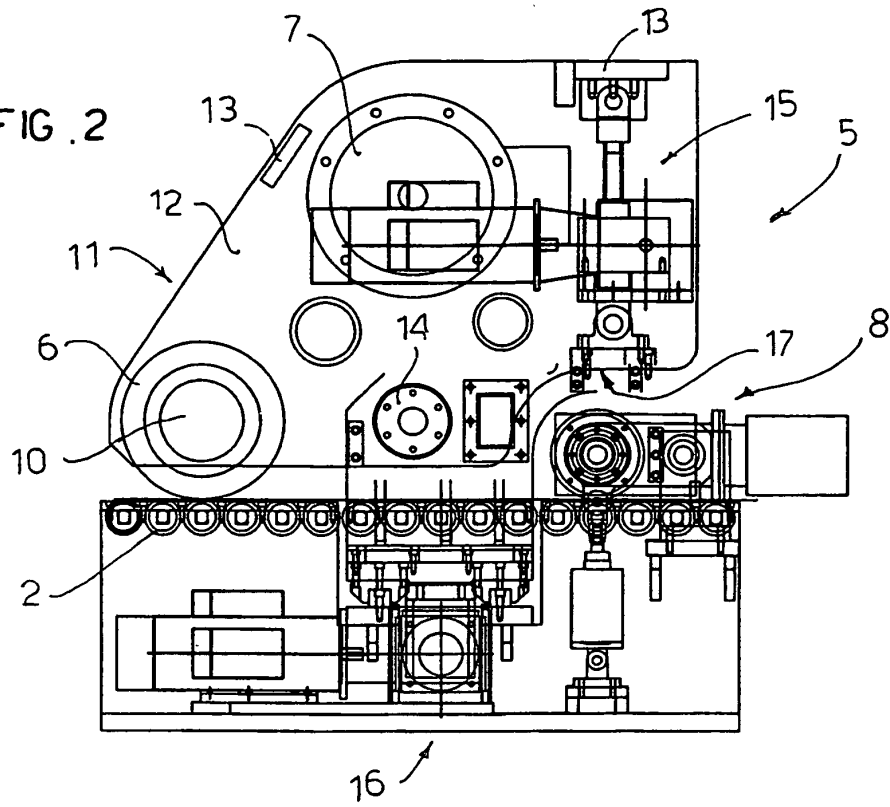


FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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