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(54) **Automatic or semi-automatic machine for covering stiff panels with sheet material**

(57) An edge folding machine has, associated to each of two roller conveyors (12,13,21,22) for feeding and clamping the laminated panel (P) guided underneath an edge folding counter rotating brush (14), a channeled roller (19,20) of extended support for the driven panel, the position of which extends under the overhanging counter rotating brush (14), beyond the pair of cooperating rollers (12,13,21,22) of the respective inlet and outlet roller conveyor of each edge folding station (S1,S2) of the machine.

The two channeled rollers (19,20) alternately sustain the leading edge (and successively the trailing edge, during a backward passage through the edge folding device of the station) of the laminated panel (P) travelling on the

same plane of advancement through the inlet and outlet roller conveyors of the station, defining by the distance of separation between them, a space or gap that is invaded by the outer portions of the bristles of the counter rotating brush (14) when momentarily lowered, synchronously with the arrival of the leading edge of a projecting marginal edge portion of the cover sheet to be folded back onto the stiff panel, from a raised stand-by position. In this manner, the clamping and feeding roller pairs (12,13,21,22) at the two sides of the rotating brush may be conveniently spaced at a certain distance from the rotation profile of the brush and lift off of adhesive from the two side marginal edge portions of the cover sheet yet to be folded is prevented.

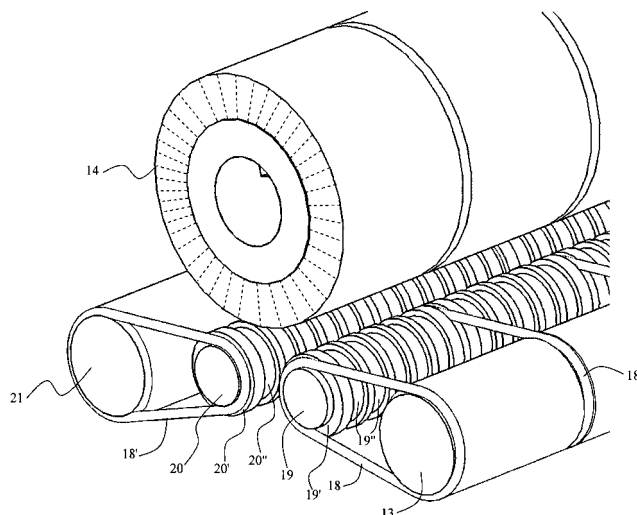


FIG. 3

Description

[0001] The present invention relates the fabrication of cardboard/fiberboard articles and alike industries and in particular to machines for covering with a sheet material relatively rigid panels such as for example cardboard panels.

[0002] Many types of machines are known and commercially available for covering flat boards with a sheet, typically a paper sheet. They differ among each other in terms of degree of automation and for the cycle of fabrication of the article. At the end of the fabrication steps, the board is completely covered by the cover sheet material over every side, including corners.

[0003] A partial or complete automation of the covering process generally implies the use of conveyors having cooperating pairs of rollers for driving the panels or alternatively using a circulating foraminous belt for allowing application of a vacuum or a plurality of spaced narrow belts running parallel and on the same plane at a certain distance from each other over pulley rollers, that is over rollers with circular grooves in which the narrow belts run. Generally, laminated panels composed of a stiff board bonded over an adhesive coated cover sheet of suitably longer dimensions advance from a first operating station of the machine through a succession of operating stations. At a first operating station, a polygonal panel of relatively rigid material, commonly of cardboard cut to size, is centrally adhered onto a similarly shaped polygonal sheet of foldable material to which an adhesive film or a layer of glue has been applied onto the coupling surface, commonly a cover sheet of paper, such to form a flat laminated panel with projecting marginal edge portions strips on all sides of the polygonal panel on which the adhesive has been distributed. The so laminated panel received onto a first belt conveyor and lying flat on the conveyor belt is eventually advanced toward the first of a succession of edge folding stations at which the projecting edge portions of cover sheet are lifted and wrapped around the edge of the panel to finally adhere onto the upper surface thereof.

[0004] Typically, the action of lifting of a projecting marginal edge portion of the cover sheet, its folding back around the edge of the rigid panel and its adhesion over the upper surface of the board, is performed by a transversal flexible bristle brush disposed orthogonally to the direction of advancement of the laminated panel. The brush may be of a fixed type, as described in US Pat. No. 4,248,657, and its function of raising the adhesive coated projecting edge portion of the cover sheet against the leading edge of the advancing panel, may be aided by compressed air jets capable of lifting the projecting marginal edge portion of the cover sheet, which therefore securely impacts against the bristles of the brush with a certain slant to ensure that it will be wrapped back against the leading edge and adhered on the top surface of the advancing laminated article.

[0005] Alternatively, a cylindrical brush may be used

rotating in a direction opposite to the direction of advancement of the leading edge of the advancing board coupled to the cover sheet such that the bristles of the counter rotating brush engage with the projecting marginal edge portion of the cover sheet lifting it, wrapping it around the edge of the stiff board and neatly adhere it onto the upper surface of the panel without the aid of cooperating edge lifting compressed air jets. Numerous commercial machines use this edge folding device with counter rotating brush, exploiting the rotation of the brush for favoring the raising of the leading edge of the projecting marginal edge portion of the cover sheet that may thus be lifted correctly and reliably without using air jets impinging on it from below the plane of advancement of the panels.

[0006] Independently of the type of device used, the edge folding stations of the machine include so called corner tucking devices of either the "knife" or "wheel" type, acting downstream of the edge folding brush, for locally pressing the side portions of the folded back projecting marginal edge portion just adhered around the leading edge of the stiff board during the passage under the edge folding brush of the station, tucking them against the flanks of the advancing board in order to complete the covering of the corners and pre-arranging them for the subsequent folding of the projecting edge portions orthogonal to those folded in the operating station being traversed.

[0007] Italian Pat. No. 1,241,719 describes a semi-automatic edge folding machine employing a counter rotating cylindrical brush and inlet and outlet conveyor means, a terminal roller of this inlet conveyor or of which cooperates with an upper pressing roller to guide and project forward the laminated panel toward the edge folding counter rotating brush. A similar pair of cooperating rollers on the other side of the brush takes the so covered leading edge portion of the advancing laminated panel pressing the folded over edge portion of the cover sheet for firmly adhering it over the upper surface of the stiff board.

[0008] The Italian Pat. no. 1,250,188, describes a semi-automatic edge folding machine wherein the counter rotating cylindrical brush performs its lifting action on the projecting marginal edge portion of the cover sheet over which is present an adhesive, in the space of separation between two distinct co-planar belt conveyors of the operating station, at the two juxtaposed ends of which there is an upper roller for pressing and driving the moving panels. The rotational trajectory of the end portion of the bristles of the rotating brush reaches down in the separation space, below the plane of advancement of the panels over the two juxtaposed belt conveyors, in order impact with the advancing projecting marginal edge portion of the cover sheet for ensuring a correct lifting thereof.

[0009] A simultaneously timed inversion of the direction of motion of the two distinct conveyors at the two opposite sides of the rotating brush and of the direction of rotation of the brush permits to carry out the edge fold-

ing of a first projecting edge portion around the leading edge of the advancing laminated panel during a first forward travel through the station, and successively of the trailing edge of the panel, during a re-tracement or backward travel through the same edge folding station by the laminated panel being treated. Thereafter a second inversion of motions makes the panel to freely travel forward through the station and proceed toward a successive edge folding station similar to the first one, in order to perform the edge folding of two other sides, orthogonal to the first two sides for a rectangular panel, also in this case through a forward passage and a backward passage through the same edge folding devices of the station.

[0010] The Italian Pat. No. 1,262,554, describes a semi-automatic or automatic edge folding machine substantially reproducing the same functional organization of parts of the machine described in the prior Italian Pat. No. 1,250,188, but wherein the discontinuity of support along the plane of travel of the panels under the edge folding counter rotating brush, typical characteristic of prior counter rotating brush machines, is substantially eliminated by introducing between the two juxtaposed ends, respectively on one side and on the other side of the counter rotating brush, of an inlet belt conveyor and of an outlet belt conveyor of the edge folding station, a third closed-loop belt conveyor, having a portion coplanar with the other two belt conveyors of inlet and outlet respectively. Such an additional belt conveyor is composed by a plurality of spaced parallel narrow belts running on pulley rollers of circulation in order to uninterruptedly sustain the laminated panels moving under the counter rotating brush on the same plane of advancement of the two distinct inlet and outlet conveyors of the station. In this case, the respective upper rollers for pressing and guiding in the two opposite directions the laminated panels, cooperate with two circulation pulley rollers of the third belt conveyors, composed by said plurality of spaced narrow belts, for sustaining on the plane of movement the laminated panel during its repeated passages under the counter rotating brush.

[0011] The lifting of the projecting marginal edge portion of the cover sheet at the leading side (and following inversion of the directions of motion, of the projecting marginal edge portion of the trailing side) of the laminated panel is performed by the bristles of the counter rotating brush that rotate into the separation gaps between adjacent parallel narrow belts that form the additional third belt conveyors of advancement and support of the laminated panel. Accordingly, the counter rotating brush has a profile of its outermost surface defined by the bristle tips that is not a continuous cylindrical surface but has a somewhat square way profile determined by two distinct heights of the bristles, the distribution of which matches with the narrow belts and with the separation gaps therebetween of the closed loop additional conveyor.

[0012] Fourth and fifth additional closed loop multiple belt conveyors are also employed for implementing the

necessary corner tucking functions.

[0013] Of course, also in this machine, the directions of linear motion of the distinct operating conveyors of the station and of the rotation motion of the counter rotating brush and of the upper pressing and driving rollers are inverted for carrying out the edge folding on two parallel sides of the laminated panel through a first forward travel and a successive backward travel of the article or part of it through the edge folding organs of the station, before being advanced toward a successive operating station of the machine.

[0014] The Italian Pat. No. 1,291,806 describes a semi-automatic or automatic edge folding machine employing a counter rotating cylindrical brush, wherein each edge folding station is no longer equipped with two or, as in the case of the Italian Pat. No. 1,262,554, three or as illustrated five distinct recirculating belt conveyors, but on the contrary a unified recirculating belt conveyor, the direction of motion of which is also in this case inverted for carrying out two edge folding operations (on the leading and successively on the trailing edge) on the incoming laminated panels.

[0015] According to this further embodiment of edge folding machine using a counter rotating brush, the necessary discontinuity of support of the laminated panel travelling under the edge folding counter rotating brush, in order to provide for the presence of a space accessible for the rotation of end portions of the bristles geometrically below the plane of travel of the flat panel, such that the leading edge of the projecting marginal edge portion of the cover sheet be correctly lifted by the rotating bristles of the brush is created by bringing the belt to circulated around a lowered circulation roller, the axis of which lays on the same vertical plane of the axis of rotation of the brush. In this way an adequate discontinuity or gap is created in the plane of support of the laminated panel as it travels directly below the rotating brush, allowing the outermost profile of rotation of the bristles of the cylindrical brush to reach down sufficiently below the plane of support of the laminated panel onto the unified belt conveyor of the edge folding station.

[0016] All these known machines have drawbacks under different aspects. The use of a unified belt conveyor in an edge folding station increases the dimensional criticalness of the functional parts that coordinately among each other provide for a correct engagement and lifting of the projecting marginal edge portion of the cover sheet of the laminated panel travelling on the unified belt conveyor, a magnified sensitivity to wear and/or deformation of the bristles of the counter rotating brush.

[0017] On the other hand, the multiplication of the number of distinct belt conveyors cooperating among each other to the functioning of each edge folding stations according to the solution proposed in the Italian Pat. No. 1,262,554, increases complexity and cost of the machine besides requiring the use of special brushes precisely profiled and installed.

[0018] Moreover, operating as customary with two

successive edge folding runs to fold first the leading edge and successively, through a retracement backward travel, also the trailing edge of the laminated panel, a partial lift off of adhesive by the bristles of the counter rotating brush occurs over the still projecting marginal edge portions of the cover sheet along two sides of the laminated panel that will be successively folded in a subsequent edge folding station of the machine and even on the trailing edge portion.

[0019] Frequent cleaning, maintenance and adjustment interventions are made more time consuming by the relative numerosity and/or difficulty of access to functional organs of the edge folding station.

[0020] Therefore, there persisted the usefulness and request for an automatic or semi-automatic edge folding machine that, on one side, be able to eliminate or reduce dimensional criticalness in order to ensure reliable operation upon the varying of the thicknesses of the covered panels and of their characteristic of stiffness and, on the other side, be of a comparatively simple construction for reducing costs of the machine and its maintenance, and for simplifying and making easier maintenance, cleaning and adjustment interventions.

[0021] A further objective of the applicant was to substantially eliminate the problem of an excessive removal of adhesive from still exposed projecting marginal edge portions of the cover sheet by the bristles of the edge folding brush.

[0022] These objectives are effectively fulfilled by the novel machine of this invention that is based on the association to each of the two conveyors, of feeding and gathering, respectively, of the laminated panel travelling underneath the edge folding counter rotating brush, both composed of pairs of pressing and/or driving rollers, of a channeled roller of advanced cantilever support of the driven panel, the position of which extends under the overhanging counter rotating brush beyond the pair of cooperating rollers that press and drive the panel of the respective inlet and outlet conveyor of the station.

[0023] The two channeled rollers alternately sustain the leading edge (and successively the trailing edge during the backward passage through the edge folding device of the station) of the laminated panel travelling on the same plane of advancement through the inlet and outlet roller pair conveyors of the station, defining by the distance of separation between them, a space or gap that can be encroached by the outer portions of the bristles of the counter rotating brush. In this manner, the pressing and driving roller pairs at the two sides of the rotating brush, composed by a sustaining roller and by the respective upper pressing and driving roller, may be conveniently spaced at a certain distance from the rotation profile of the brush.

[0024] The recessed portions of the surface of the channeled rollers of extended cantilever support of the flung forward panel make more reliable the correct engagement and lifting of the projecting marginal edge portion of the cover sheet by the bristles of the counter ro-

tating cylindrical brush upon approaching the limit of cantilever rest on the channeled roller. These channels may be parallel spaced circular channels or defined by one or several helicoidal threads or by embossings of the outer cylindrical surface of the roller or any other functionally equivalent conformation of the surface of the roller. The separation distance along adjacent annular channels, the pitch of single or plural helices or the distance between adjacent gofferings is such to prevent excessive saggings of the adhesive coated projecting marginal edge portion of the cover sheet.

[0025] Ordinary motion transmission organs rotate the channeled rollers of extended cantilever support of the laminated panel under the counter rotating brush at the same tangential speed as the pair of cooperating rollers that clamp and drive the laminated panel along the plane of travel through the station. These motion transmission organs may be toothed belts and gears keyed on the shafts of the rollers or more preferably consist of pluralities of elastic circular cross section belts running in dedicated annular grooves with semicircular bottom formed in the cylindrical surface of the rollers.

[0026] Actuators automatically controlled synchronously with the progressive reaching of certain positions by the travelling laminated panel as detected by common sensors and in function of a certain control program, move the shaft of the rotating brush over the plane orthogonal to the plane of advancement of the laminated panels, from a first raised position of stand-by, at which the brush is practically lifted off the plane of travel of the panels, to a second operating position, at which the bristles of rotating brush interferes with the plane of travel of the panels, and vice versa. In this way, by rhythmically lowering the rotating brush inside the space of separation between the juxtaposed coplanar channeled rollers of extended support, and raising the brush immediately after having folded back the projecting marginal edge portion of the cover sheet, the extent of the travel of contact between the bristles of the rotating brush and the side projecting marginal edge portions of the cover sheet yet to be folded (the trailing marginal edge portion of the trailing side) is practically minimized or substantially null, thus eliminating the inconveniences that may be caused by an excessive lifting off of adhesive from still exposed edge portions surfaces of the cover sheet.

[0027] The invention is defined in the annexed claims.

Figure 1 is a general view of a machine made according to the present invention;

Figure 2 is partial lateral view of a first of two similar edge folding stations of the machine of Figure 1.

Figures 3 and 4 show the spatial organization of the organs of the edge folding device according to a preferred embodiment.

[0028] With reference to Figure 1, the automatic machine for covering relatively rigid panels, for example of cardboard or fiberboard, with a cover sheet, for example

of paper, has a first section, generally definable as station for coupling, a cover sheet to a relatively stiff board, that is identified as a whole in the figure, with the letter A.

[0029] This section of the machine, that may include as shown also a control console 2 and a reservoir 3 of liquid glue, eventually provided with thermostatically controlled heating elements in case of use of a hot applicable adhesive, has conveyors and automatic handling organs that may be of any appropriate type among known devices as commonly employed in these automatic machines for bookbinding and specifically for fabricating cardboard and fiberboard articles. In this section of the machine, a layer of fluid adhesive is applied onto a surface of a cover sheet and a stiff board is centrally coupled onto the glued surface of the cover sheet.

[0030] The laminated panel P thus constituted according to common automation techniques well known to the expert artisan, advances on the foraminous belt conveyor 4, on the surface of which is firmly held by the effect of a vacuum applied through the apertures of the foraminous belt 4 circulating around a hollow structure, commonly made with extruded aluminum of appropriate cross sectional profile, connected to a vacuum source.

[0031] The belt conveyor 4, thus advances the laminated panels P toward the first of two functioning similarly edge folding stations, indicated as wholes with S 1 and S2, respectively, in the view of Figure 1, which, as will be described in detail, are reached in succession by the panels P.

[0032] In the embodiment shown, the directions of travel of the panels through edge folding station S1 and through the second edge folding station S2 are orthogonal to each other. However, the two stations may even be in line, in which case the machine may contemplate the presence of suitable handling means, for example a vacuum lifting arm, for momentarily lifting, rotating by 90° and relowering a panel onto the circulating foraminous belt conveyor 5 that connects the first to the second station the panel already covered on two first side edges (e.g. top and bottom edges) and yet to be covered along the other two side edges orthogonal to the first two (e.g. along the two flanks) in the second stations. S2, similarly to what was described as being manually performed by an operator in the machined described in the Italian Pat. No. 1,241,719.

[0033] In the machine depicted in Figure 1, the panel that has had two parallel side edges covered in the first station S 1, by performing the folding of the leading projecting edge portion of the cover sheet during a first forward passage of the panel and thereafter of its trailing projecting edge portion of the cover sheet during a retracing backward passage under the edge folding devices the same station S1, to finally travel through the same station S1 and proceed onto the foraminous belt conveyor 5 along an orthogonal direction in respect to the direction of circulation of the first foraminous belt conveyor 4. The second conveyor 5 will convey the panel already covered onto two sides to the second edge folding station

S2.

[0034] In the second station S2 is similarly performed the folding of the now leading edge and thereafter also of the trailing edge, respectively through a first forward passage and successive backward passage through the same edge folding devices of the station S2. The finished article is finally driven onto the recirculating foraminous belt conveyor 6 that expels it. The completely covered panels may fall by gravity inside a collecting container or transport case (not depicted in the figure).

[0035] Figure 2 is a schematic side view of the main organs of the first edge folding station S 1 of the two stations that are substantially similar.

[0036] A panel P arrives to the first station S1 on the circulating foraminous belt conveyor 4, at the end of which there is a cooperating upper roller 8 for clamping and driving the panel entering the edge folding station S 1.

[0037] The circulating belt conveyor 4 runs is moved by the drive roller 9 around a hollow structure, the interior space of which is connected to a vacuum source, according to a common technique.

[0038] The inlet conveyor of the station is composed by two pairs of opposing rollers 10-11 and 12-13 that cooperate for advancing the panel P toward the counter rotating brush 14 of the station, according to a common panel handling technique employed in these automatic machines. Of course, the pairs of opposite rollers clamp between them the panel to drive it forward and to this end, the upper rollers are loaded by pneumatic cylinders 25 that exert a constant pressure, that can be adjusted during a trimming phase of the edge folding devices of the station.

[0039] Of course, the tangential speeds of rollers are identical and to this end may be used as in the example shown, common motion transmissions gears or belts and pulleys. In the depicted embodiment, the roller 11 is driven by the motor 26 through a toothed belt 27.

[0040] The rollers 13 and 21 are driven by the motor 28 (only partially visible) also through a toothed belt transmission.

[0041] The laminated panel travelling under the rotating brush 14 is held in a correct orientation by the contrasting upper rollers 35.

[0042] The lower rollers 13 and 21 of the respective pairs of compressing and driving roller at the inlet side 13-12 and at the outlet side 21-22 of the rotating brush 14 of the station, driven through a toothed belt transmission by the motor 28, transmit the rotational motion respectively to the lower roller 16 of the other inlet pair and to the lower roller 23 of the other outlet pair through circular cross section elastic belts 15 and 34. Moreover, through two further pluralities of circular cross section elastic belts 18 and 18', the rotational motion is transmitted also to the respective channeled rollers 19 and 20 of extended support of the panel under the rotational profile of the brush 14.

[0043] Details of the characteristics of the channeled

rollers 19 and 20, alternately providing extended cantilever support of the laminated panel under the counter rotating brush 14 and landing support of the portion of the panel exiting from under the counter rotating brush, and of the relative motion transmissions are depicted in the simplified schematic view of Figure 3 and in the photographic rendering of Figure 4.

[0044] The interruption of support of the panel under the rotating brush is, according to the present invention, effectively reduced greatly improving the support to the travelling panel, thus allowing to cover even lightweight boards of relatively low stiffness. Moreover, such a result is achieved without the drawbacks that the use of a unified foraminous belt conveyor, by making the belt to circulating around a lowered roller, according to the solution described in the prior Italian Pat. No. 1,291,806, implies.

[0045] The pair of extended support channeled rollers 19 and 20 may have, as in the depicted sample illustration, two distinct pluralities of circular grooves or channels of different size and purposes. A few of these 19' and 20', constitute circular grooves into which run the circular cross section elastic belts 18, 18' that transmit the rotational motion from the respective panel driven roller of the inlet and of the outlet conveyors of the station, respectively.

[0046] Interleaved to these circular grooves 19' and 20' in which runs the elastic motion transmission belts 18 and 18', other circular channels 19'', 20'' are present (or according to an alternative embodiment even other geometries with parts in relief alternating with recessed parts) to favor the lifting action of the bristles of the counter rotating brush 14 on the projecting marginal edge portion of the cover sheet at the moment it extends beyond the rest line on the extended support channeled roller, finding the counter rotating brush 14 already timely lowered inside the separation space between the two extended support rollers, such that the tips of the bristles encroach at least partially into the separation space between the two opposite rollers 20 and 19.

[0047] Suitable circular cross section elastic belts are for example the commercially available "polycord" products of the HABASIT company or the "megaweld" products of the MEGADYNE company, because of their weldability. Of course, the circular cross section motion transmission belts run in circular grooves having a semicircular bottom formed on the cylindrical surface of the rollers.

[0048] When the leading edge of the projecting marginal edge portion of the cover sheet previously coupled to a rigid board reaches a certain position, as detected for example by a photocell sensor, the counter rotating brush 14 is momentarily lowered by the pair of pneumatic cylinders 29, thus bringing the bristles to rotate below the plane of travel of the flat panels, within the space of interruption of the continuity of support of the trailing panel, defined by the gap between the two juxtaposed channeled rollers, associated respectively to the inlet roller pair conveyor 10-11 and 12-13 and to the outlet roller pair conveyor that comprises the roller pair 21-22.

[0049] When the leading edge of the panel is detected by a second photocell sensor, suitably positioned downstream of the rotating brush, the brush 14 is recalled to its stand-by raised position by the pair of pneumatic cylinders 29, thus effectively preventing the brushing off of adhesive from side projecting marginal portions and eventually even of the trailing edge projecting marginal edge portion yet to be folded.

[0050] Simultaneously, the other pair of pneumatic cylinders 30 lowers the side tucking device 32 while the pair of pneumatic cylinders 31 raises the lower contrasting plate 33. The two simultaneous actions of short duration effectively tuck the two opposite sides of the marginal edge portion of the cover sheet just folded around and onto the upper surface of the stiff board, making the corner portions of the folded edge portion of the cover sheet to adhere against the flanks of the stiff board and/or on the still projecting out side marginal edge portions of the cover sheet.

[0051] The small diameter roller 24 is rigidly connected to the mobile assembly of the tucking device and follows its shiftings in the vertical plane.

[0052] The lower roller 23 is rotated by the roller 21 through the elastic belts 34 when the position of the panel is detected by a suitably positioned photocell sensor, the pneumatic cylinder pair 30 and 31 recalls in the respective stand-by positions the tucking device 32 carrying the small roller 21 and the cooperating lower contrast plate 33.

[0053] The laminated panel crosses the edge folding station S 1 as far as coming to rest on the sustaining wheels 36 and once the trailing edge of the projecting marginal edge portion is detected by a suitably positioned photocell sensor, the programmable control unit commands the inversion of the direction of rotation of the motor 28 and consequently of the roller pairs 21-22, 12-13, of the rollers 23, 20, 19, 16 and of the other organs to which motion is transmitted.

[0054] In this way, the panel is driven back toward the rotating brush for repeating the edge folding operation at the trailing edge that now becomes the leading edge upon travelling backward through the same edge folding device of the station.

[0055] As will be evident to the skilled reader, the sequence of coordinated motions of the operating organs of the station will replicate the same actions on the travelling laminated panel crossing backward the station, as they have already been described for the forward crossing.

[0056] For this purpose, an identical tucking device as the one downstream of the brush 14 described above is replicated upstream of the rotating brush. The tucking blade 32' is coordinately lowered by the pair of cylinders 30', while the pair of cylinders 31' lifts the lower contrast plate 33'. Also in this second edge folding operation, the two simultaneous actions of short duration squeeze the opposite corners of the folded back edge portions of the cover sheet just wrapped around and adhered over the

upper surface of the stiff board, causing the corner portion of the bent over cover sheet to adhere against the flanks of the board and/or on the relative side edge portion still projecting out from underneath the board.

[0057] Also in the tucking device upstream of the rotating brush 14, the small roller 24' is rigidly connected to the mobile assembly of the device and follows its shiftings in the vertical plane, such not to interfere with the leading edge of a new laminated panel P approaching the inlet side of the station.

[0058] In the sample embodiment of machine described herein, the outer diameter of the counter rotating brush 14 was 85 mm, the distance between the axis of the two channeled rollers 20 and 19 of extended support of the panel was 40 mm and their outer diameter 28 mm. The reciprocating travel on the vertical plane of the rotating brush (which is normally adjustable) was of about 10 mm, such that upon arrival of the leading edge of the projecting edge portion of the cover sheet, the profile of revolution of the brush directly below its axis of rotation (that is along the mid plane of the space of interruption of the support of the travelling panel) reached down about 5 mm below the plane of travelling of the panel, tangent to the outer circumferences of the two opposing channeled rollers 19 and 20, respectively, alternately of extended cantilever support of the panel driven underneath the counter rotating brush and of landing rest at the side of exiting of the panel from engagement with the bristles of the rotating brush.

[0059] With reference to Figure 2, after the panel has terminated the second backward passage through the first edge folding station S1, being again driven by the pair of rollers 12-13 and eventually held down by the small roller 24' of the mobile tucking device on the inlet side of the station, the pneumatic cylinders 30', 31' and 29 rise the tucking device 32', lower the contrast plate 32' and simultaneously the rotation direction of the various organs is reversed. Therefore, the panel is again driven forward to freely pass below the rotating brush 14 that has already been raised to its stand by position until reaching the rest wheels 36. At that point the wheels are momentarily moved away from each other, letting the laminated panel thus with the cover sheet folded onto two of its sides fall over the second foraminous belt conveyor 5 that carries it to the second edge folding station S2 of the machine of Figure 1.

[0060] The second edge folding station is substantially a replica of the first station S1 (already described with reference to Figures 2 and 3) except for the absence of the tucking devices.

[0061] In such a final edge folding station S2 (for the considered machine), takes place the folding of the other two projecting marginal edge portions of the cover sheet, orthogonal to the edges already folded in the first station S1.

[0062] Of course, also in this case, the laminated panels travel a first time through the edge folding device of the station for folding the now leading edge of the pro-

jecting marginal edge portion of the cover sheet and, through a retracement backward travel through the station device, the folding of the last of the four edge portions that was before the trailing edge.

5 **[0063]** After completing these last two edge folding passages, through the device of the second edge folding station S2, the finished article is finally expelled from the machine, commonly carried onto a discharge tape conveyor 6 to fall into a collecting case (not shown in the figure).

Claims

1. A machine for covering at least a face edges and corners of a relatively stiff polygonal board, comprising an operating station for coupling said polygonal board centrally onto an adhesive coated polygonal sheet leaving projecting marginal edge portions of the cover sheet along the sides of the polygonal board, a first belt conveyor carrying the so laminated panel toward a first of at least two edge folding stations reached in succession by the panel for folding back and adhering all the projecting marginal edge portions of the cover sheet onto the upper surface of the board, along a first side edge and on a second parallel side edge during a first forward pass and a successive backward pass through a same station, respectfully, each edge folding station comprising a transversal cylindrical brush counter rotating in relation to the direction of travel of a leading edge of the laminated panel, the bristles of the rotating brush lifting and folding back the projecting marginal edge portion of the cover sheet adhering it onto the upper surface of the board, said first edge folding station being between said first belt conveyor and a second belt conveyor for carrying the panel toward a second edge folding station, each edge folding station comprising an inlet conveyor and an outlet conveyor at one and at the other side, respectively, of said rotating brush, **characterized in that** each of the said inlet and outlet conveyors comprises a terminal channeled roller of extended support beyond a pair of juxtaposed rollers of the conveyor for clamping and driving the laminated panel, the axis of rotation of said channeled roller lying below the revolution profile of the bristles of the rotating brush at a certain backed-off position from the plane on which lies the axis of rotation of the overhanging brush; controlled actuators for moving the rotating brush from a stand-by position above the plane of travel of the laminated panels on said inlet and outlet roller conveyors to a working position at which the bristles of the rotating brush reach down into the space of interruption of support below the plane of travel of the panel, defined by the separation distance between said channeled terminal rollers of extended

support.

2. The machine of claim 1, wherein said inlet and outlet conveyors are composed of pairs of juxtaposed rollers. 5
3. The machine according to claim 1, wherein said channeled terminal rollers of said inlet and outlet roller conveyors of each of said edge folding stations, facing each other across a separation distance that is the sum of the respective distance of backing off of the channeled rollers from said plane on which the axis of rotation of the brush moves from said stand-by to said working position and vice versa, have circular grooves in which run elastic circular cross section belts that transmit motion from the lower roller of a respective pair of juxtaposed rollers of the conveyor. 10 15
4. The machine of claim 3, wherein said channeled terminal rollers have circular channels interleaved to said circular grooves. 20
5. The machine of claim 1, wherein at least said first edge folding station has identical tucking devices at the inlet side and the outlet side, respectively, of the station for tucking the two opposite side corners of the projecting marginal edge portion of the cover sheet just folded back and bonded over the upper surface of the board, adhering them against the respective flanks of the board and/or the respective projective marginal side edge portions yet to be folded. 25 30

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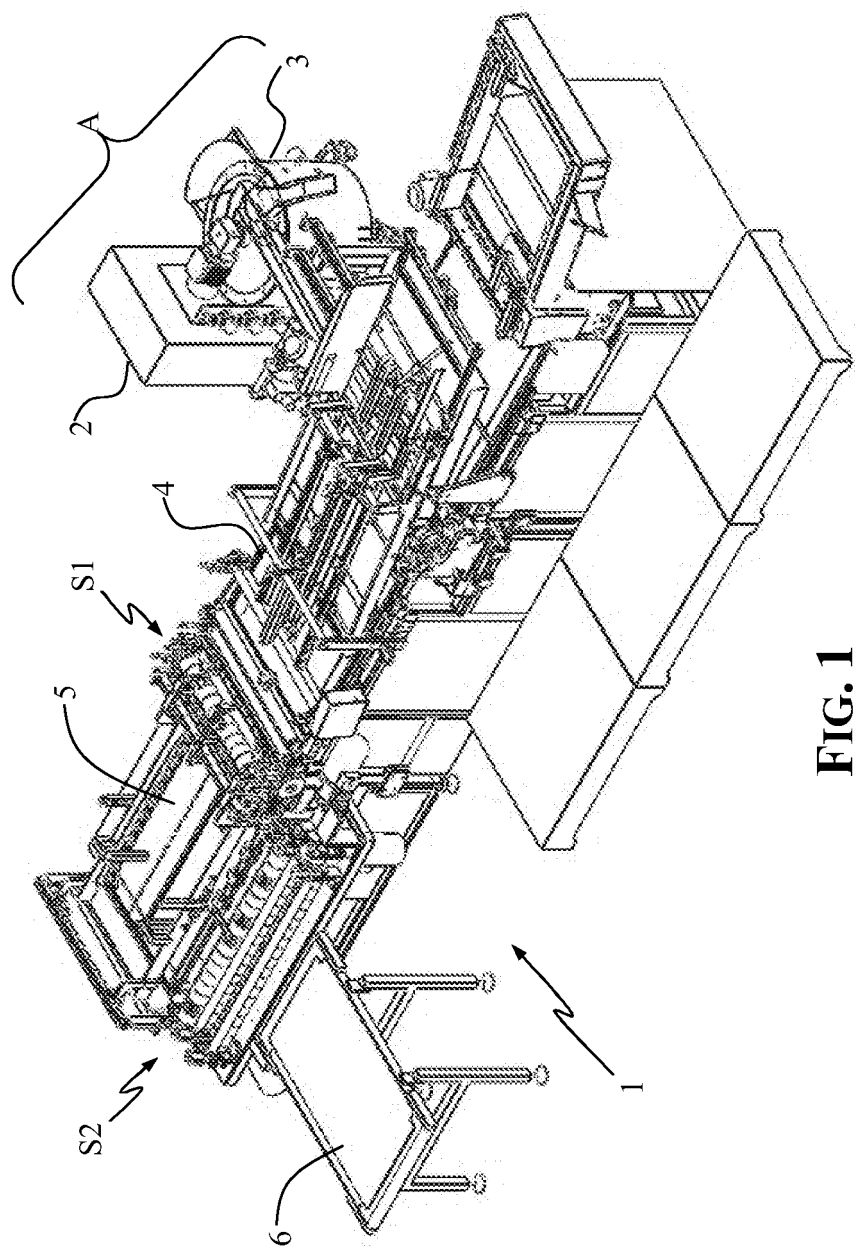


FIG. 1

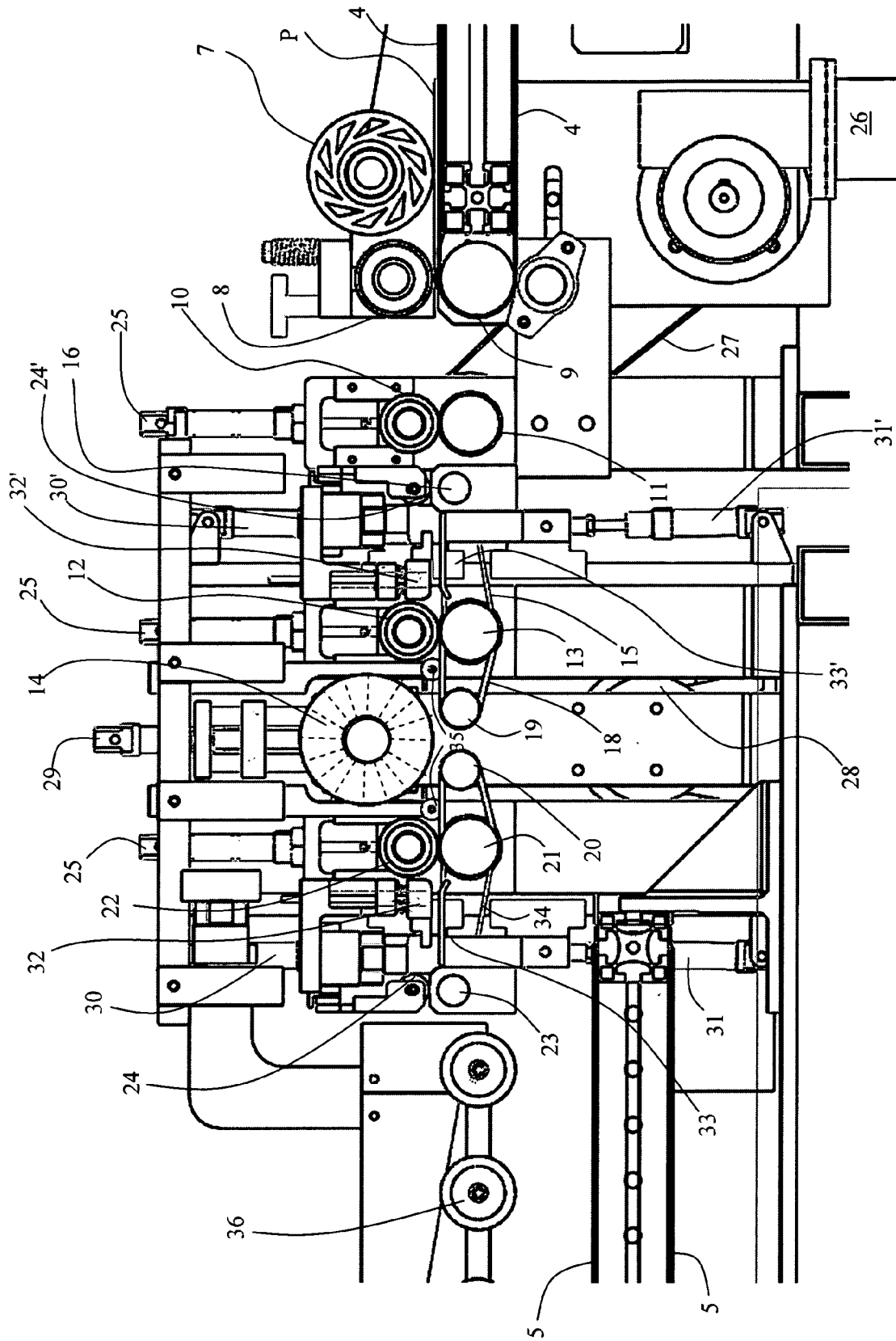


FIG. 2

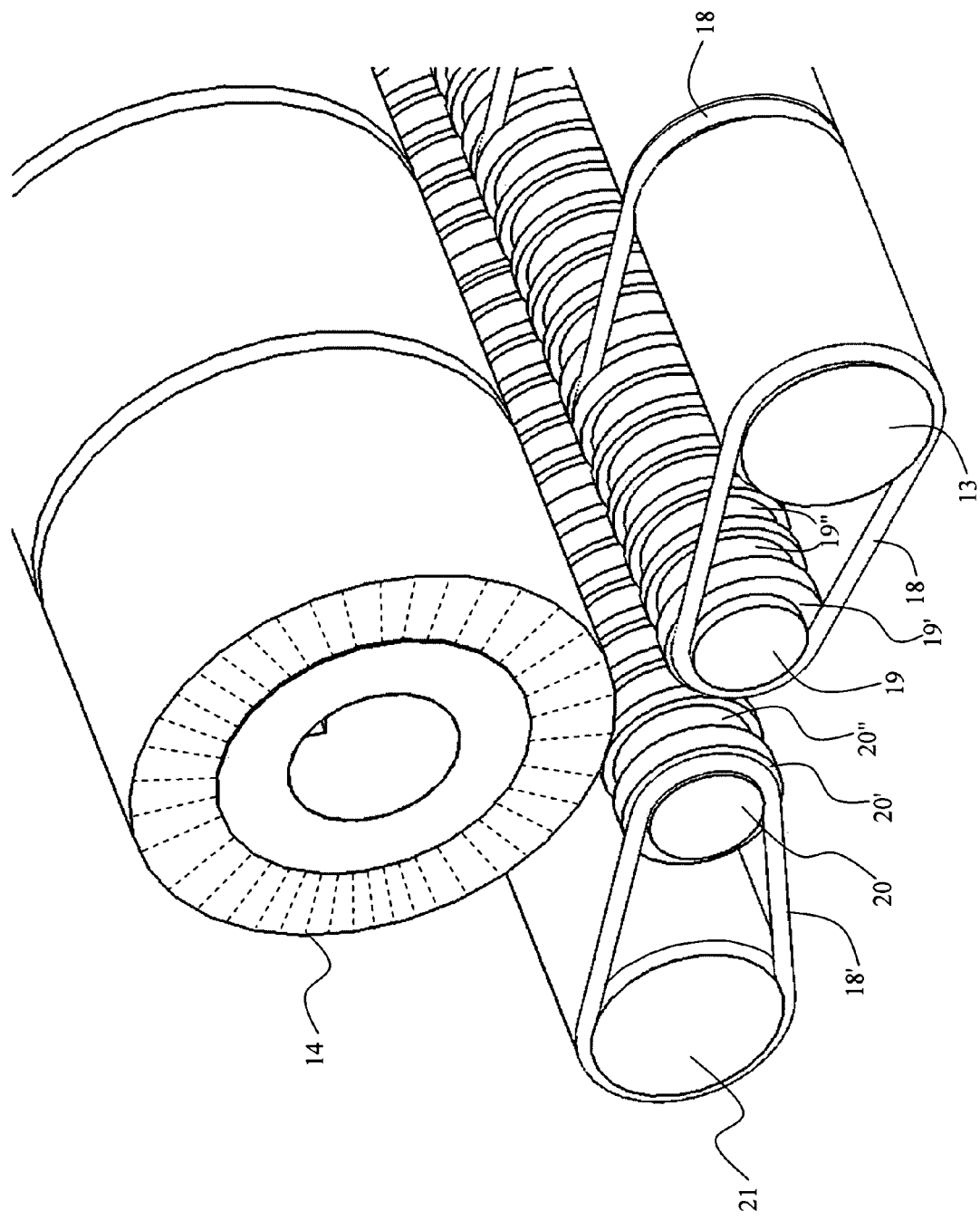


FIG. 3

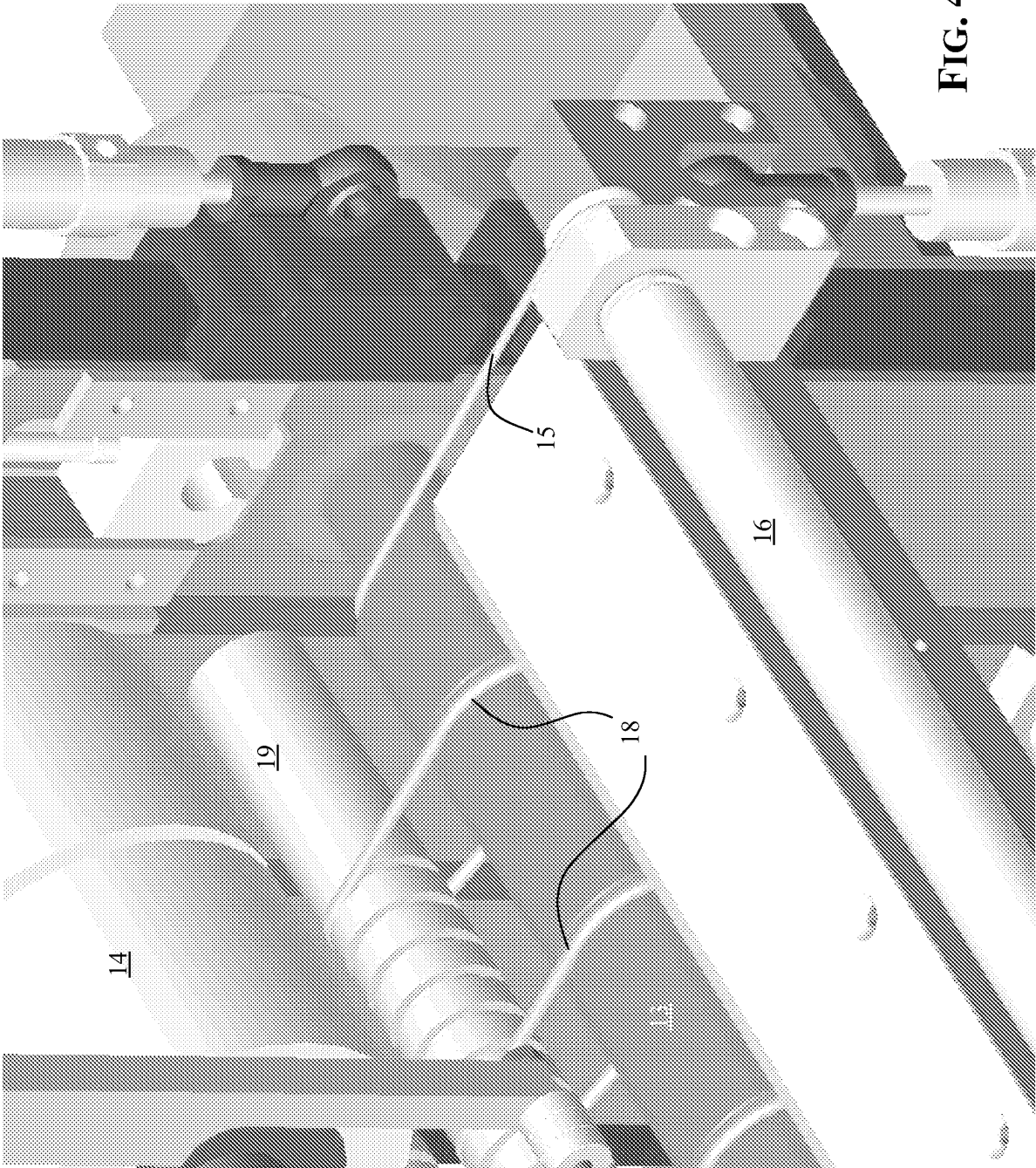


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 06 42 5855

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Place of search Munich		Date of completion of the search 23 May 2007	Examiner Johne, Olaf
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23-05-2007

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