(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 458 340 A2**

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **91108375.6**

(51) Int. Cl.5: **B26D 9/00**

(22) Date of filing: **23.05.91**

(30) Priority: **24.05.90 JP 134458/90**

(43) Date of publication of application:
27.11.91 Bulletin 91/48

(84) Designated Contracting States:
CH DE FR GB IT LI

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(54) **Slitterscorer.**

(57) The known slitterscorer in a corrugating machine for carrying out cutting and scoring of a continuously traveling corrugated cardboard sheet along the traveling direction of the sheet, is improved. The improvement resides in that the slitterscorer comprises a shear unit for forming notches (slots) at a plurality of locations along the widthwise direction of the continuously traveling corrugated cardboard sheet.

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BACKGROUND OF THE INVENTION:

Field of the Invention:

The present invention relates to a slitterscorer provided with a shear unit which is operated upon order change and which can for a plurality of notches (slots) along a widthwise direction of a continuously traveling corrugated cardboard sheet.

Description of the Prior Art:

At first, description will be made on a construction and operations of one example of a rotary shear in the prior art with reference to Figs. 5 to 8. A rotary shear is an apparatus acting upon a corrugated cardboard sheet manufactured continuously in a corrugating machine at the preceding step for cutting it in the widthwise direction or notching it along the widthwise direction, and it operates upon order change and can function to deal with change of setting in response to variations of a specification such as width change of trims 16, width change of produced sheets 2 and the like. Fig. 6 is a perspective view showing an operating state of a rotary shear, in which an engaging condition between an anvil 20 on a circumferential surface of an anvil cylinder 17 and a cutting knife 19 of a knife cylinder 18 and a working condition upon a traveling corrugated cardboard sheet 1 are illustrated, and the knife cylinder 18 having the knife 19 fixedly secured thereto is pivotably supported at its opposite ends via bearings not shown from frames provided upright at the both ends of the width of the apparatus.

In addition, an anvil cylinder 17 disposed in opposition to the above-mentioned knife cylinder 18 is also pivotably supported at its opposite ends via bearings from the same frames. The anvil cylinder 17 is coupled to the above-described knife cylinder 18 via corresponding gears so that they can be rotated in the opposite directions as synchronized with each other, and a corrugated cardboard sheet 1 travels through a gap between the anvil cylinder 17 and the knife cylinder 18 while being kept in rolling contact with the anvil cylinder 17. On the surface of the anvil cylinder 17, as shown in a developed form in Fig. 7, the anvil (elastic body) 20 is partly removed so that its central portion may be gradually reduced in width from a total width ℓ up to a predetermined dimension ℓ_0, and thereby a step (unevenness) is formed. Therefore, by variably setting a relative phase of the anvil cylinder 17 engaged with the knife 19 on the knife cylinder 18, various modes of cutting and machining as shown in Fig. 8 can be carried out.

More particularly, if the anvil 20 is engaged with the knife 19 at a position A in Fig. 8, then perfect cutting over the entire width is possible, while if it is engaged with the knife 19 at a position B in the same figure, then at the both width end portions of the corrugated cardboard sheet 1, notches having a length P_0 in Figs. 7 and 8 can be formed. As described above, the rotary shear of the aforementioned type can machine notches having any arbitrary length from zero to the maximum length of $(W-\ell_0)/2$ at the both width ends of the corrugated cardboard sheet 1 by appropriately variably setting the position B where the anvil 20 is engaged with the knife 19.

Next, explaining the operation, as initial setting of the rotary shear, at first the anvil cylinder 17 is rotated by driving a motor for indexing, and thereby a relative phase of the anvil cylinder 17 with respect to the knife 19 corresponding to a desired cutting or machining condition for the corrugated cardboard sheet 1 is adjusted and maintained. Subsequently, an electromagnetic clutch not shown is operated, and by intermittently transmitting power from a line shaft at a predetermined timing, notching or cutting for the traveling corrugated cardboard sheet 1 is carried out.

Fig. 9 illustrates a machined condition of a corrugated cardboard sheet so as to correspond in position to the state shown in Fig. 10. Slitterscorers Pa and Pb are apparatuses for applying predetermined ruled lines K and slitting slots S to a traveling corrugated cardboard sheet 1 as shown in Fig. 9 by means of provided ruled line rolls 21a and 21b and slitter knives 22a and 22b, and in relation to a necessary product sheet width W_0, by appropriately selecting the corrugated cardboard sheet width W, it is possible to carry out simultaneous production of a plurality of sheet (multi-sheet production) (Fig. 9 illustrates the case of two-sheet production). In addition, in order to achieve shortening of a resetting time accompanying order change, often two apparatuses Pa and Pb are installed as cascaded in the direction of traveling of the sheet. It is to be noted that the above-described produced entire corrugated cardboard web width W was set to be somewhat broader than the width W_0 of a product sheet to be used, and the opposite width end portions where unacceptable faults such as deviations of overlapping or projection of paste upon sticking elementary sheets are liable to occur, are cut away in a belt shape, and they are sucked as waste paper 16 into respective trim ducts 23a and 23b.

Now, brief explanation will be made on change of setting accompanying order change. New trim positions accompanying the order change are transmitted as signals from an order change system controller not shown, in the slitterscorer Pb under a standby condition, besides setting in posi-

tion of the trim duct 23b, various setting corresponding to the new order is effected, at the same time in a trim cutting device (rotary shear), in order to set cut amounts at the both width ends of the corrugated cardboard web corresponding to the new order, a relative phase angle of the anvil cylinder 17 is set with respect to the position of the knife 19. Subsequently, the knife cylinder 18 and the anvil cylinder 17 are rotated in the opposite directions at a predetermined timing for allowing the corrugated cardboard sheet 1 to pass therebetween, and trim cutting and notching are effected at desired positions. Next, the above-mentioned notched position is transferred to the slitterscorer Pb in a standby state, then at a predetermined position at first the ruled line rolls 21b are engaged with the corrugated cardboard sheet 1, subsequently the slitter knives 22b are engaged therewith, and successively machining is effected according to the new order.

On the other hand, in the slitterscorer Pa which has been working according to the old order, at a predetermined timing when the leading end of the corrugated cardboard sheet to be machined according to the new order arrives, the engagements with the ruled line roll 21a and the slitter knife 22a are successively released. In addition, new trims 16b produced from the corrugated cardboard sheet 1 according to the new order are respectively sucked into a pair of trim ducts 23b newly provided at the slitterscorer Pb for the new order and conveyed thereby, and after they have been cut by a cutterblower 24 provided in the midway, they are disposed.

The rotor shear in the prior art had only two kinds of capabilities of forming notches of arbitrary lengths at the both width ends of a traveling corrugated cardboard web and perfectly cutting the web over its entire width, and accordingly under the setting of two-sheet production as shown in Fig. 9, as a result of order change, only the width of the trims 16 at the ends of the width is changed. In other words, a specification could be changed stably only under a limited condition such that a slitting slot for separation at the center of a sheet is continuous, in the case where even if the above-mentioned slitting slot for separation of a sheet should become discontinuous as a result of change of a production sheet width, cut lengths of the two sheets traveling in parallel are the same, or in the case where only one kind of production sheets 2 are produced from one corrugated cardboard sheet 1 not shown.

However, upon change of a specification according to order change, it may often occur that not only the dimension in the widthwise direction of the product sheets 2 is changed as shown in Fig. 5, but also the cut lengths L of the two sheets 2 traveling in parallel are also arbitrarily changed. Also, upon two-sheet production in which two kinds of sheets are produced in parallel from a single corrugated cardboard web, in the case where the cut lengths of the parallel sheets are different from each other, in a cut-off step of the process at the downstream not shown, the respective sheets would be conveyed to separate rotary drum shears not shown in Fig. 5, respectively, and would be cut into predetermined lengths. Accordingly, in the case where a specification has been changed, for instance, as shown in Fig. 5, a discontinuous portion X would remain at the central slitting slot, hence upon change of traveling routes (separation into upper and lower routes) in a cut-off step of the process at the downstream which is effected in the case where the sheet lengths of the sheets traveling in parallel are different as described above, not only the aforementioned discontinuous portion would be broken and would become unacceptable product sheets, but also the broken sheet pieces would be caught by conveyor means (feed rolls) at the downstream, and so, troubles such as jam-up would arise frequently.

Hence, from the above-mentioned reasons, in the heretofore known rotary shear, in the case where the position of the slitting slot for separating the sheets from each other is changed, a method for avoiding damage of the sheets occurring at the above-mentioned discontinuous portion X by once cutting off the preceding and succeeding corrugated cardboard webs over their entire widths upon order change, was employed. However, this method has a shortcoming that restriction for the trailing end of the formerly ordered sheet and the leading end of the newly ordered sheet is temporarily freed, and so, there occurs zig-zag traveling of the product sheets 2 or variation of the conveying speed. Consequently, a precision in the cut length and the like would become inaccurate, and it would become a principal cause of various troubles which may arise during the period before the new sheet traveling condition is stabilized.

As described above, the rotary shear in the prior art had only two kinds of capabilities of forming notches of arbitrary lengths in the widthwise direction of a sheet at the both width ends of a corrugated cardboard sheet and perfectly cutting the sheet over its entire width. Accordingly, although the rotary shear can smoothly deal with (switch) by means of notches formed at the both width ends under an extremely limited condition as in the case where only trim widths are changed according to order change, upon multi-sheet production in which a plurality of kinds, two kinds for instance, of sheets having different widths are produced from a single corrugated cardboard web, in the case where the widths of the sheets are

changed according to order change and the cut sheet lengths are different, at the changing point of the new and old orders, a slitting position would shift in the widthwise direction, resulting in a discontinuous portion, hence there was a disadvantage that the sheets would be broken by separation of the sheet traveling routes at the cut-off in the next step of the process and the sheets would become unacceptable product sheets. also, besides it would become a principal cause of various troubles such that the broken sheet pieces may block a space between conveyor rolls in the next step of the process, resulting in jam-up. Thus, in the case where the sheet is perfectly cut along its widthwise direction at the portion of the order change as a countermeasure for the above-mentioned problems in the prior art, although the disadvantage caused by breaking of the sheet at the slitting position is eliminated, the ends of the sheets according to the new and old orders would be freed, hence the conveying condition would become unstable, and consequently, there was a shortcoming that separate problems would be produced such that the sheet would travel in a zig-zag manner, or its traveling speed (amount) would vary, resulting in deterioration of a precision in cutting dimensions upon cut-off in the next step of the process.

SUMMARY OF THE INVENTION:

It is therefore one object of the present invention to provide an improved slitterscorer equipped with a shear unit therein, which is free from the above-mentioned shortcomings of the slitterscorer in the prior art.

According to one feature of the present invention, there is provided a slitterscorer in a corrugating machine for carrying out cutting and scoring of a continuously traveling corrugated cardboard sheet along the traveling direction of the sheet, in which the slitterscorer comprises a shear unit for forming notches (slots) at a plurality of locations along the widthwise direction of the continuously traveling corrugated cardboard sheet, whereby the problems involved in the heretoknown slitterscorer can be resolved.

According to the present invention, owing to the above-mentioned structural feature, in the case where trim width dimensions at the opposite side edge of the sheet are changed according to order change, or in the case where sheet widths are varied during multi-sheet production in which a plurality of kinds of sheets having different lengths are produced, since it is possible to machine and form notches directed in the widthwise direction of the sheet only at the portions where the notches are necessitated, the disadvantage such that the sheet is broken at the change point of a specification would be eliminated, even if the new and old sheets are not perfectly separated according to order change as is the case with the method in the prior art. Accordingly, the sheets can be conveyed stably, a precision in cutting dimensions can be maintained accurate, and also troubles such as jam-up or the like can be eliminated.

The above-mentioned and other objects, features and advantages of the present invention will become more apparent by reference to the following description of one preferred embodiment of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

In the accompanying drawings:

Fig. 1 is a front view (a cross-section view taken along line B-B in Fig. 3) showing a structure of a shear unit provided in a slitterscorer according to one preferred embodiment of the present invention;

Fig. 2 is a cross-section view taken along line A-A in Fig. 1;

Fig. 3 is a side view of the slitterscorer shown in Fig. 1;

Fig. 4 is a schematic view showing one example of setting of a shear unit on the left side and a machined condition of a corrugated cardboard sheet on the right side with the illustration on the right side corresponding in position to the illustration on the left side;

Fig. 5 is a schematic view illustrating disadvantages of a rotary shear in the prior art;

Fig. 6 is a perspective view showing an operating state (machining state) of the rotary shear in the prior art;

Fig. 7 is a developed view of an outer circumferential surface portion of an anvil cylinder in the rotary shear in the prior art;

Fig. 8 is a schematic view illustrating a machined condition of a corrugated cardboard sheet, the illustration corresponding in position to that in Fig. 7;

Fig. 9 is a schematic view showing scoring and cut-machining state on a corrugated cardboard sheet;

Fig. 10 is a side view for explaining conventional rotary shear and slitterscorer and disposal of slitted trims;

Fig. 11 is a front view of slitter knives; and

Fig. 12 is a front view of ruled line rolls.

DESCRIPTION OF THE PREFERRED EMBODIMENT:

Now the present invention will be described in

greater detail in connection to one preferred embodiment illustrated in the accompanying drawings. A slitterscorer provided in a corrugating machine according to one preferred embodiment is illustrated in Figs. 1 to 4. In these figures, the functions of a slitterscorer P for carrying out cutting and scoring for a continuously traveling corrugated cardboard sheet 1 along the traveling direction of the sheet, are similar to those of the above-described slitterscorer in the prior art.

Now, the present invention can achieve a larger effect in function in the case of multi-sheet production where two or more product sheets 2 are produced in parallel from a single corrugated cardboard sheet 1 by providing a shear unit which can form notches (slots) at a plurality of locations along the widthwise location of a traveling corrugated cardboard sheet 1 in the above-described slitterscorer, and the invention is characterized in that even in the case where a width W_o of a product sheet 2 and/or a cut length L of the sheet are changed according to order change, the sheet can be stably transferred to the next step of the process in a continuous state as a whole by forming notches directed in the widthwise direction only at necessary portions without perfectly cutting and separating the sheet 1 as is the case with the slitterscorer in the prior art.

The construction will be explained in the following. Figs. 1 and 2 illustrate a structure of a shear unit section equipped in the slitterscorer according to the present invention. Knife heads 4 having knives 3 fixedly secured thereto as directed in the axial direction of the circumferential surface have a ring shape divided into a plurality of pieces along an axial direction of a pivotably supported shaft 5, the respective knife heads can slide in the axial direction (the widthwise direction of the corrugated cardboard sheet) via keys 6 interposed between the heads 4 and the shaft 5, and also they can be fixed at predetermined positions. To one end portion of the shaft 5 is fixedly secured a gear 7, and the opposite ends of the shaft 5 are pivotably supported via bearings 8a and 8b from frames 9a and 9b of the slitterscorer P. It is to be noted that reference numeral 10 in Fig. 1 designates an electromagnetic clutch brake for transmitting rotation from a driving device not show to the shaft 5 at a predetermined timing.

On the other hand, under the shaft 5 is juxtaposed an anvil cylinder 12 having an elastic body 12 fixedly secured onto its circumferential surface, a gear 13 is fixedly secured to one end of the same anvil cylinder, and it is meshed with the gear 7 fixedly secured to the above-mentioned shaft 5. The opposite axial ends of the anvil cylinder 12 are also pivotably supported via bearings 14a and 14b from the frames 9a and 9b. In the above-described structure, notches directed in the widthwise direction of a corrugated cardboard sheet 1 can be formed at desired positions on the sheet by synchronized rotation of the knife 3 having a plurality of knife heads 4 mounted thereon as disposed at predetermined positions along the widthwise direction of the sheet in response to an operation signal and the elastic body 11 on the anvil cylinder 12 with the sheet 1 pinched therebetween.

Fig. 4 is a schematic view showing one example of setting of the shear unit and notches formed on a corrugated cardboard web 2 as a result of the setting. It is to be noted that with regard to setting of the knife heads 4, there are various methods such that they are moved to and set at predetermined positions by a setting function of a slitter knife 22 in the slitterscorer main body or by a well-known individual setting function via a carrier 15 which is movable in the axial direction of the shaft 5. Thereby, even in the case where not only the width of the trims 16 and the width of the product sheets are changes as shown on the right side in Fig. 4 according to order change, but also in the next step of the process the traveling routes of the sheets traveling in parallel are separated into upper and lower routes due to difference in sheet cut lengths L, stable transfer of product sheets 2 can be achieved without damaging the sheets.

As described above, according to the present invention, since notches (slots) can be formed only at necessary locations by moving and setting the knife heads 4, there is no need to perfectly cut the corrugated cardboard sheet 1 over the entire width as is the case with the slitterscorer in the prior art, stable transfer of sheets can be maintained, and the problems in the prior art such that a precision in the sheet cut length L in the next step of the process is deteriorated or troubles in transfer of the sheets are generated by jam-up, can be resolved.

As described in detail above, according to the present invention, since a shear unit for forming notches (slots) at a plurality of locations in the widthwise location of a corrugated cardboard sheet, is provided, even in the case of order change in multi-sheet production, the sheet is not cut and separated over the entire region in the widthwise direction as is the case with the slitterscorer in the prior art, and therefore, jam-up in the next step of the process which was generated upon order change at a high speed or upon order change for a sheet having a poor rigidity, can be prevented. In addition, many excellent effects can be achieved such that zig-zag traveling of the trailing end of an old sheet and the leading end of a new sheet caused by cutting over the entire width is eliminated, and unacceptable faults in a cutting precision generated by unstability of traveling of the sheet are eliminated.

While a principle of the present invention has been described above in connection to one preferred embodiment of the invention, it is a matter of course that many apparently widely different embodiments of the present invention can be made without departing from the spirit of the present invention.

Claims

1. A slitterscorer in a corrugating machine for carrying out cutting and scoring of a continuously traveling corrugated cardboard sheet along the traveling direction of the sheet; characterized in that said slitterscorer comprises a shear unit for forming notches (slots) at a plurality of locations along the widthwise direction of the continuously traveling corrugated cardboard sheet.

2. A slitterscorer as claimed in Claim 1, characterized in that said shear unit is provided with a plurality of rotary knife heads (4), each having a knife (3) mounted thereon and extending in the widthwise direction of the corrugated cardboard sheet (1), in such manner that they can be adjusted in position in the widthwise direction of the corrugated cardboard sheet.

3. A slitterscorer as claimed in Claim 2, characterized in that said shear unit is provided with an anvil cylinder (12) disposed with respect to said knives (3) so as to pinch the corrugated cardboard sheet (1) therebetween, which has an elastic body (11) fixedly secured onto its circumferential surface and rotates in synchronism with said knife heads (4).

Fig. 1

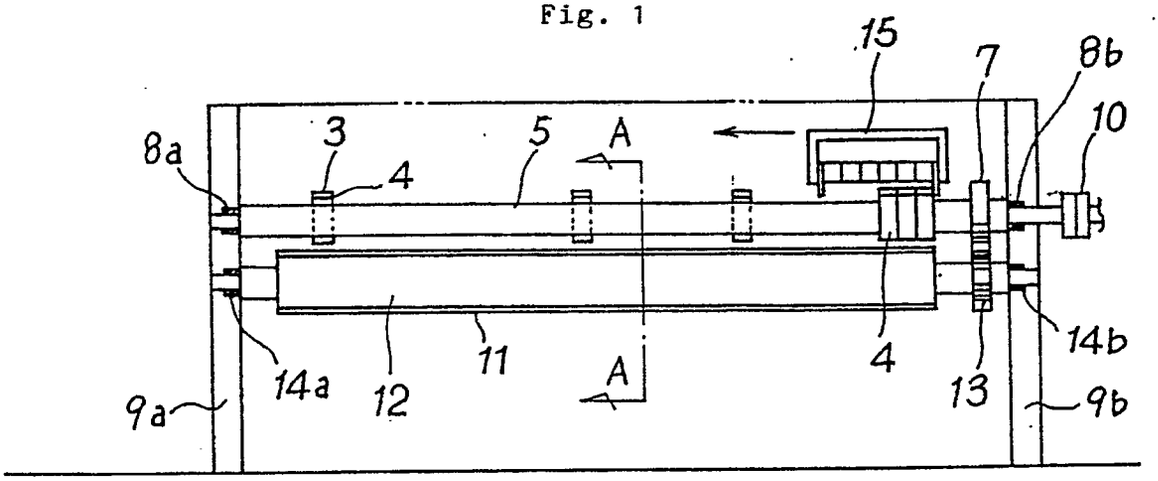

Fig. 2

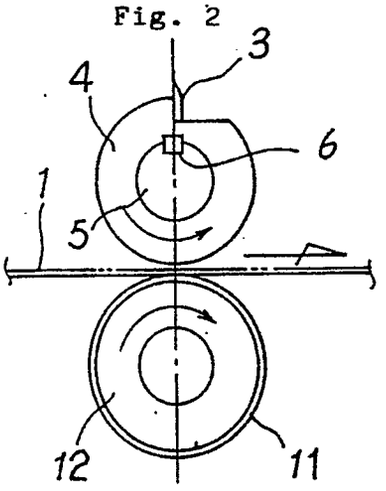

Fig. 3

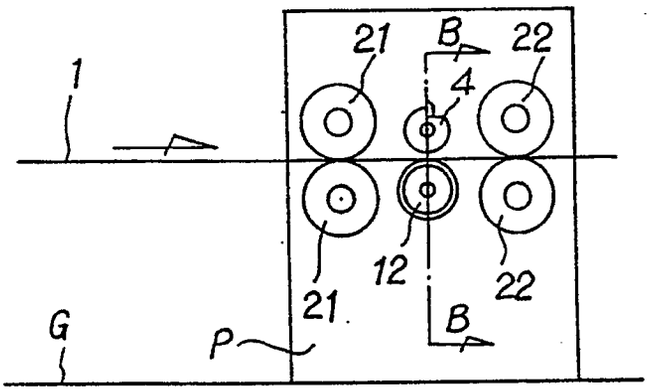

Fig. 4

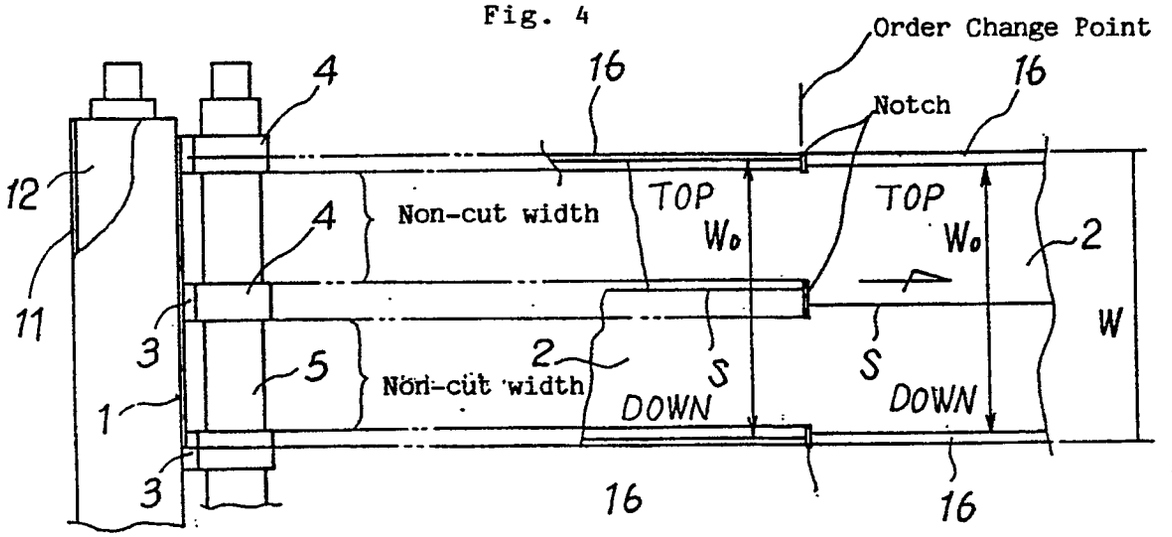

Fig. 5 (Prior Art)

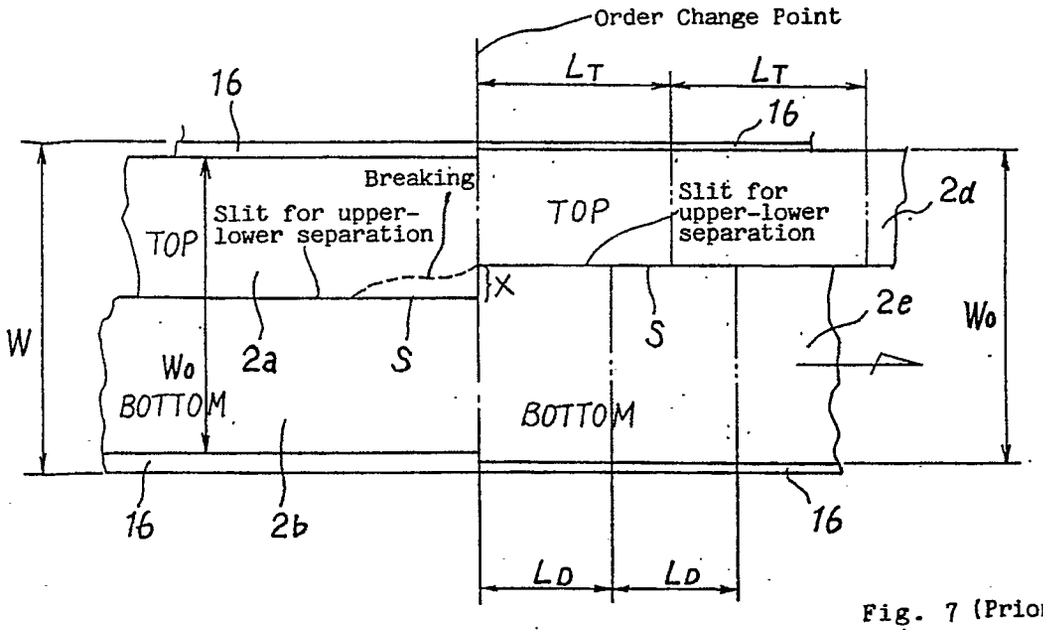

Fig. 6 (Prior Art)

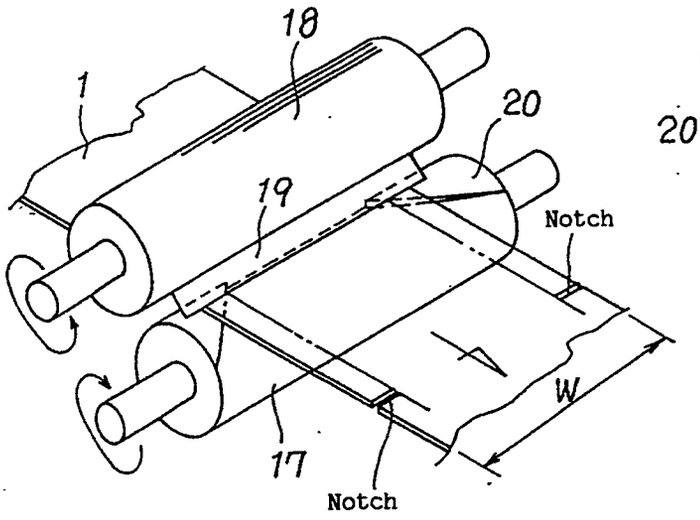

Fig. 7 (Prior Art)

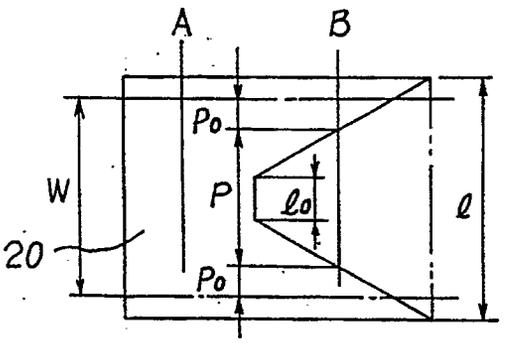

Fig. 8(Prior Art)

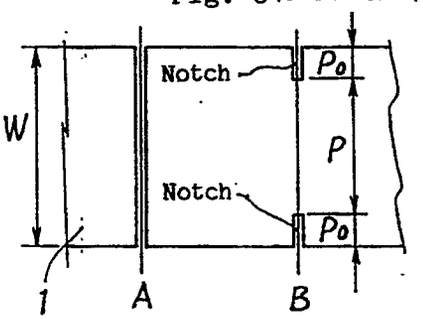

Fig. 9

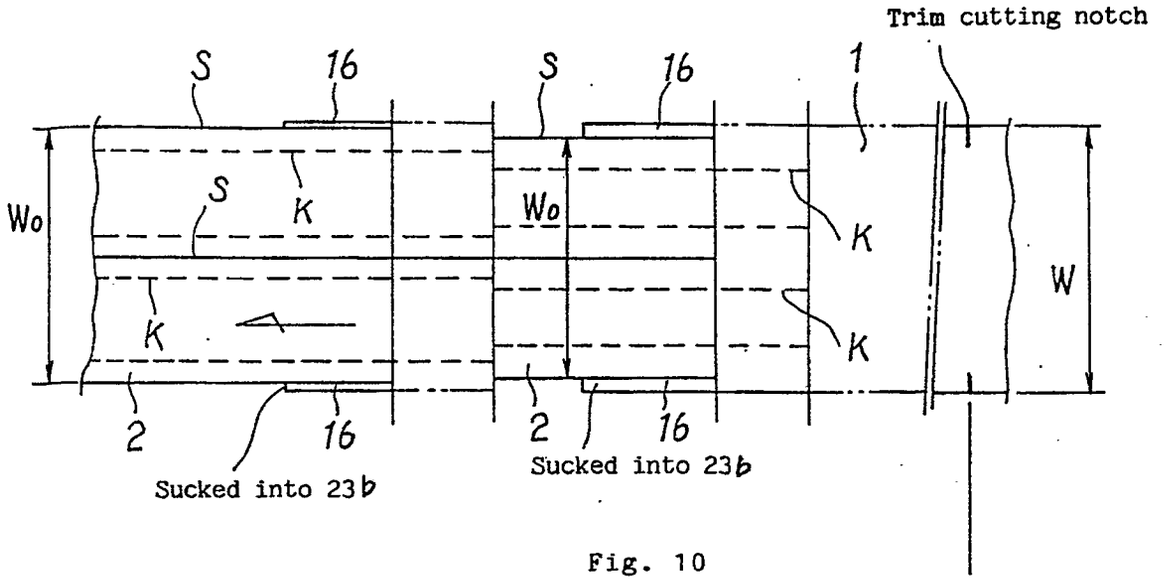

Fig. 10

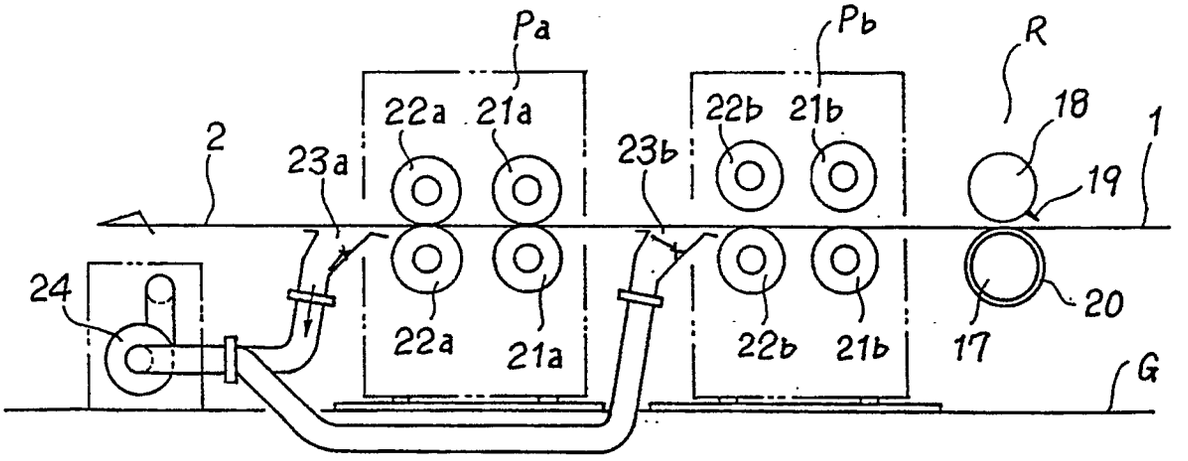

Fig. 11

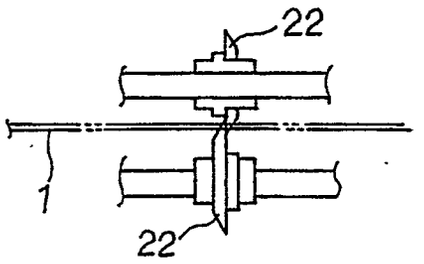

Fig. 12