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(54) Process and apparatus for manufacturing a lamella for a light building panel

(57) In a process and apparatus for manufacturing a lamella (7) for use in a light building panel (1) the lamella is used for improving the mechanical characteristics of the panel. The process for its manufacture comprises four sub-processes; i.e. input, cutting, exit, and suction of the remnants of the manufacturing process. The apparatus for the lamella's manufacture comprises inlet (9), cutting ensemble (10), exit (11), and suction ensemble (12) for suction of the remnants of the manufacturing process.

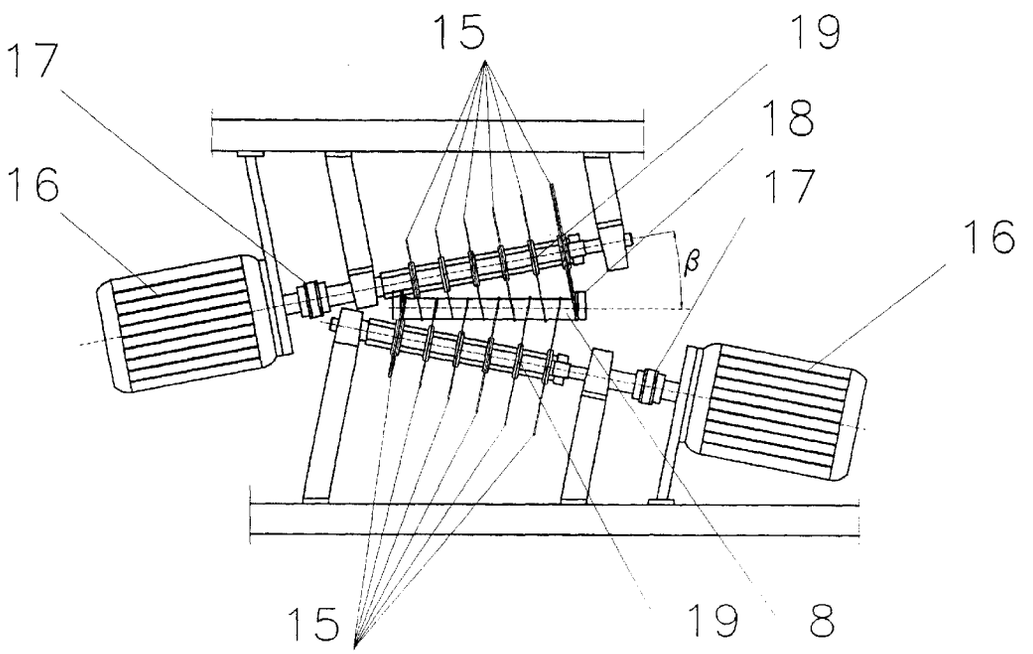

FIG. 3

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Description

Technical field

[0001] This invention relates to a process and apparatus for manufacturing a lamella for a light building panel and to such a lamella. It relates to the technical fields: circular saws; systems for cutting; light building panels; treatment of insulation material.

Technical problem to be solved

[0002] Technical problems which are to be addressed by the present invention are problems arising from the use of light building panels, their mechanical characteristics and problems arising from cutting panels of mineral wool (also rock wool) or glass wool or other mineral filling for light building panels or other material used for insulation purposes (hereinafter 'mineral filling') in the process of manufacturing components for light building panel filling. Said problems arise mainly due to:

- tedious and dangerous manipulation by manually serving saws for cutting said mineral filling;
- imprecise cutting due to nonequally applied pushing forces;
- impurities such as lumps or parts of fiber and the like on the surface of freshly cut mineral filling components;
- impurities such as dust particles within the surroundings of the process (the environment).

State of the art

[0003] The insulation of buildings is done in several ways. One of the possibilities is to use light building panels of mineral filling, which have some unwanted mechanical features addressed by the present invention.

Description of the invention

[0004] For convenience, the following general description includes reference numerals which match those used in the drawings, which are described in more detail later.

[0005] A light building panel (1) typically comprises at least three layers: a lower layer (2) of metal sheet or other water resistant material; a middle layer of mineral filling (3), and an upper layer (4) of metal sheet or other water resistant material. To improve its mechanical strength said light building panel can be reinforced by ribs along the length of the panel or other type of profile (hereinafter 'ribs'). If said ribs are not additionally supported by a mineral filling, either their twisting (deformation) or increased sensitivity to local pressure application or another type of load may occur. Polyurethane or similar material is not fire resistant in use.

[0006] Said light building panel (1) rib (5) is reinforced by inserting a lamella of mineral filling (7) which can be glued using a thin layer of adhesive (6) on to a supporting part of the rib of metal sheet or other water resistant material. The term 'lamella' is used to include fillings of the shape described below.

[0007] The lamellas (7) are made of mineral filling and are characterized by a cross section of a trapezoidal shape (also known as a trapezium). Thereby the side surfaces of the trapezoid form an inner (acute) angle of 75° to 83° with base side of the trapezoid. In other words, the sides of the trapezoid describe the acute angle α whereby α comprises angles of 75° to 83°, in a particular embodiment 79°. The length of the lamellas (7) is not restricted, nor is the width or height. In a particular embodiment the lamellas feature the acute angle α of 79° and are 1200 mm long, 37 mm high (thick) and 25 mm wide (the size of the shorter parallel side of the trapezoid).

[0008] The lamellas (7) can be manufactured using apparatus for lamella (7) manufacturing, said apparatus manufacturing the final form of the lamellas from the initial form ofa mineral panel (slab, plate) (8) using a technological process comprising inlet into the apparatus, cutting, outlet from the apparatus and cleaning of impurities from the surface of the manufactured lamellas using suction. Said apparatus comprises:

(a) An inlet part (9) which performs a function of guiding and positioning at least one panel made of mineral wool into the apparatus and can be of stable steel construction with added side sliding guides (13). The base surface of inlet comprises either rollers or a conveyer belt, in the particular embodiment the rollers (14). The side sliding guides (13) serve for guiding and positioning the mineral filling panels (plates) (8) into a cutting ensemble (10). Said panel (8) slides over an inlet (9) surface guided by a side guide (13) to thereby ensure the correct position for entry between the cutting disks or circular saws (15).

(b) the cutting ensemble (10) performing a function of cutting and comprising at least two shafts (19) with intersection centerlines. The circular saws (15) are connected (attached) to said shafts (19) whereby their diameter monotonically increases (in the particular embodiment monotonically linearly) with distance from the intersection of said shafts' (19) centerlines. In the particular embodiment the sizes of the circular saws increase from 160 mm to 250 mm. The shafts (19) are driven using a driving mechanism and/or engine, in the particular embodiment an electromotor (16) which transmits momentum to the shaft (19) via a clutch (17). The centerlines of the shafts (19) intersect forming an angle of 2β. In the particular embodiment the first of the shafts (19) forms the angle of $+\beta$, and the second the angle $-\beta$ with its respective projection onto the

base surface (plane) of the panel (8). The angle β can be calculated from β=90°-α and is 11° in the particular embodiment. As the centerline of the shaft (19) forms the normal of the plane in which particular circular saws (15) lie, said circular saws (15) perform cuts which form the angle with base surface plane) of the panel (8), i.e. 79° in the particular embodiment. Adjacent circular saws are separated using spacer rings or other type of spacers ensuring the uniformity of manufactured lamellas' (7) sizes prescribed by the technological process. During the cutting process it is necessary to maintain and/or limit the transverse and the longitudinal movement of material undergoing said process between particular ensembles of circular saws (15). In the particular embodiment this is achieved by guides guiding the panel (8) during the cutting phase. Said guides in the particular embodiment comprise side and bottom guides, whereas it is pressed by guiding roller (18). The actual angle β, the diameters of respective circular saws (15) and the distance between adjacent circular saws (15) depend on the desired geometry of the lamellas (7).

(c) An outlet (11) performing the function of guiding from the apparatus, and can be stable steel welded construction used to guide manufactured lamellas (7) and has, similarly to inlet (9), side sliding guides to guide cut panel (8) from the cutting ensemble.

(d) at least one suction chamber (12) performing the function of removing (suction) of impurities in the form of dust, lumps, particles of fiber and other remnants of cutting the mineral filling, while well sealing and/or reducing the amount of exit of said impurities into the surroundings of the apparatus or into the environment. In the particular embodiment said chambers (12) prevent access to the circular saws during the operation and thereby perform a safety function as well.

[0009] The subject of this invention is further described with help of embodiments presented below and by the accompanying exemplary drawings, in which:

[0010] Fig. 1 shows a light building panel (1) with a lower layer (2), middle layer (3), upper layer (4), rib (5), adhesive (6), lamella (7) and angles α and β.

[0011] Fig. 2 shows apparatus for manufacturing the lamellas (7) with a panel (plate, slab) of mineral filling (8), inlet (9), cutting ensemble (10), exit (11), system and/or chambers for suction (12), side guides (13) and rollers (14).

[0012] Fig. 3 shows a cutting ensemble with the panel of mineral filling (8), circular saws (15), electromotor (16), clutch (17), guiding roller (18), shafts (19), and angle β.

[0013] The apparatus described in this invention and in the particular embodiment performs its function as follows:

[0014] The panel of mineral filling (8) is guided into the cutting ensemble. There the panel (8) is cut by the ensemble ofcircular saws (15) into lamellas (7). Said saws (15) are connected to the shaft (19) in such a fashion that their respective planes form alternating angles of +β and -β with a normal of the panel (8). The cross section of the lamellas (7) is equal to the trapezoid. Said trapezoid's dimensions are related to the distance between the circular saws (15). The angle formed by the side sides of the trapezoid with its base side (i.e. angle 90°-β) is determined by the angle formed by the centerline of the respective shaft (19) with the circular saws (15) attached thereto and the line parallel to the base surface (plane) of the panel (8). Thereby the projections of the axis of the shaft (19) on to the base surface (plane) of the panel (8) should be as perpendicular to the direction of the panel (8) movement as possible. The normals of the respective circular saw (15) planes should be as parallel as possible to the axis of the shaft (19) with the circular saws (15) attached thereto. The lamellas (7) manufactured by the described process are led from the cutting ensemble (10) into the system for suction (cleaning) or suction chambers (12) whereby the lamellas (7) are cleaned of the remnants of cutting or ofa previous process and/or impurities such as lumps of fibers, fiber particles, or dust etc. using suction. In the particular embodiment of this invention the lamellas feature the angle α of 79° and are 1200 mm long, 37 mm high (thick) and 25 mm wide (the size of the shorter parallel side of the trapezoid). The base surface of the apparatus is formed of rollers (14).

[0015] Following this the lamellas (7) are led by a transport system to a trapezoidal profiled metal sheet where they are inserted to fill the channels with the trapezoid cross sections (5).

[0016] It is self evident that the above described invention can be also used in other particular forms without changing the substance of the invention.

Claims

1. A lamella made of mineral filling or other material used for insulation purposes whereby said lamella is of trapezoid form, wherein said lamella is a component of a light building panel, **characterized in that** its cross section forms a trapezoid wherein the side sides of said trapezoid form an inner angle ranging from 75° to 83°.

2. A lamella according to claim 1, **characterized in that** it is permanently fastened to a supporting layer of a rib of metal sheet or other water resistant material using adhesive or glue (6).

3. A process for manufacturing a lamella made of mineral filling or other insulation material **character-**

ized in that it comprises:

(a) guiding and positioning at least one panel (8) made of mineral filling or at least one panel (8) made of other insulation material into an apparatus on rollers or conveyer belt whereby movement of said panel is transversely limited and positioning is achieved by side guide means;
(b) cutting with at least two ensembles of circular saws wherein said saws are attached to shafts, said shafts' centerlines alternately intersecting and forming an angle, said angle computed by subtracting the inner angle of the trapezoid form of said lamella cross section from a right angle and multiplying result by two, said circular saws performing the cutting of the panel made of mineral filling or other insulation material thereby forming the inner angle of the trapezoid cross section of the lamella;
(c) guiding from the apparatus on rollers or a conveyer belt whereby transverse movement of the guided material is limited by side guides;
(d) suction of remnants of the manufacturing process.

4. Apparatus for manufacturing a lamella made of mineral filling or other insulation material, **characterized in that** it comprises:

(a) an inlet (9) comprising rollers (14) or a conveyer belt and side guides (13);
(b) a cutting ensemble (10) comprising at least two ensembles or circular saws (15) wherein each particular ensemble comprises at least one circular saw (15) and wherein the circular saws (15) of each particular ensemble are attached to a shaft (19) wherein the centerlines or projections thereof on a common plane of adjacent shafts (19) intersect forming an angle β, said angle β computed by subtracting the inner angle of the trapezoid form of said lamella cross section from a right angle and multiplying the result by two;
(c) an exit (11) comprising rollers (14) or a conveyer belt and side guides (13);
(d) at least one suction chamber (12) for cleaning impurities and/or limiting the exit of impurities which are formed during cutting;

whereby said components of said apparatus can be arranged in any desired order.

5. Apparatus according to claim 4, **characterized in that** the cutting ensemble has at least one of the following characteristics:

(a) at least two circular saws (15) are attached to the shaft (19), said saws (15) lying in planes with normals essentially parallel to the shaft (19) centerline, said saws' (15) diameters monotonically increasing from the intersection of said shafts (19) centerlines or projections thereof;
(b) the diameters of said saws (15) range from 160 mm to 250 mm;
(c) adjacent circular saws (15) are spaced one from another using elements for providing an appropriate distance between said adjacent circular saws (15);
(d) the cutting ensemble comprises two shafts (19) wherein the centerline of the first shaft (19) forms with its projection on to the plane of the panel (8) an angle of $+\beta$ and wherein the centerline of the first shaft (19) forms with its projection onto the plane of the panel (8) an angle of $-\beta$ and wherein the angle β is computed from $\beta=90°-\alpha$ and wherein the angle α is the acute angle formed by side sides ofa trapezoid with the base line of said trapezoid, and said trapezoid is the cross section shape of the lamella (7);
(e) the shaft (19) is driven by a driving engine (16) via a clutch (17);
(f) circular saws (15) perform the cutting of the panel (8) in such a fashion that the cut forms the angle with the base plane of the panel (8);
(g) between each cutting ensemble there are guides (18) to guide the panel (8) whereby said guides comprise at least a guiding roller (19) above the panel (8), bottom, and side guides.

6. Apparatus according to claim 4 or claim 5, **characterized in that** the suction is performed by a suction chamber whereby said suction chamber performs at least one of the following functions:

(a) reducing exit of impurities such as remnants of the manufacturing process of said lamellas into the environment;
(b) a safety function by preventing access to the circular saws (15) during operation.

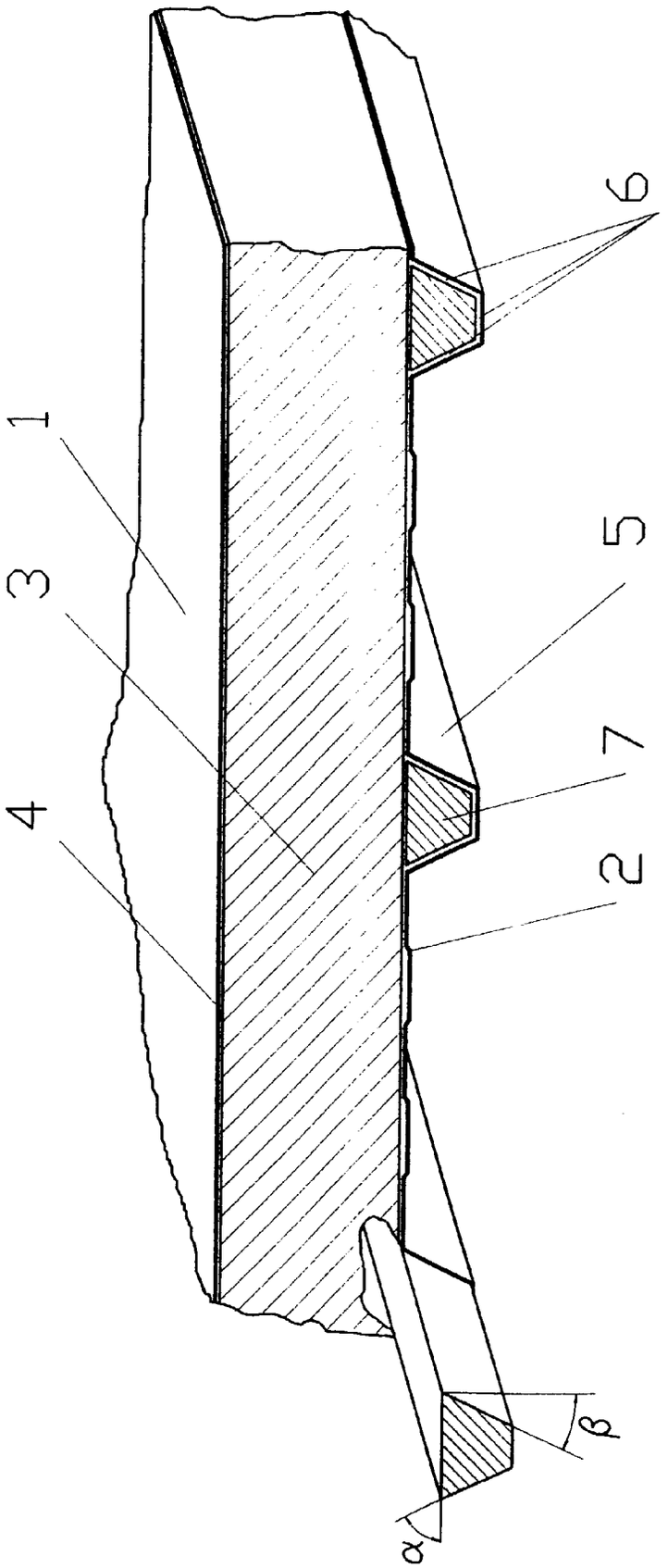

FIG. 1

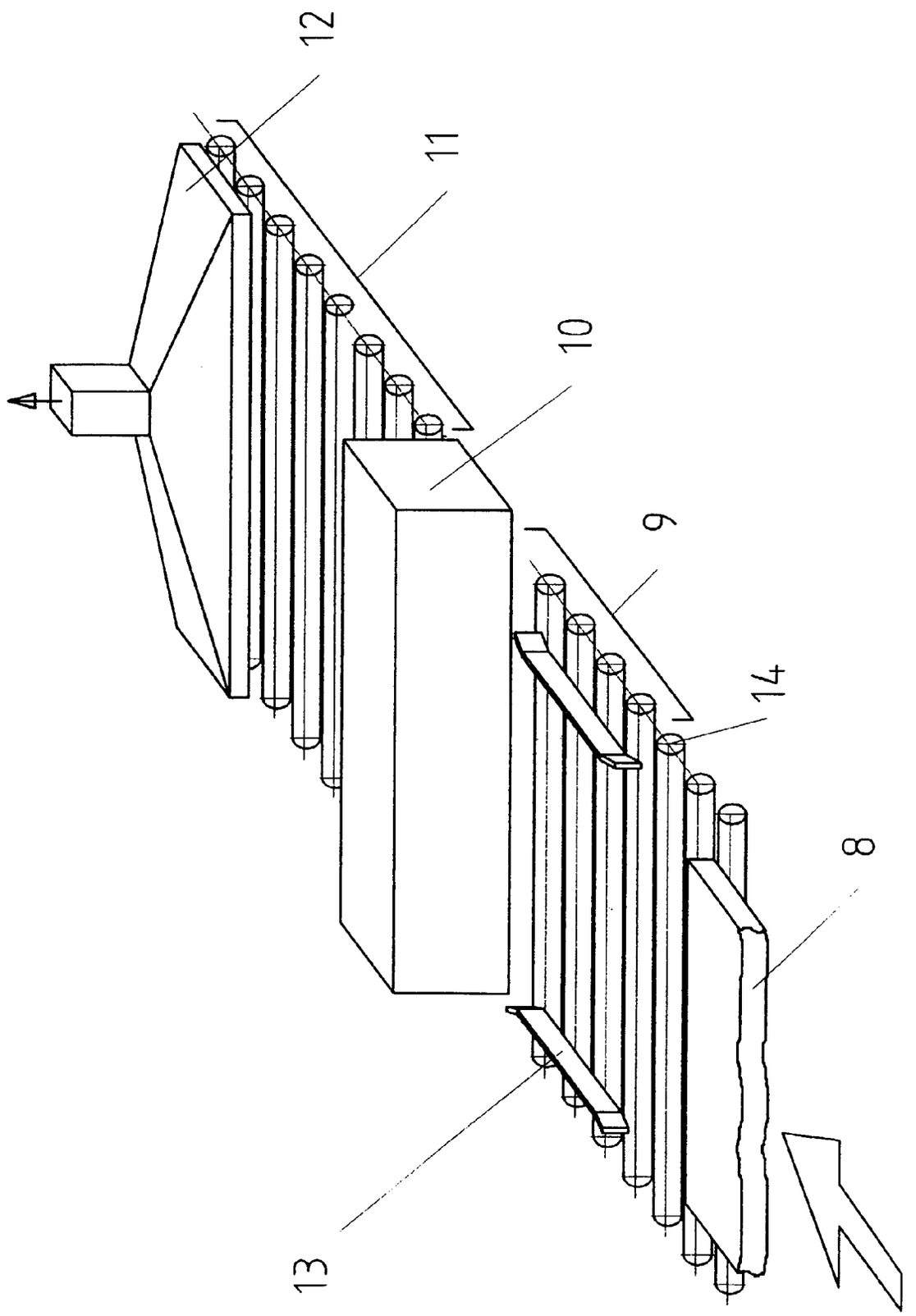

FIG. 2

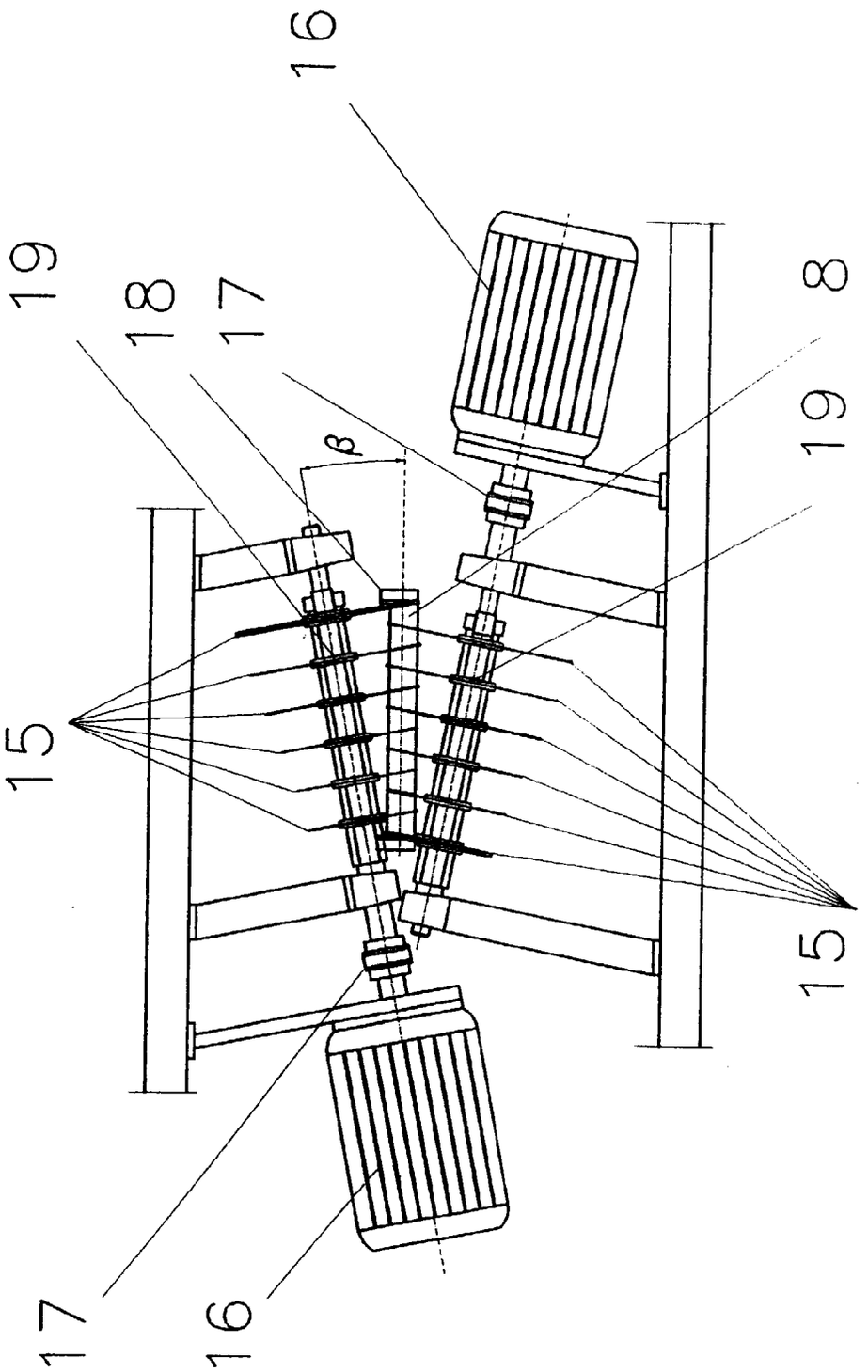

FIG. 3