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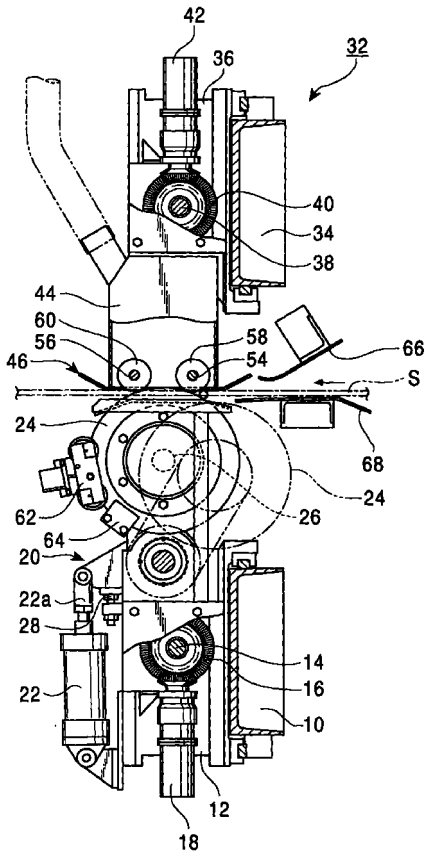
(54) Slitter

(57) A slitter comprises at its one side a circular slitting blade driven to be rotated in the direction in which a paperboard sheet to be slit is fed, and at its the other side at least one receiving roller which receives the paperboard sheet being slit thereon.

The slitting blade is disposed below the paperboard sheet, and the at least one receiving roller includes a pair of receiving rollers disposed as close to each other in the direction in which the paperboard sheet is fed as possible while maintaining both rollers out of contact with said slitting blade, with a vertical line passing through a center of rotation of said slitting blade between the pair of receiving rollers.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a slitter. More specifically, the present invention relates to a slitter which is capable of slitting an endless corrugated paperboard sheet, for instance, along the direction in which the sheet is fed by rotating a single thin slitting blade at a high speed.

Description of the Related Art

[0002] A slitter for slitting, for instance, a corrugated paperboard sheet continously fed along the direction in which the sheet is fed comprises a pair of upper and lower slitting blades on opposite sides of the line along which the corrugated paperboard sheet is fed (the feed line), which slitting blades are rotated in directions opposite from each other. Each of these slitting blades is configured to be a single blade and they are positioned in such a way that flat sides of their blade tips overlap a predetermined length. The corrugated paperboard sheet is slit along the feeding direction by horizontally feeding the corrugated paperboard sheet between the slitting blades.

[0003] Since these single blade type slitting blades are large in thickness, there has been the disadvantage that the quality of the sheet can be worsened if the length of the portion which the upper and lower blades overlap is not appropriately set in accordance with the thickness of the corrugated paperboard sheet. More specifically, when the sheet is slit, the slit portion of the sheet may be crushed by the slitting blades, so that the slit portion loses its neatness and becomes ragged. In order to slit the corrugated paperboard sheet in a desired manner by enhancing the neatness of the slit portion of the corrugated paperboard sheet, the length of the overlapping portion of the upper and lower slitting blades has to be adjusted in accordance with the thickness of the sheet with accuracy. This adjustment operation has been an extremely troublesome one requiring dexterity. In addition, since the gap between the slitting blades greatly influences the result of slitting the corrugated paperboard sheet, it has to be set extremely closely. This setting can take a lot of time.

[0004] Therefore, in order to overcome the above problem, a slitter comprising a single disk slitting blade whose thickness is extremely thin (less than 2 mm) and a sheet receiver which is disposed opposite of the disk slitting blade with a feed line of a corrugated paperboard sheet therebetween has been proposed. According to this slitter, the corrugated paperboard sheet can be slit by rotating the slitting blade at a speed one and a half to three times as high as the feeding speed of the corrugated paperboard sheet with a portion of the tip of the slitting blade being positioned at a gap defined between a pair of receiving rollers constituting a sheet receiving device so as not to contact the rollers (slitting condition). Thus, this offers some advantages. For instance, since a single slitting blade can be used, adjusting the slitting blade relative to the corrugated paperboard sheet can be simplified. In addition, since the slitting blade is extremely thin, the slit portion of the corrugated paperboard sheet can be prevented from being crushed.

[0005] According to the above slitter, the corrugated paperboard sheet is slit by the slitting blade while it is supported by the pair of receiving rollers disposed opposite of the slitting blade with the feed line therebetween. In this condition, since the pair of receiving rollers are disposed parallel to the direction perpendicular to the direction in which the corrugated paperboard sheet is fed, the receiving rollers contact the corrugated paperboard sheet on the same line which is perpendicular to the feeding direction. More specifically, since the corrugated paperboard sheet slit by the slitting blade is supported only by the slitting blade at one point along the feeding direction, the corrugated paperboard sheet can escape from the slitting blade particularly if the corrugated paperboard sheet to be slit is one with low stiffness, and a result, cannot be slit in a reliable manner.

SUMMARY OF THE INVENTION

[0006] In view of the above problem, an object of the present invention is to provide a slitter capable of slitting a sheet in a reliable and desired manner while at the same time keeping the slit portion of the sheet neat and clean.

[0007] These and other objects are achieved according to the present invention in one aspect thereof by providing a slitter comprising at its one side a circular slitting blade driven to be rotated in the direction in which a paperboard sheet to be slit is fed, and at its the other side at least one receiving roller which receives the paperboard sheet being slit thereon, characterized in that said slitting blade is disposed below the paperboard sheet, said at least one receiving roller includes a pair of receiving rollers disposed as close to each other in the direction in which the paperboard sheet is fed as possible while maintaining both rollers out of contact with said slitting blade, with a vertical line passing through a center of rotation of said slitting blade between the pair of receiving rollers.

[0008] These and other objects are achieved according to the present invention in another aspect thereof by providing a slitter comprising at its one side a circular slitting blade driven to be rotated in the direction in which a paperboard sheet to be slit is fed, and at its the other side at least one receiving roller which receives the paperboard sheet being slit thereon, characterized in that said slitting blade is disposed below the paperboard sheet and is reciprocally movable between a slit-

ting position where a tip portion of said slitting blade protrudes from said one side to said the other side and a stand-by position where the tip portion of said slitting blade remains out of contact with said paperboard sheet, said at least one receiving roller includes a pair of receiving rollers separated in the direction in which the paperboard sheet is fed with a vertical line passing through a center of rotation of said slitting blade located at said slitting position between the pair of receiving rollers, one of said pair of receiving rollers upstream in the feeding direction is disposed adjacent to the most upstream position of the protruding portion of the slitting blade located at the slitting position, while the other of said pair of receiving rollers downstream in the feeding direction is disposed adjacent to the most downstream position of the protruding portion of the slitting blade.

[0009] The above and other objects, features, and advantages of the present invention will become apparent from the following description read in conjunction with the accompanying drawings, in which like reference numerals designate the same elements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Figure 1 is a side and a partially cutaway view showing a main part of a slitter according to the first embodiment of the present invention.

Figure 2 is a rear view showing a main part of the slitter according to the first embodiment of the present invention.

Figure 3 is a side and partially longitudinal sectional view showing the sheet receiver of the slitter according to the present invention.

Figure 4 is a front and partially longitudinal sectional view showing a main part of the sheet receiver of the slitter according to the present invention.

Figure 5 is a bottom view showing the sheet receiver of the slitter according to the first embodiment of the present invention.

Figure 6 is a schematic illustration showing the relationship between the slitting blade of the slitter and the receiving roller according to the first embodiment of the present invention.

Figure 7 is a front and partially longitudinal sectional view showing a slitter according to the second embodiment of the present invention.

Figure 8 is a bottom view showing the sheet receiver of the slitter according to the second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] Now, preferred embodiments of the slitter according to the present invention will be described with reference to the drawings. In the actual slitter, a plurality of pairs of a slitting blade and a sheet receiver are disposed along the widthwise direction of these devices. However, only one pair is shown in the drawings.

[0012] Figures 1 and 2 show a main part of a slitter according to the first embodiment of the present invention. A guide rail 10 is disposed below a feed line along which the corrugated paperboard sheet S is fed. The guide rail 10 extends horizontally in the widthwise direction of the slitter which crosses the feed line. A slitter yoke 12 is mounted on the guide rail 10. The slitter yoke 12 includes a gear 16 threaded into a screw shaft 14 disposed parallel with the guide rail 10. The gear 16 is rotatable and is not movable in the axial direction. The slitter 12 can be moved along the guide rail 10 and can be stopped at any desired point by driving a motor 18 provided on the yoke 12 forwardly or reversely.

[0013] In addition, a fork-like slitter head 20 is pivotably mounted on the yoke 12 so as to be swung in the feeding direction. A piston rod 22a of a hydraulic cylinder 22 is pinned to the slitter head 20 with its bottom portion pinned to the yoke 12. Further, a slitting blade 24 with thin thickness (less than 2mm) is rotatably supported via a rotating shaft 26 parallel with the screw shaft 14. The slitting blade 24 is driven in the counterclockwise direction in Figure 1 by a driving means (not shown). By biasing the hydraulic cylinder 22 forwardly or reversely, the slitting blade 24 can be reciprocally moved between a slitting position where the tip of the slitting blade protrudes from an upper surface of the corrugated paperboard sheet S fed along the feeding direction as shown in solid line of Figure 1 and a stand-by position where the blade tip remains out of contact with the lower surface of the corrugated paperboard sheet S as shown in double dotted line in Figure 1. The slitting blade 24 is so configured as to be rotatably driven from the upstream side to the downstream side in the direction in which the corrugated paperboard sheet S is fed when the slitting blade 24 is in the area where the corrugated paperboard sheet S is slit, so that the lower surface of the corrugated paperboard sheet S can be set to a position where slitting of the corrugated paperboard sheet S is started (the position where the tip of the slitting blade 24 contacts the lower surface of the corrugated paperboard sheet S for the first time).

[0014] An adjustable bolt 28 contactable by the slitter head 20 when it has moved from the stand-by position to the slitting position is threaded into the slitter yoke 12 so as to adjust the slitting position of the slitting blade 24. In addition, as shown in Figure 2, a guide plate 30 extends along the line along which the sheet is fed and is disposed below such line so as to support the lower surface of the corrugated paperboard sheet S.

[0015] A sheet receiver 32 is disposed above the line along which the sheet is fed in order to stably support the sheet S by opposing the slitting blade 24. Namely, a guide rail 34 is disposed to be parallel to the guide rail 10 with the feeding line therebetween. A receiving yoke

36 is mounted on the guide rail 34 so as to be freely movable. The receiving yoke 36 is provided with a gear 40 threaded into a screw shaft 38 disposed parallel to the guide rail 34. The gear 40 is rotatable and is not movable in the axial direction. By rotating the gear 40 by means of a motor 42 provided on the yoke 36 forwardly and reversely, the receiving yoke 36 can be freely moved along the guide rail 34 and can be stopped at any desired position. When the slitter yoke 12 is shifted in the axial direction along the guide rail 10, the receiving yoke 36 is also shifted along the guide rail 34 synchronously with the slitter yoke 12.

[0016] A suction chamber 44 is suspended from the lower portion of the receiving yoke 36 to serve as a support means which opens downward and is connected to a suction source (not shown). The suction chamber 44 acts to suck and then remove the paper powder produced when the corrugated paperboard sheet S is slit. A guide plate 46 is provided on the lower open end of the suction chamber 44. As shown in Figures 3 and 5, the guide plate 46 comprises a body portion 46a which extends parallel with the feeding line so as to close the open portion of the suction chamber 44 and guide portions 46b, 46c which are inclined upwardly toward the open end and formed at the upstream and the downstream sides of the body portion 46a, respectively. A pair of openings 48,50 are formed on the body portion 46a as spaced apart in the feed direction from each other. The openings 48,50 are configured in such a way that portions of receiving rollers 58, 60 (which will be described later) can protrude downward (that is, toward the side on which the slitter yoke 12 is provided) from the corresponding openings 48, 50. In addition, a slit 52 with a predetermined width is formed between openings 48,50 along the feed line so as to receive the upper portion of the slitting blade 24. The width of the slit 52 is set to be a little larger than that of the slitting blade 24.

[0017] As shown in Figure 3, a pair of support shafts 54,56 extending in the widthwise direction which crosses the feed line is housed inside the suction chamber 44. The support shafts 54,56 are spaced apart in the feeding direction from each other with a vertical line C passing through the center of the slitting blade 24 located at the slitting position therebetween. The first receiving roller 58 is fitted on the support shaft 54 located upstream in the feeding direction, so that a portion of the outer periphery of the first receiving roller 58 can protrude from the opening 48 formed upstream of the guide plate 46. In addition, the second receiving roller 60 is fitted on the support shaft 56 located downstream in the feeding direction, so that a portion of the outer periphery of the second receiving roller 60 can protrude from the opening 50 formed downstream of the guide plate 46. The corrugated paperboard sheet S is stably supported at two points spaced apart in the feeding direction by the outer peripheries of the pair of receiving rollers 58,60 spaced apart in the feeding direction from each other. More specifically, as shown in Figure 3, by positioning the slitting blade 24 at the slitting position, the tip of the slitting blade 24 is partially received in the slit 52 of the guide plate 46, while at the same time the pair of receiving rollers 58,60 are positioned upstream and downstream in the feeding direction, respectively. In this situation, the corrugated paperboard sheet S horizontally fed from the right in Figure 1 is slit along the feeding direction by rotating the slitting blade 24 at a speed one and a half to three times as high as the feeding speed at which the corrugated paperboard sheet S is fed.

[0018] As shown in Figure 6, the first receive roller 58 is located almost immediately above the slitting start position A where slitting of the corrugated paperboard sheet S is started by the slitting blade 24 located at the slitting position, so that the corrugated paperboard sheet S can be reliably supported upon it being slit. Namely, the first receiving roller 58 prevents the corrugated paperboard sheet S from floating due to the rotation of the slitting blade 24, so that the corrugated paperboard sheet S can be reliably slit. A peripheral groove 58a is formed on the first receiving roller 58 on the trace along which the slitting blade 24 reciprocates between the stand-by position and the slitting position. This prevents the slitting blade 24 from contacting the first receiving roller 58 while the slitting blade 24 is moved between the stand-by position and the slitting position even if the first receiving roller 58 is situated immediately above the slitting start position A.

[0019] On the other hand, at the second receiving roller 60, the tip of the slitting blade 24 located at the slitting position is situated at almost immediately above a position B which is below the corrugated paperboard sheet S. This reliably prevents floating of the corrugated paperboard sheet which would not be fully prevented only by the first receiving roller 58 which only can come into linear contact with the sheet S in some cases. More specifically, since the first receiving roller 58 is located substantially immediately above the slitting start position A, it can happen that the slitting start position A gets spaced apart in the feeding direction from a position C where the slitting blade 24 at the slitting position moves away from the upper surface of the corrugated paperboard sheet S, depending on the thickness of the corrugated paperboard sheet or the size of the slitting blade 24. In this situation, even if the corrugated paperboard sheet S can be prevented from floating at the slitting start position A, a floating force may be applied to the corrugated paperboard sheet S between the slitting start position A and the position C, and as a result, floating of the sheet S may occur downstream from the slitting start position A, which can make the slitting extremely difficult or impossible. Namely, the first and second receiving rollers 58, 60 are positioned to be as close as possible to each other with the vertical line C therebetween under the condition that they do not contact the slitting blade 24 situated at the slitting position.

[0020] In Figure 1, the reference number 62 indicates

a grinder which automatically grinds the slitting blade 24 to enable the corrugated paperboard sheet S to be slit in a good condition. The reference number 64 indicates a coating device which coats the slitting blade 24 with a lubricant such as oil. Further, the reference numbers 66,68 indicate upper and lower plates which are situated upstream in the feeding direction from the slitter to guide the corrugated paperboard sheet S toward the slitter.

[0021] Next, the operation of the slitter in accordance with the first embodiment will be described. As shown in Figure 1, when the corrugated paperboard sheet S is slit, the tip of the slitting blade 24 is partially received in the slit 52 of the guide plate 46, while at the same time the pair of rollers 58, 60 are positioned upstream and downstream in the direction in which the blade tip is rotated, respectively, by shifting the slitting blade 24 from the stand-by position to the slitting position. In this situation, the corrugated paperboard sheet S is slit along the feeding direction by rotating the slitting blade 24 at a speed one and a half to three times as high as that at which the corrugated paperboard sheet S is fed while at the same time feeding the corrugated paperboard sheet S horizontally. Namely, while the upper surface of the corrugated paperboard sheet S is supported at the two points spaced apart in the feeding direction by the pair of receiving rollers 58,60 protruding downwardly from the guide plate 46, the corrugated paperboard sheet S is slit by the slitting blade 24.

[0022] Under this condition, since the first and second rollers 58, 60 are positioned to be as close as possible to the slitting blade 24 with the vertical line C therebetween under the condition that they stay separated from the slitter blade 24, and the first receiving roller 58 is situated almost immediately above the slitting start position A, the corrugated paperboard sheet S can be reliably slit by the slitting blade 24 without the corrugated paperboard sheet S being forced to float. In addition, since the pair of receiving rollers 58,60 protruding downwardly from the guide plate 46 support the corrugated paperboard sheet S so as to be rotated by the movement of the corrugated paperboard sheet S, the guide plate 46 does not resist the feeding of the corrugated paperboard sheet S. Since the paper powder produced when the corrugated paperboard sheet S is slit is sucked into the suction chamber 44 through the openings 48,50 and the slit 52 of the guide plate 46, degradation of the slitting performance by the paper powder adhering to the tip of the slitting blade 24 is prevented.

[0023] When a job change command is transmitted after the current corrugated paperboard sheet S is completed, the hydraulic cylinder 22 is energized to move the slitting blade 24 from the slitting position to the stand-by position. Then, the motors 18, 42 are synchronously driven to move the slitter yoke and the receiving yoke along the guide rails 10, 34 to a new position where the corrugated paperboard sheet S is to be slit in the new job. Then, as described above, the slitting blade 24 is moved to the slitting position and then rotated at a high speed, while at the same time the corrugated paperboard sheet S to be slit in accordance with the new job specification is fed, whereby the corrugated paperboard sheet S can be reliably slit along the feeding direction. As described above, since the peripheral groove 58a is formed on the first receiving roller 58 upstream in the feeding direction on the trace along which the slitting blade 24 is moved, the slitting blade 24 is not reliably kept from contacting the first receiving roller 58 while it is moved between the stand-by position and the slitting position.

[0024] As described above, according to the slitter of the first embodiment, since the corrugated paperboard sheet S to be slit by the slitting blade 24 can be supported at two points by the pair of the receiving rollers 58, 60 spaced apart in the feeding direction from each other, the corrugated paperboard sheet S can be reliably slit. Namely, even if the corrugated paperboard sheet S lacks stiffness, the corrugated paperboard sheet S can be prevented from being forced to float due to the rotation of the slitting blade 24, and as a result, the slitting can be conducted so as to leave a neat cut portion of the sheet S.

[0025] The corrugated paperboard sheet S can be prevented from being stripped by the fact that the slitting blade 24 is disposed below the feed line of the corrugated paperboard sheet S so as to slit the corrugated paperboard sheet S from below. Namely, the corrugated paperboard sheet S fed to the slitter is manufactured by attaching a liner fed from below to a single facer fed from above at a double facer situated upstream in the feeding line. For this reason, if the corrugated paperboard sheet S is slit under the condition that the slitting blade 24 is disposed above the feed line, the liner attached to the lower side of the single facer may be pushed in the direction in which it can be stripped. There is a risk that the liner may be stripped if the liner and the single facer are not firmly attached. However, in the case where the slitting blade 24 is disposed below the feed line as in the first embodiment, since the liner is pushed in the direction causing it to be attached, the corrugated paperboard sheet S can be reliably prevented from being stripped.

[0026] On the other hand, in the case where the lower surface of the corrugated paperboard sheet S is printed downstream of the slitter, the slitting of the corrugated paperboard sheet from below by the slitting blade 24 can prevent the printing operation on its lower surface from being badly affected even if long burrs like whiskers should remain at a portion slit on the upper surface of the corrugated paperboard sheet S.

[0027] In the first embodiment, the corrugated paperboard sheet is supported by the receiving rollers protruding from the openings of the guide plate provided on the suction chamber. However, the guide plate may be omitted. In addition, the slitter may adopt a structure which is inverted from that in the first embodiment.

Namely, the slitter may be configured in such a way that the slitting blade is disposed above the feed line, while the sheet receiving device is disposed below the feed line. With this configuration, the corrugated paperboard sheet can still be stably supported by the pair of receiving rollers when it is slit by the slitting blade and thus reliably slit.

[0028] Further, in the first embodiment, the slitting blade is configured so as to be swingably moved between the stand-by position and the slitting position. However, the slitter head, which supports the slitting blade on the slitter yoke, may be linearly moved up and down by a linear actuator such as a hydraulic cylinder in order to linearly reciprocate the slitting blade between the slitting position and the stand-by position. In this case, since the slitting blade does not swing, the peripheral groove does not need to be provided on the first receiving roller. The suction chamber serves as a support member in the first embodiment. However, the support member is not restricted to a box structure like the suction chamber but can be of any structure so long as it can rotatably support the receiving roller. In this respect, a pair of frames spaced apart in the widthwise direction from each other can be adopted, for instance.

[0029] Figures 7 and 8 show a slitter in accordance with the second embodiment comprising a pair of rollers 69,70 which are disposed to extend over substantially the entire widthwise length of the widest corrugated paperboard sheet S to be processed by the slitter. This makes adjustment of the position of a sheet receiving device 71 unnecessary at the time of a job change. Elements the same as those in the first embodiment will not be explained again.

[0030] A suction chamber 72, which serves as a support member extending in the direction crossing the feed line, is provided between frames 78 of the slitter above the feed line of the corrugated paperboard sheet S. A guide plate 73 is provided on the lower open end of the suction chamber 72. The guide plate 73, similarly to that of the first embodiment, comprises a body portion 73a which extends parallel to the feed line so as to close the opening portion of the suction chamber 72 and guide portions 73b, 73c which are formed at the upstream side and the downstream side of the body portion 73a , respectively, and are inclined upwardly toward the open end. The body portion 73a of the guide plate 73 is formed with an opening 74 the size of which is set larger than that of the width of the corrugated paperboard sheet S to such an extent that a portion of the pair of the receiving rollers 69,70 protrude downwardly from the opening 74.

[0031] As shown in Figure 8, a pair of support shafts 75,76, each of which extends in the widthwise direction of the corrugated paperboard sheet S crossing the direction in which the corrugated paperboard sheet S is fed, are provided as spaced apart a predetermined distance in the feeding direction with a vertical line C passing through the center of the rotation of the slitting blade 24 situated at the slitting position therebetween. The elongated first receiving roller 69, which is longer than the width of the corrugated paperboard sheet S of the greatest width among the corrugated paperboard sheets to be processed by the slitter, is rotatably fitted on the support shaft 75 situated upstream in the feed line. The roller 69 is set in such a way that an outer peripheral portion thereof protrudes slightly outwardly (downwardly) from the opening 74 of the guide plate 73. In addition, the elongated second receiving roller 70, which is also longer than the width of the corrugated paperboard sheet S of the greatest width among the corrugated paperboard sheets to be processed by the slitter, is rotatably fitted on the support shaft 76 situated downstream in the feed line. The roller 70 is set in such a way that an outer peripheral portion therof protrudes a little outwardly (downwardly) from the opening 74 of the guide plate 73. This enables the corrugated paperboard sheet S to be stably supported by the outer peripheries of the pair of receiving rollers 69,70 spaced apart in the feeding direction from each other. Namely, by positioning the slitting blade 24 at the slitting position, the tip of the slitting blade 24 is partially received in the opening 74 of the guide plate 73 while at the same time the pair of receiving rollers 69,70 are set upstream and downstream in the direction in which the blade tip is delivered. Under this condition, the corrugated paperboard sheet S horizontally fed is slit along the feeding direction by rotating the slitting blade 24 at a speed one and a half to three times as high as that at which the corrugated paperboard sheet S is fed.

[0032] In addition, the first and second receiving rollers 69, 70 are positioned so as to be as close as possible to the slitting blade 24 under the condition that they do not contact the slitting blade 24 situated at the slitting position. It is to be noted that the first receiving roller 69 located upstream in the feeding direction is set to be as close as possible to the vertical line C under the condition that it does not contact the slitting blade 24 while the slitting blade 24 is moved between the stand-by position and the slitting position, and as a result, it is positioned to be adjacent to the position where slitting of the corrugated paperboard sheet S by the slitting blade 24 situated at the slitting position is started. Therefore, in this embodiment, no peripheral groove is formed on the first receiving roller 69. In addition, the second receiving roller 70 situated downstream in the feeding direction is, like in the first embodiment, positioned almost immediately above the position B where the tip of the slitting blade 24 situated at the slitting position starts to move downwardly away from the corrugated paperboard sheet S.

[0033] Next, the operation of the slitter according to the second embodiment will be explained. When the corrugated paperboard sheet S is slit, the tip of the slitting blade 24 is partially received in the opening of the guide plate 73 while at the same time the pair of receiving rollers 69,70 are positioned upstream and down-

stream in the direction in which the blade tip is delivered by shifting the slitting blade 24 from the stand-by position to the slitting position. In this condition, the corrugated paperboard sheet S can be slit along the direction in which the corrugated paperboard sheet S is fed by rotating the slitting blade 24 at a speed which is one and a half to three times as high as that at which the corrugated paperboard sheet S is fed and horizontally feeding the corrugated paperboard sheet S. More specifically, with the upper surface of the corrugated paperboard sheet S supported at two points spaced apart from each other in the direction in which the corrugated paperboard sheet S is fed by the pair of the receiving rollers 69,70 protruding downwardly from the guide plate 73, the corrugated paperboard sheet S can be slit by the slitting blade 24 between the two points.

[0034] In this case, the first and second rollers 69, 70 are set to be as close as possible to the slitting blade 24 with the vertical line therebetween but so that they do not contact the slitting blade 24 situated at the slitting position and the first receiving roller 69 is positioned to be adjacent to the position A where slitting of the corrugated paperboard sheet S is started by the slitting blade 24. The corrugated paperboard sheet S can therefore be reliably slit without the sheet S being forced to float when the sheet S is slit. In addition, since the pair of receiving rollers 69,70 protrude downwardly from the guide plate 73 and thus support the corrugated paperboard sheet S, the guide plate 73 does not resist the feeding of the corrugated paperboard sheet S. Besides, since the first and second rollers 69, 70 support the entire widthwise length of the corrugated paperboard sheet S, the corrugated paperboard sheet S can be slit in a stable and desired manner.

[0035] Next, when a job change command related to the corrugated paperboard sheet S is transmitted, the corrugated paperboard sheet S can be slit in accordance with the new job specification simply by positioning the slitting blade 24 at the slitting position, i.e. by shifting the slitting blade 24 once shifted to the stand-by position to the position where the corrugated paperboard sheet S is to be slit in accordance with the new job specification. Namely, since the position of the sheet receiver 71 itself does not have to be adjusted at the time of a job, no mechanism for moving the sheet receiver need be provided so that the cost of the machine can be reduced and the structure of the machine can be simplified as well. Further, the liner can be prevented from being stripped from the corrugated paperboard sheet S by disposing the slitter 24 below the feed line, as in the case of the first embodiment.

[0036] In the second embodiment, the slitter head supporting the slitting blade on the slitter yoke may be so configured as to be linearly moved up and down by a linear actuator such as a hydraulic cylinder to linearly reciprocate the slitting blade between the stand-by position and the slitting position. In this case, the space between the first and second rollers can be further reduced so that slit portion of the corrugated paperboard sheet S can be supported in a stable manner. The suction chamber serving as the support member is provided between the pair of frames in this embodiment. However, the receiving rollers may be directly mounted on a pair of frames serving as the support member, with the suction chamber omitted.

[0037] As described above, according to the present invention, since the corrugated paperboard sheet is supported relative to the slitting blade located at the slitting position at two points by the pair of receiving rollers spaced apart in the direction in which the corrugated paperboard sheet is fed, while at the same time the receiving roller located upstream in the feeding direction is positioned to be adjacent to the position where slitting of the corrugated paperboard sheet is started by the slitting blade, the corrugated paperboard sheet can be slit in a reliable and desired manner. Thus, this enables the portion slit by the slitter to exhibit a neat cut, thereby enhancing the quality of the corrugated paperboard sheet.

[0038] Further, in a case where the pair of rollers is configured so as to extend over the generally entire widthwise length of the corrugated paperboard sheet, only the slitter has to be adjusted at the time of a job; so that no mechanism for adjustably moving the receiving roller is required. Therefore, the structure of the machine can be simplified and the cost can be greatly reduced as well. Still further, since substantially the entire widthwise length of the corrugated paperboard sheet can be supported, the corrugated paperboard sheet can be slit by the slitting blade in a stable and desired manner.

[0039] Preferred embodiments of the invention has been described with reference to the accompanying drawings, but it is to be understood that the invention is not limited to these precise embodiments, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of the invention as defined in the appended claims.

Claims

1. A slitter comprising at its one side a circular slitting blade driven to be rotated in the direction in which a paperboard sheet to be slit is fed, and at its the other side at least one receiving roller which receives the paperboard sheet being slit thereon, characterized in that:

   said slitting blade is disposed below the paperboard sheet,
   said at least one receiving roller includes a pair of receiving rollers disposed as close to each other in the direction in which the paperboard sheet is fed as possible while maintaining both rollers out of contact with said slitting blade,

with a vertical line passing through a center of rotation of said slitting blade between the pair of receiving rollers.

2. A slitter comprising at its one side a circular slitting blade driven to be rotated in the direction in which a paperboard sheet to be slit is fed, and at its the other side at least one receiving roller which receives the paperboard sheet being slit thereon, characterized in that:

said slitting blade is disposed below the paperboard sheet and is reciprocally movable between a slitting position where a tip portion of said slitting blade protrudes from said one side to said the other side and a stand-by position where the tip portion of said slitting blade remains out of contact with said paperboard sheet,
said at least one receiving roller includes a pair of receiving rollers separated in the direction in which the paperboard sheet is fed with a vertical line passing through a center of rotation of said slitting blade located at said slitting position between the pair of receiving rollers,
one of said pair of receiving rollers upstream in the feeding direction is disposed adjacent to the most upstream position of the protruding portion of the slitting blade located at the slitting position, while the other of said pair of receiving rollers downstream in the feeding direction is disposed adjacent to the most downstream position of the protruding portion of the slitting blade.

3. A slitter according to claim 1 or 2, wherein said receiving roller located downstream and said roller located upstream are disposed to be substantially symmetrical with reference to the vertical line passing through the center of rotation of the slitting blade located at the slitting position.

4. A slitter according to claim 1, 2 or 3, wherein said slitting blade is a thin blade with a thickness of less than 2 mm.

5. A slitter according to claim 1 or 2, 3 or 4, wherein the rotating speed of said slitting blade is one and a half to three times as high as the speed at which the paperboard sheet is fed.

6. A slitter according to claim 5, wherein the rotating speed of said slitting blade is 1.8 times as high as the speed at which the sheet is fed.

7. A slitter according to claim 1, 2, 3, 4, 5 or 6, wherein said slitting blade is swingable about a point located below said one side of the paperboard sheet between the slitting position and the stand-by position.

8. A slitter according to claim 1, 2, 3, 4, 5, 6 or 7, wherein said slitting blade is movable up and down at said one side of the paperboard sheet between the slitting position and the stand-by position.

9. A slitter according to claim 1, 2, 3, 4, 5, 6, 7 or 8, wherein the slitter further comprises at said other side a suction chamber for sucking and thus removing paper powder produced by slitting of the paperboard sheet, and the suction chamber houses said pair of receiving rollers so as to support them and includes an opening immediately below each of said pair of receiving rollers.

10. A slitter according to claim 1, 2, 3, 4, 5, 6, 7, 8 or 9, wherein at least one of said pair of receiving rollers includes a peripheral groove which prevents said slitting blade from coming in contact therewith while said slitting blade moves between the slitting position and the stand-by position.

FIG. 1

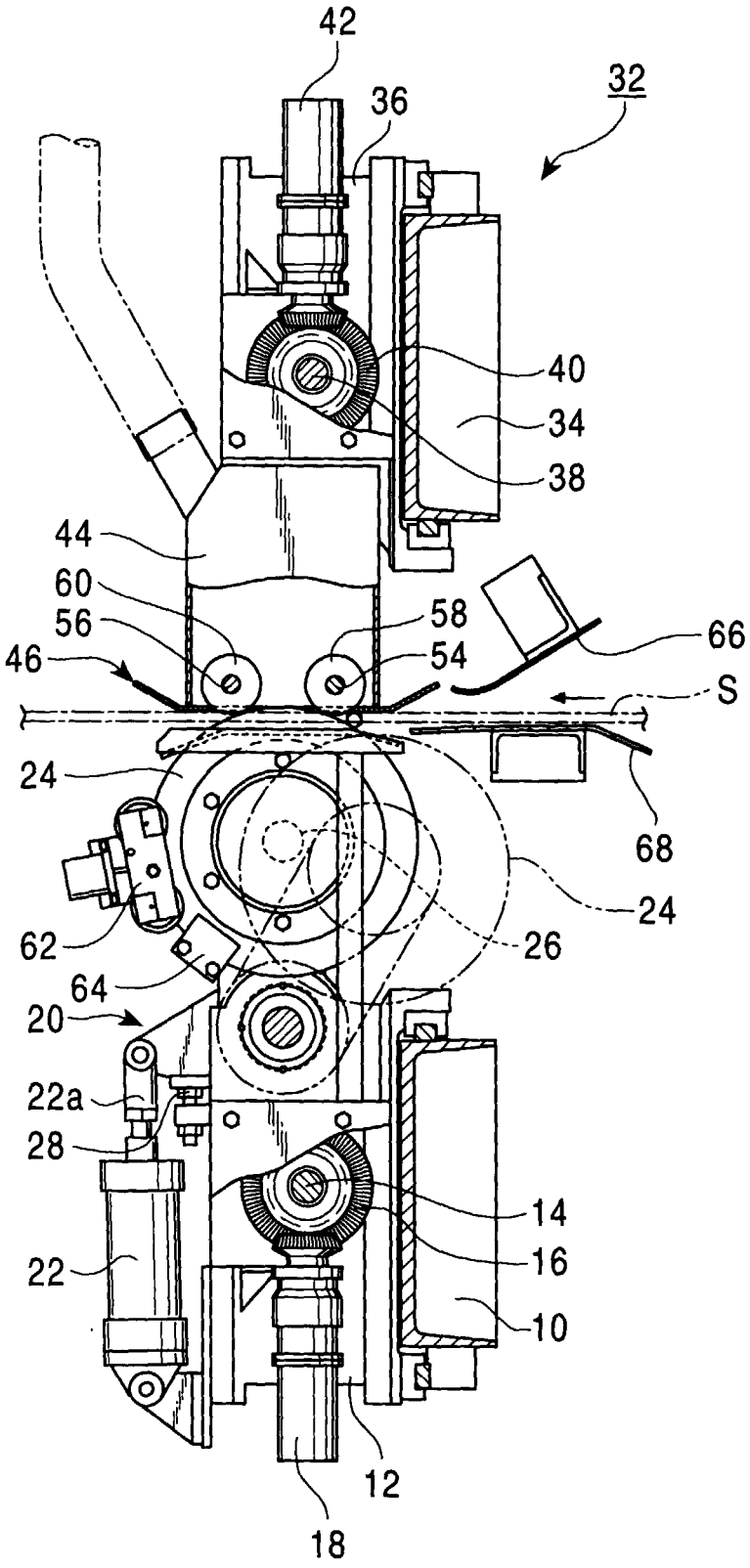
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FIG. 2

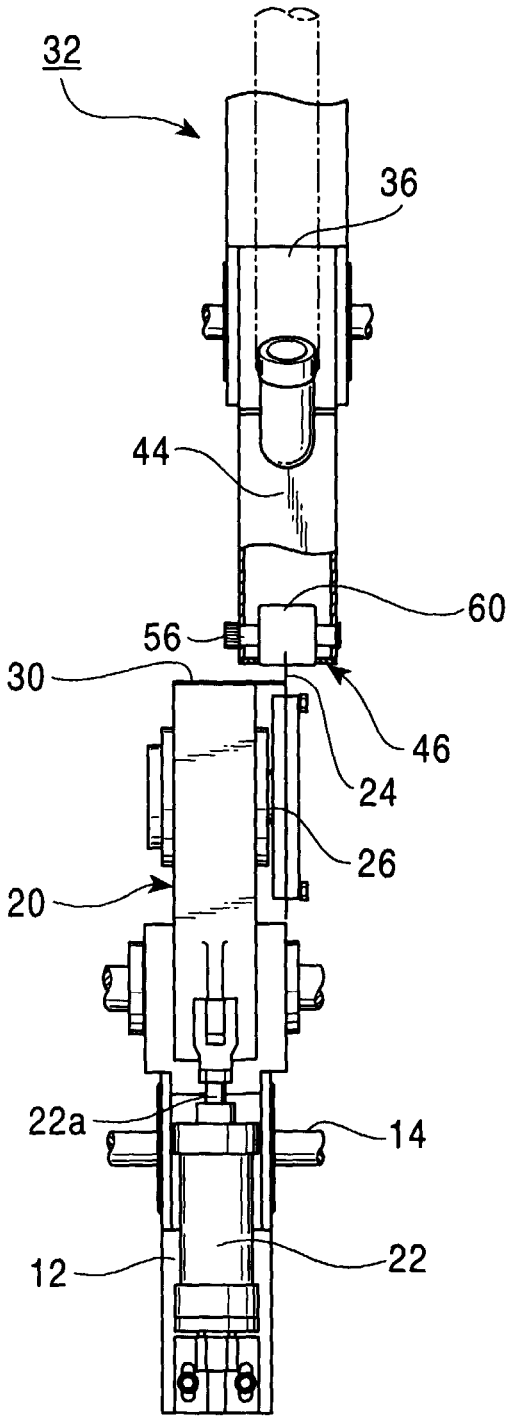


FIG. 3

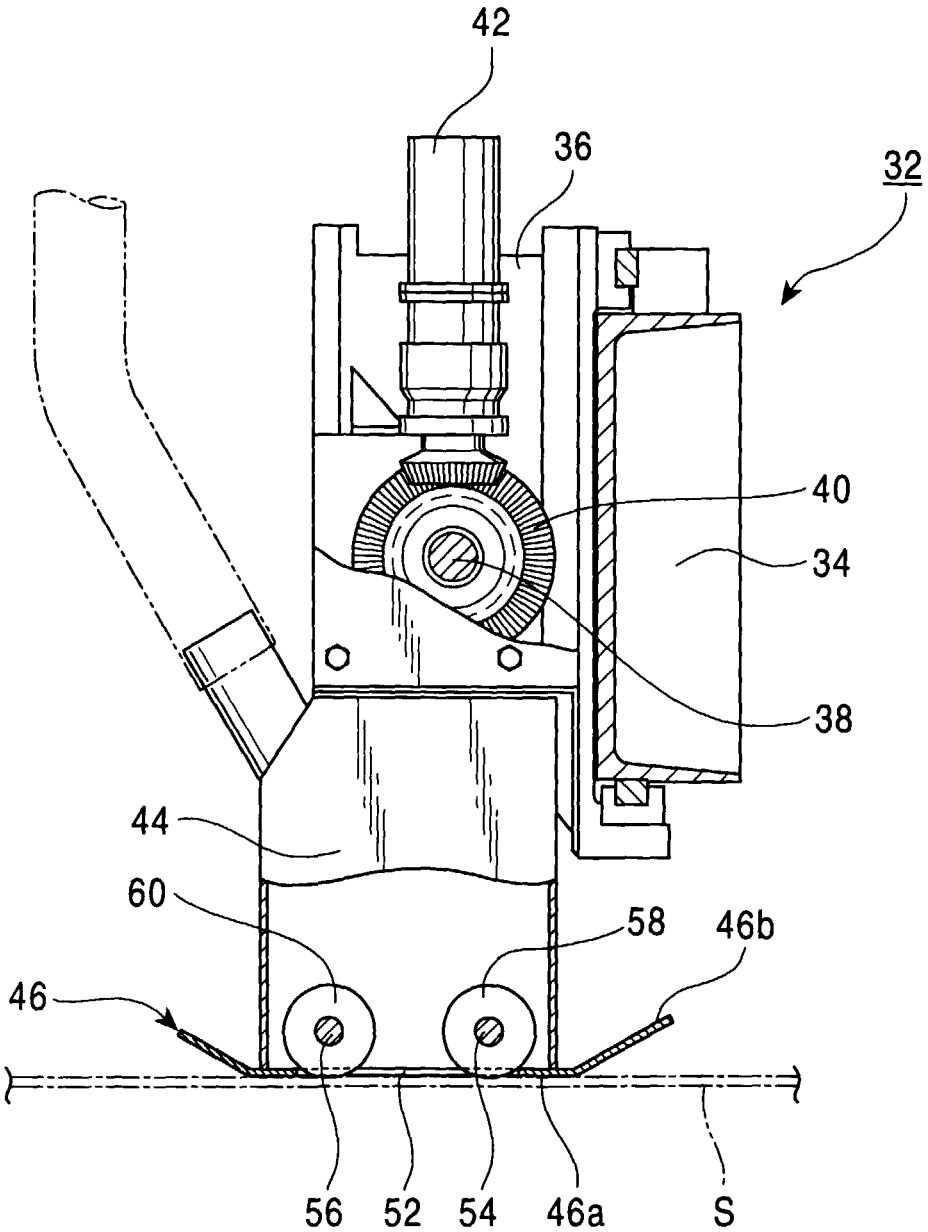


FIG. 4

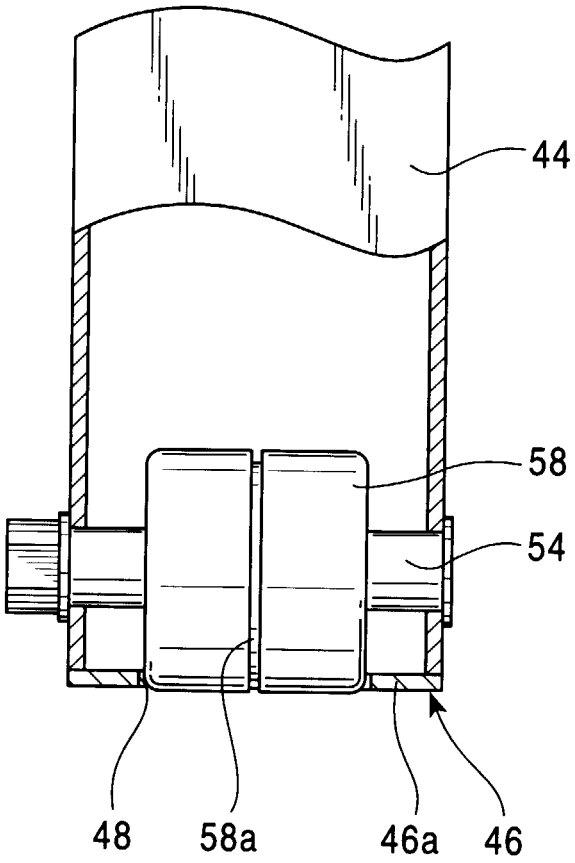


FIG. 5

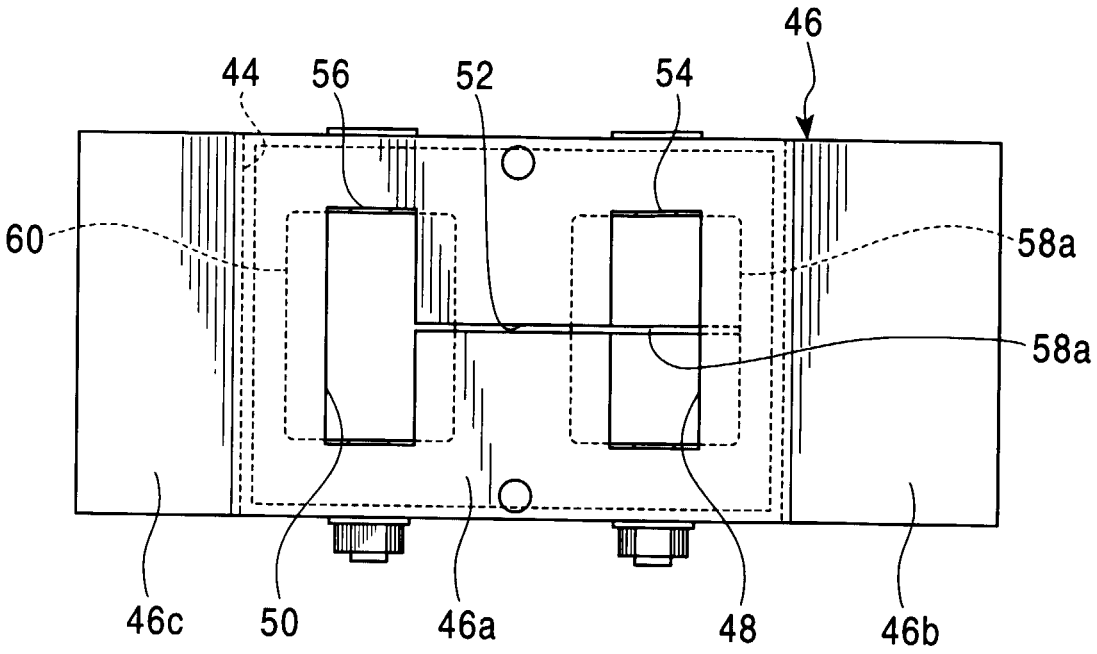


FIG. 6

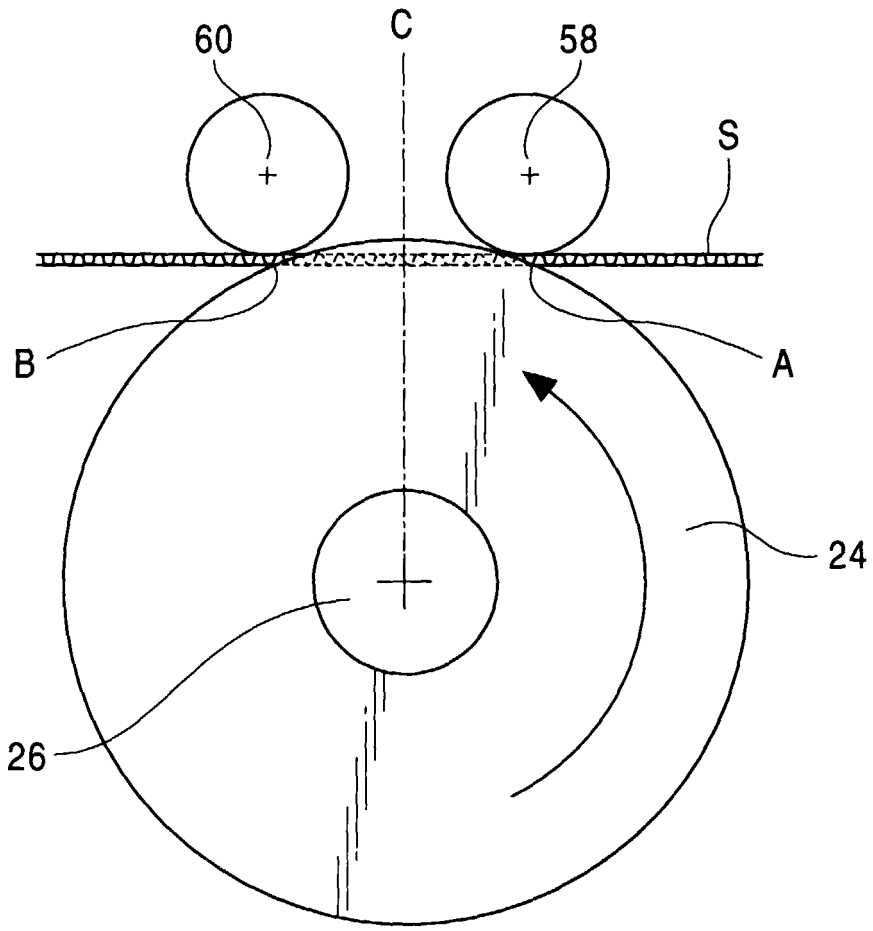


FIG. 7

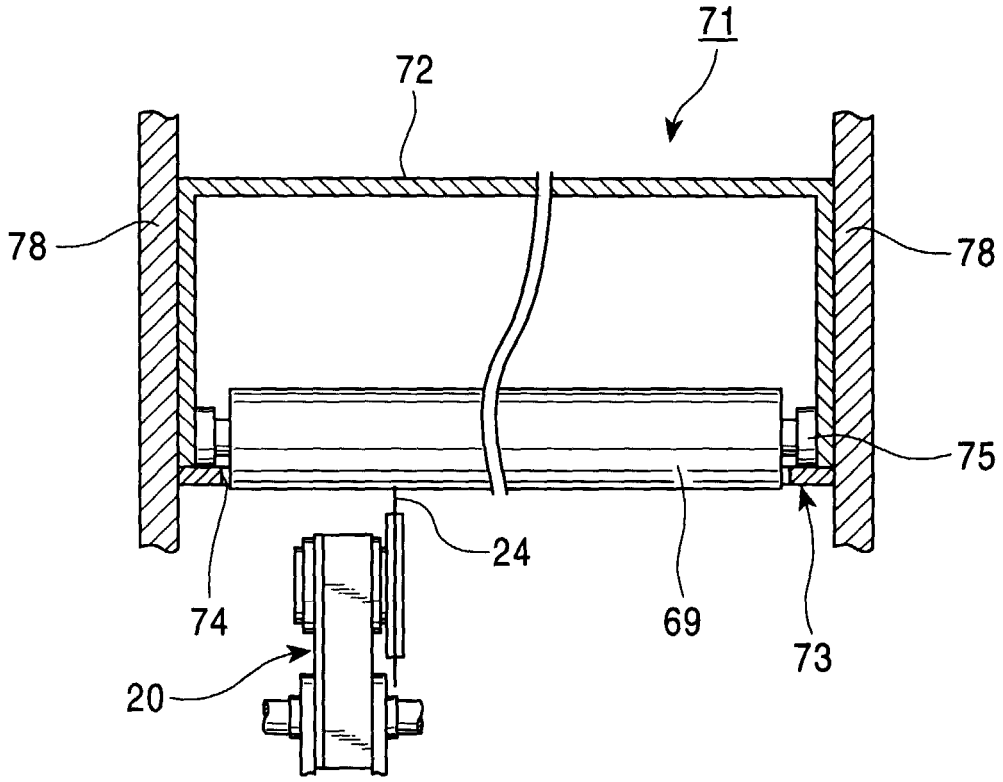
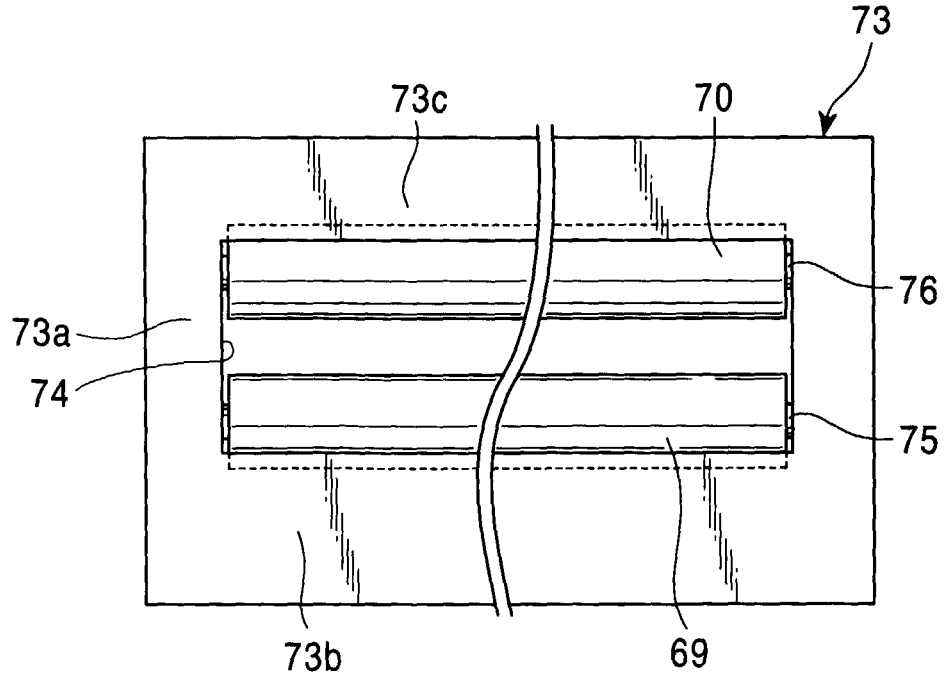


FIG. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 99 11 9030

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 307 768 C (ISSENMANN) * the whole document *	1	B26D7/20 B26D1/22 B26D1/15
X A	GB 929 264 A (CLARKSON BROOKE & COMPANY) * the whole document *	1 3	
X A	US 2 305 536 A (LANGSTON ET AL.) 15 December 1942 (1942-12-15) * column 2, line 10 - line 15; figure 3 *	1,2 7,8	
X A	DE 29 46 118 A (PONTAROLLO ETTORE) 4 June 1980 (1980-06-04) * figure 1 *	1,2 7,8	
A	EP 0 443 396 A (PETERS W MASCHF) 28 August 1991 (1991-08-28) * column 4, paragraph 2 *	5,6	
A	EP 0 585 927 A (MITSUBISHI HEAVY IND LTD) 9 March 1994 (1994-03-09) * abstract *	9	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	GB 588 015 A (COMMUNICATIONS PATENTS LTD) * figures 2,3 *	10	B26D
A	DE 42 28 686 A (BHS BAYERISCHE BERG) 3 March 1994 (1994-03-03)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 December 1999	Vaglienti, G

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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03-12-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 307768 C		NONE	
GB 929264 A		NONE	
US 2305536 A	15-12-1942	NONE	
DE 2946118 A	04-06-1980	IT 1202799 B	09-02-1989
		US 4263827 A	28-04-1981
EP 0443396 A	28-08-1991	CH 682645 A	29-10-1993
		AT 113889 T	15-11-1994
		AU 639531 B	29-07-1993
		AU 7123291 A	22-08-1991
		CA 2036684 A,C	22-08-1991
		DE 69105006 D	15-12-1994
		ES 2065560 T	16-02-1995
		JP 2074913 C	25-07-1996
		JP 4226887 A	17-08-1992
		JP 7112678 B	06-12-1995
		US 5134913 A	04-08-1992
EP 0585927 A	09-03-1994	JP 6079688 A	22-03-1994
		AU 660231 B	15-06-1995
		AU 4601793 A	10-03-1994
		DE 69310640 D	19-06-1997
		DE 69310640 T	20-11-1997
		US 5435217 A	25-07-1995
GB 588015 A		NONE	
DE 4228686 A	03-03-1994	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82