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(11) **EP 0 863 247 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.09.1998 Bulletin 1998/37

(51) Int. Cl.⁶: **D06F 89/00**

(21) Application number: **98200578.7**

(22) Date of filing: **26.02.1998**

(84) Designated Contracting States:
**AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC
NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

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(30) Priority: **26.02.1997 NL 1005377**

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(54) **Apparatus for folding a flat piece of laundry and a method for doing so**

(57) The invention relates to an apparatus (1) for folding a flat piece of laundry, such as a tablecloth, comprising feeding and discharging means (10) for the piece of laundry, first and second auxiliary conveying means (30,40) for the piece of laundry arranged consecutively in the supply direction of the piece of laundry near the feeding and discharging means, and first and second direction changing means (20) for the piece of laundry to direct the piece of laundry over the first and the second auxiliary conveying means.

According to the invention means are included that are able to hold the piece of laundry against the first auxiliary conveying means.

It is thus possible to fold a piece of laundry in various ways.

The invention also relates to a method for folding a flat piece of laundry, such as a tablecloth, in the shape of a W.

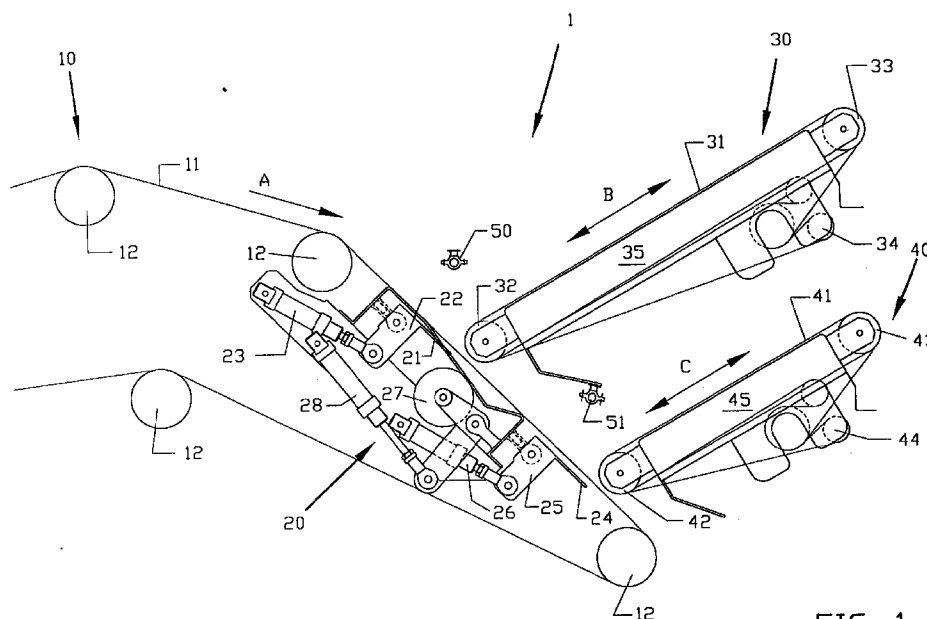


FIG. 1

EP 0 863 247 A1

Description

The invention relates to an apparatus for folding a flat piece of laundry, such as a tablecloth, comprising feeding and discharging means for the piece of laundry, first and second auxiliary conveying means for the piece of laundry arranged consecutively in the supply direction of the piece of laundry near the feeding and discharging means, and first and second direction changing means for the piece of laundry to direct the piece of laundry over the first and the second auxiliary conveying means. The invention also relates to a method for folding a flat piece of laundry with the help of the apparatus according to the invention.

A suchlike apparatus is known and is marketed by the applicant, so that laundries, for instance, can fold flat linen, such as tablecloths or sheets, twice in half after washing and mangling. For that purpose the cloth is fed with the help of feeding and discharging means and when the front edge reaches the first auxiliary conveying means it is lead by the first direction-changing means over the first auxiliary conveying means. When half the cloth has been carried along by the first auxiliary conveying means, the first direction-changing means are deactivated and the direction of movement of the first auxiliary conveying means is reversed, so that the cloth is conveyed between the feeding and discharging means and the first auxiliary conveying means folded in half upon itself and is carried along by the feeding and discharging means. This process is repeated with the second auxiliary conveying means, so that the cloth is eventually discharged by the feeding and discharging means, folded over twice. With the known apparatus a so-called French fold can also be made, in which the front third part of the cloth is folded over with the help of the first auxiliary conveying means, and then the double-folded portion is folded onto the rear third part with the help of the second auxiliary conveying means.

This known apparatus has the disadvantage that the laundry can only be folded once or twice in half or be provided with a French fold.

It is an object of the invention to provide an apparatus with which a flat piece of laundry can also be folded in another manner.

This object is achieved with the apparatus of the sort given in the preamble, in which the apparatus comprises means able to hold the piece of laundry against the first auxiliary conveying means.

By arranging the holding means it is possible to hold a piece of laundry, the front portion of which has in part already passed the first auxiliary conveying means, behind this front portion against the first auxiliary conveying means, as a result of which the first auxiliary conveying means can pull back the front portion of the piece of laundry counter to the direction of movement of the feeding and discharging means and can guide it onto the first auxiliary conveying means, so that a dou-

ble-folded portion of the piece of laundry is made on the first auxiliary conveying means. With the help of the holding means it is therefore possible to fold the piece of laundry in an alternative manner, for instance in a W-shaped fold, as will be described below. It is therefore possible with the invention either to obtain a piece of laundry which is folded over twice or provided with a French fold in the known way, or, alternatively, to obtain a piece of laundry folded in a W-shape.

Preferably the holding means are formed by pressure means so as to press the piece of laundry against the first auxiliary conveying means, which pressure means preferably comprise a pressure roll, to press the piece of laundry against the first auxiliary conveying means without slipping.

Preferably the pressure means comprise a double-acting pneumatic cylinder in order to press the pressure roll against the first auxiliary conveying means as desired, so that the pressure roll can be activated or deactivated quickly and at the correct moment.

For this purpose the pressure means are preferably arranged at the location at which the first auxiliary conveying means approach closest to the feeding and discharging means, so that they can be arranged at the other side of the feeding and discharging means with regard to the first auxiliary conveying means and do not obstruct the transit of a piece of laundry.

Preferred embodiments of the invention are described in claims 6, 7 and 8.

The invention also relates to a method for folding a flat piece of laundry, such as a tablecloth, in the shape of a W, with the help of an apparatus according to any one of the preceding claims, the following steps being performed:

- a - the flat piece of laundry is fed by means of the feeding and discharging means, which remain moving in the same direction during all the steps; the first and the second auxiliary conveying means are moved towards the feeding and discharging means;
- b - when the front edge of the piece of laundry reaches the second auxiliary conveying means, the second direction-changing means are activated and the direction of movement of the second auxiliary conveying means is reversed, whereupon the front portion of the piece of laundry is moved away from the feeding and discharging means with the help of the second auxiliary conveying means;
- c - when half of the piece of laundry has passed the first auxiliary conveying means, the first direction-changing means are activated and the holding means are also activated to hold the piece of laundry against the first auxiliary conveying means, and the direction of movement of the first as well as the second auxiliary conveying means is reversed;
- d - from the middle of the piece of laundry the middle portion of the piece of laundry is subsequently taken along, folded, on the first auxiliary conveying

means moving away from the feeding and discharging means until the middle half of the piece of laundry is folded double; the front portion of the piece of laundry is simultaneously guided back to the feeding and discharging means with the help of the second auxiliary conveying means;

e - when the middle half of the piece of laundry has been folded double on the first auxiliary conveying means, the first direction-changing means and the holding means are deactivated and the direction of movement of the first as well as the second auxiliary conveying means is reversed, whereupon the first auxiliary conveying means lead the double-folded middle portion of the piece of laundry onto the rear portion thereof, while the front portion of the piece of laundry is guided away from the feeding and discharging means with the help of the second auxiliary conveying means, so that the remaining portion of the piece of laundry is guided over the feeding and discharging means folded in a Z shape;

f - when the Z-shaped portion of the piece of laundry reaches the second auxiliary conveying means, the second direction-changing means are deactivated and the direction of movement of the second auxiliary conveying means is reversed, whereupon the second auxiliary conveying means lead the front portion of the piece of laundry onto the Z-shaped portion, and the feeding and discharging means discharge the piece of laundry in the shape of a W.

The method is preferably carried out with an apparatus according to the invention which is provided with first and second blowing means according to claim 6, in which at the start of step c an air pulsation is applied to the piece of laundry with the help of the first blowing means and in which at the start of step f an air pulsation is applied to the piece of laundry with the help of the second blowing means, so as to press the piece of laundry on the respective auxiliary conveying means, so that the piece of laundry is carried along with certainty when reversing the direction of movement of the auxiliary conveying means and the piece of laundry will not slip or slide over the auxiliary conveying means.

With the apparatus according to the invention it is, of course, also possible to carry out other methods for folding a piece of laundry, for instance to obtain a piece of laundry folded in a Z-shape.

Below the invention will be elucidated on the basis of the drawing.

Figure 1 shows a preferred embodiment of the folding apparatus according to the invention in side view.

The figures 2 to 5 show the folding apparatus according to figure 1 at various stages of the folding process of a piece of laundry.

Figure 1 shows the preferred embodiment of the folding apparatus 1 according to the invention in side

view. The folding apparatus 1 consists of feeding and discharging means 10, first auxiliary conveying means 30, second auxiliary conveying means 40, direction-changing means 20 and blowing means 50 and 51.

The feeding and discharging means 10 consist of endless belt strips 11, of which a great number are led in a parallel and spaced fashion over guide rolls 12. During operation the belt strips 11 are driven by a driving apparatus, not shown, at a constant speed in the direction shown by arrow A.

The first auxiliary conveying means 30 consist of a frame 35 with end rolls 32 and 33 on two opposite ends, about which an endless conveyor belt 31 is arranged. During operation the end rolls 32 and 33 are driven by a driving apparatus 34, and the endless conveyor belt 31 is also driven thus. The endless conveyor belt 31 is movable in two directions according to arrow B. The end roll 32 is arranged in the direct vicinity of the belt strips 11, in such a way that a piece of laundry can pass without difficulty between the belt strips 11 and the conveyor belt 31 over the end roll 32. The second auxiliary conveying means 40 are identical to the first auxiliary conveying means 30, the reference numerals of corresponding components being increased by 10.

The first direction-changing means consist of a frame 22 with guide fingers 21 on it, in which a double-acting pneumatic cylinder 23 can swivel the frame 22 around a swivelling point between a position in which the fingers 21 are contained under the belt strips 11, as in figure 1, and a position in which the guide fingers 21 project obliquely between the belt strips 11. The second direction-changing means with the guide fingers 24, the frame 25 and the cylinder 26 are correspondingly made. The direction-changing means are placed such that when the guide fingers project obliquely between the belt strips 11, a piece of laundry is led to the first or second conveyor belt 31 and 41, respectively.

The blowing means 50 and 51 respectively comprise a blow pipe with openings through which air can be blown in the direction of the transition between the belt strips 11 and the conveyor belt 31 and the conveyor belt 41, respectively. The blow pipes are attached in a non-described manner to the frame of the apparatus which is not shown.

Between the first and the second direction-changing means a pressure roll 27 is arranged which is swivable with the help of a double-acting pneumatic cylinder 28 with which the pressure roll can be placed in a position in which it is spaced under the belt strips 11, and a position in which not specifically shown circular grooves on the driving roll 27 press against the end roll 32 of the first auxiliary conveying means 30 in between the belt strips 11.

The operation of the apparatus for forming a W-shaped fold in a cloth will be elucidated on the basis of the figures 2 to 5. A cloth 2 is fed over the belt strips 11. In the initial situation the conveyor belts 31 and 41 move towards the belt strips 11. The cloth is led through

between the belt strips 11 and conveyor belt 31 in the direction of conveyor belt 41. When the front edge of the cloth approaches conveyor belt 41, the guide fingers 24 are activated and the direction of movement of conveyor belt 41 is reversed, as shown by the arrow in figure 2. In that way the front portion of the cloth is led over the second conveyor belt 41. This is the situation as shown in figure 2.

When half the cloth has passed roll 32, the direction of movement of the conveyor belt 31 and the conveyor belt 41 is reversed, so that the directions of movement are those indicated by the arrows in figure 3. At the same time the guide fingers 21 are activated and the pressure roll 27 is pressed against the end roll 32. The rear half of the cloth 2 is now led by the guide fingers 21 over the first conveyor belt 31, and, at the same time, the front half of the cloth is pulled back by the conveyor belt 31 counter to the direction of movement of the belt strips 11, because the pressure roll 27 presses the cloth against the conveyor belt 31. Leading the front portion of the cloth back is helped by the direction of movement of the second conveyor belt 41. By feeding the rear half of the cloth and leading back the front half of the cloth, the middle portion of the cloth is carried along, folded double, on conveyor belt 31 of the first auxiliary conveying means 30. This is shown in figure 3.

As soon as the middle half of the cloth 2 rests folded up on the conveyor belt 31, the direction of movement of the first conveyor belt 31 as well as the second conveyor belt 41 is reversed again and the guide fingers 21 are deactivated and the pressure roll 27 is retracted from end roll 32. This moment is shown in figure 4. Because the direction of movement of conveyor belt 31 is reversed, see the arrow in figure 4, the double-folded portion of the cloth is carried back to the belt strips 11, while the rear portion of the cloth is still being fed by the belt strips 11. Because of this the double-folded portion of the cloth comes to rest on the rear portion of the cloth and this portion which is folded in a Z shape is further transported between the belt strips 11 and the end roll 32. In the situation as shown in figure 4 an air pulsation is applied in the direction of the cloth with the help of the blow pipe 50, whereby the double-folded portion of the cloth is pressed against the first conveyor belt 31, so that this portion is carried along with certainty when reversing the direction of movement of the conveyor belt 31 and will not slip or slide over the conveyor belt 31.

While the double-folded portion of the cloth on conveyor belt 31 is thus laid on the end portion of the cloth, the front portion of the cloth is again led over the second auxiliary conveying means 40 by the guide fingers 24. This takes place until the folded portion of the cloth reaches the end roll 42 of the second auxiliary conveying means 40. At this moment the guide fingers 24 are deactivated and the direction of movement of conveyor belt 41 is reversed. This situation is shown in figure 5. After this the front portion of the cloth is guided back by the conveyor belt 41 to the belt strips 11, while the por-

tion of the cloth which is already folded is further transported on the belt strips 11. The front portion of the cloth thus comes to rest on the previously folded portion of the cloth and the whole is further transported along under the end roll 42 by the belt strips. In the situation as shown in figure 5, the second blow pipe 51 applies an air pulsation in order to press the front portion of the cloth against the second conveyor belt 41, so that this portion is carried along with certainty when reversing the direction of movement and the risk that it slips or slides over conveyor belt 41 is avoided.

With the help of the apparatus using the method described above a flat piece of laundry is folded into a piece of laundry in the shape of a W.

The control of the apparatus is executed by control means known per se, while the apparatus can be provided with sensors (not shown) for detecting the front or rear edge of the piece of laundry, for instance.

With the help of the apparatus it is also possible to fold a piece of laundry twice or to provide it with a French fold in the known way and it is also possible to fold a piece of laundry into a Z shape.

Claims

1. Apparatus for folding a flat piece of laundry, such as a tablecloth, comprising feeding and discharging means (10) for the piece of laundry, first (30) and second (40) auxiliary conveying means for the piece of laundry arranged consecutively in the supply direction of the piece of laundry near the feeding and discharging means, and first and second direction changing means (20) for the piece of laundry to direct the piece of laundry over the first and the second auxiliary conveying means, **characterised in that** the apparatus comprises means able to hold the piece of laundry against the first auxiliary conveying means.
2. Apparatus according to claim 1, **characterized in that** the holding means are formed by pressure means so as to press the piece of laundry against the first auxiliary conveying means.
3. Apparatus according to claim 2, **characterized in that** the pressure means comprise a pressure roll (27).
4. Apparatus according to claim 3, **characterized in that** the pressure means comprise a double-acting pneumatic cylinder (28) in order to press the pressure roll (27) against the first auxiliary conveying means as desired.
5. Apparatus according to claim 2, 3 or 4, **characterized in that** the pressure means are arranged at the location at which the first auxiliary conveying means approach closest to the feeding and dis-

charging means.

6. Apparatus according to any one of the preceding claims, **characterized in that** above the transition between the feeding and discharging means and the first and the second auxiliary conveying means, respectively, first (50) and second (51) blower means, respectively, are arranged for blowing air to the transition concerned. 5
7. Apparatus according to any one of the preceding claims, **characterized in that** the feeding and discharging means comprise parallel spaced endless belt strips (11) led over guide rolls (12), and in that the first and second auxiliary conveying means comprise an endless band (31 and 41, respectively) that is guided around end rolls (32, 33 and 42, 43, respectively) and is movable in two directions by means of driving means (34 and 44, respectively). 10 15 20
8. Apparatus according to claim 7, **characterized in that** the first and second direction-changing means comprise first (21) and second (24) guide fingers, which are movable between the belt strips (11) with the help of a first (23) and a second (26) double-acting pneumatic guide cylinder, respectively. 25
9. Method for folding a flat piece of laundry, such as a tablecloth, in the shape of a W, with the help of an apparatus according to any one of the preceding claims, the following steps being performed: 30
 - a - the flat piece of laundry is fed by means of the feeding and discharging means, which remain moving in the same direction during all the steps; the first and the second auxiliary conveying means are moved towards the feeding and discharging means; 35
 - b - when the front edge of the piece of laundry reaches the second auxiliary conveying means, the second direction-changing means are activated and the direction of movement of the second auxiliary conveying means is reversed, whereupon the front portion of the piece of laundry is moved away from the feeding and discharging means with the help of the second auxiliary conveying means; 40 45
 - c - when half of the piece of laundry has passed the first auxiliary conveying means, the first direction-changing means are activated and the holding means are also activated to hold the piece of laundry against the first auxiliary conveying means, and the direction of movement of the first as well as the second auxiliary conveying means is reversed; 50 55
 - d - from the middle of the piece of laundry the middle portion of the piece of laundry is subsequently taken along, folded, on the first auxil-

iary conveying means moving away from the feeding and discharging means until the middle half of the piece of laundry is folded double; the front portion of the piece of laundry is simultaneously guided back to the feeding and discharging means with the help of the second auxiliary conveying means;

e - when the middle half of the piece of laundry has been folded double on the first auxiliary conveying means, the first direction-changing means and the holding means are deactivated and the direction of movement of the first as well as the second auxiliary conveying means is reversed, whereupon the first auxiliary conveying means lead the double-folded middle portion of the piece of laundry onto the rear portion thereof, while the front portion of the piece of laundry is guided away from the feeding and discharging means with the help of the second auxiliary conveying means, so that the remaining portion of the piece of laundry is guided over the feeding and discharging means folded in a Z shape;

f - when the Z-shaped portion of the piece of laundry reaches the second auxiliary conveying means, the second direction-changing means are deactivated and the direction of movement of the second auxiliary conveying means is reversed, whereupon the second auxiliary conveying means lead the front portion of the piece of laundry onto the Z-shaped portion, and the feeding and discharging means discharge the piece of laundry in the shape of a W.

10. Method according to claim 9, in which the apparatus is provided with first and second blowing means according to claim 6, in which at the start of step c an air pulsation is applied to the piece of laundry with the help of the first blowing means and in which at the start of step f an air pulsation is applied to the piece of laundry with the help of the second blowing means, so as to press the piece of laundry on the respective auxiliary conveying means.

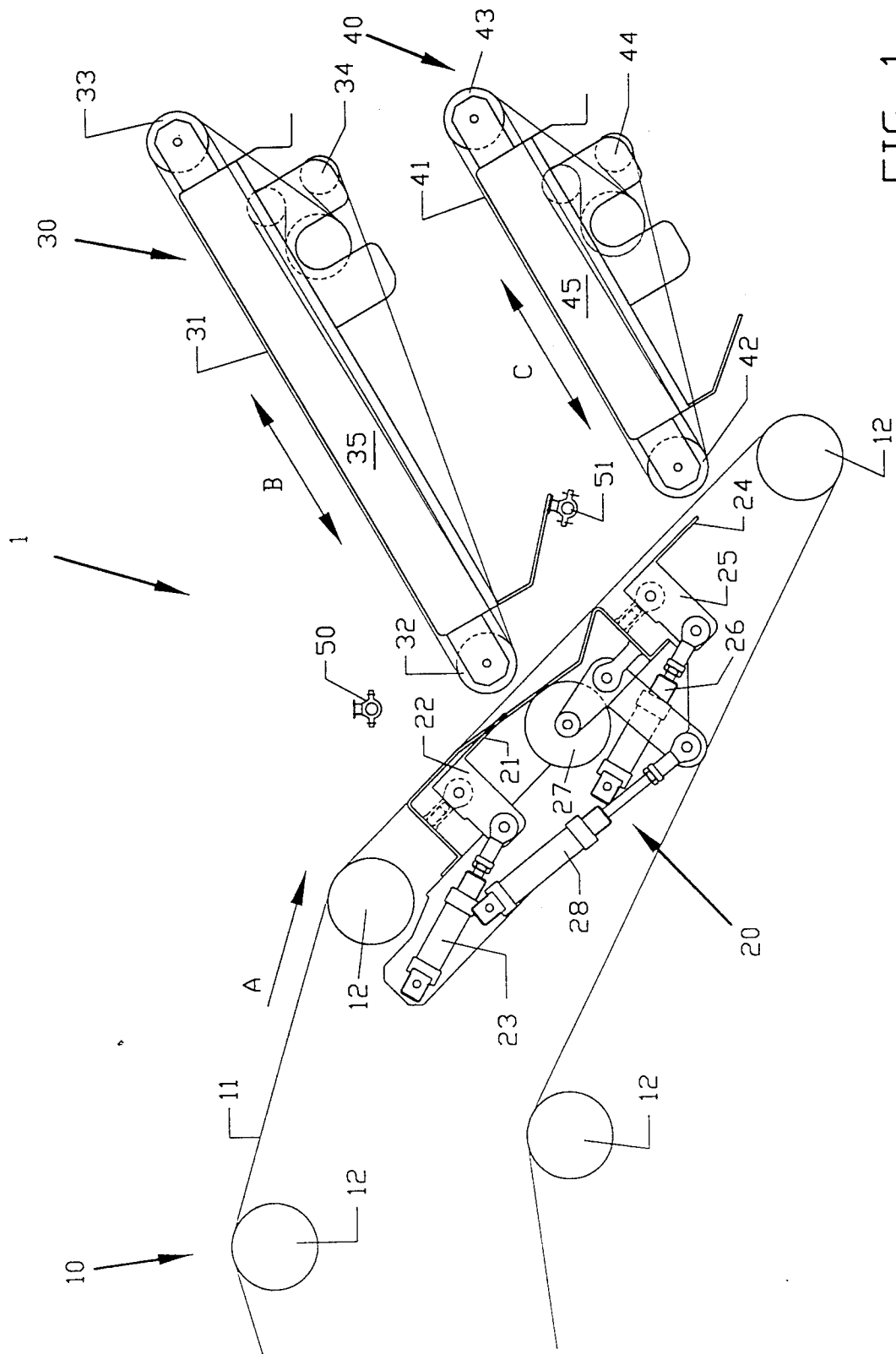


FIG. 1

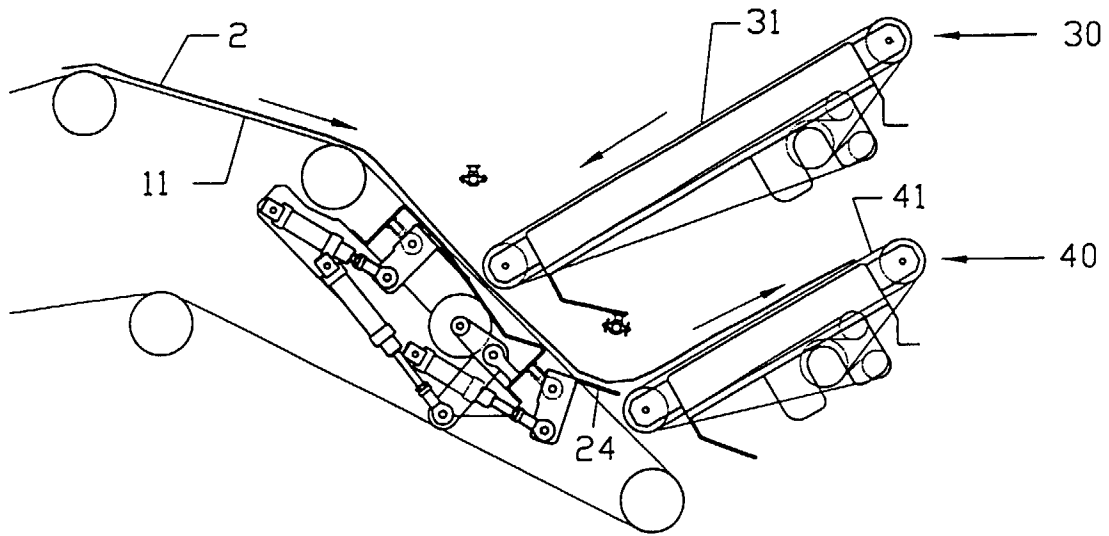


FIG. 2

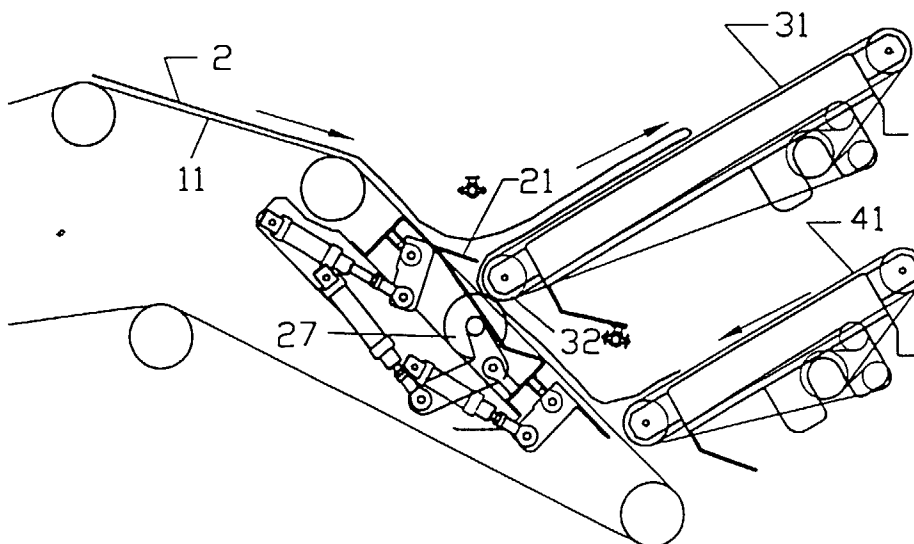


FIG. 3

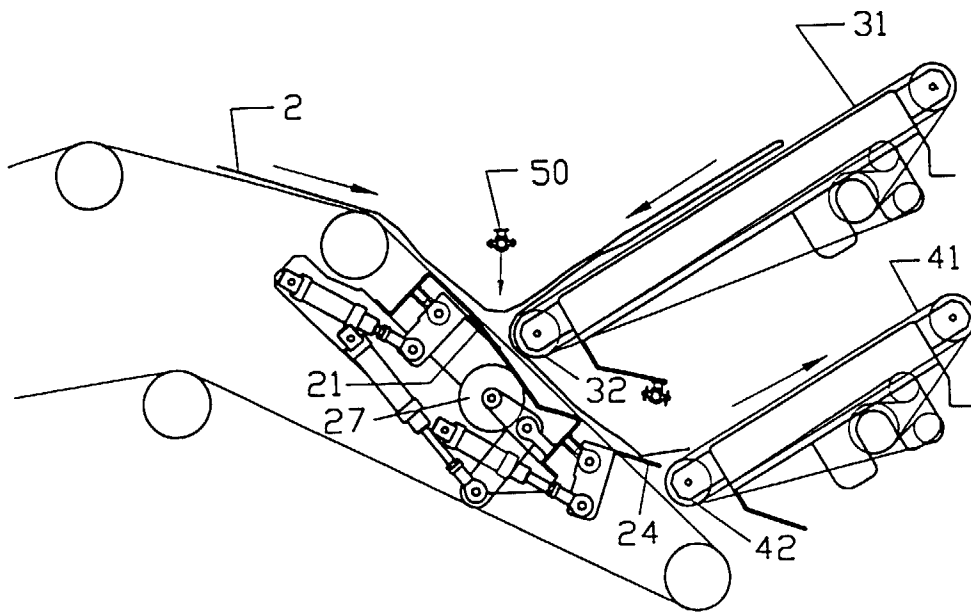


FIG. 4

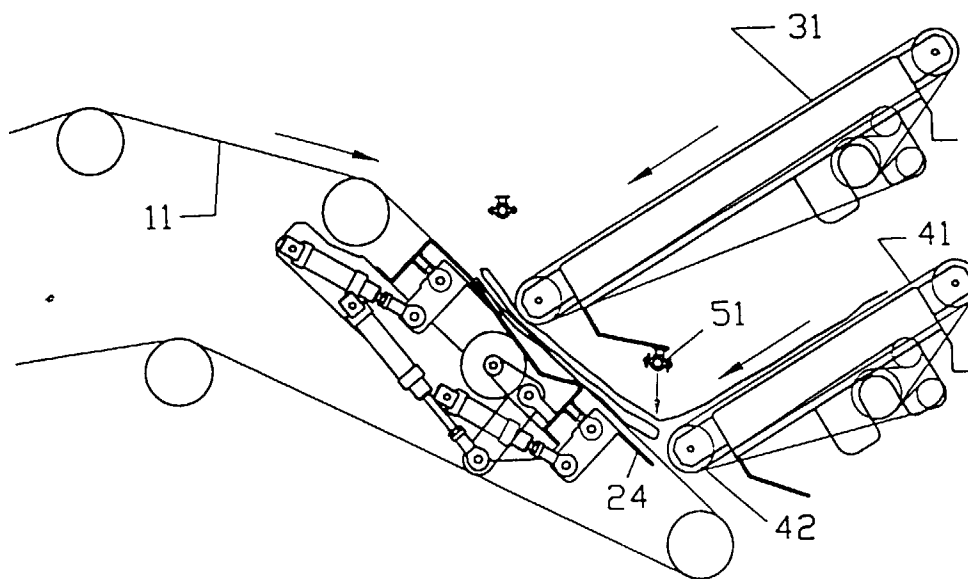


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 0578

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.6)
A	DE 93 01 400 U (HERBERT KANNEGIESSER GMBH + CO.) 6 May 1993 * page 5, line 4 - line 30; figure 1 * ---	1,9	D06F89/00
A	DE 22 58 697 A (E. & E. PETERS GMBH) 20 June 1974 * claim; figures * -----	1-4,9,10	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D06F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		25 June 1998	Courrier, G
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