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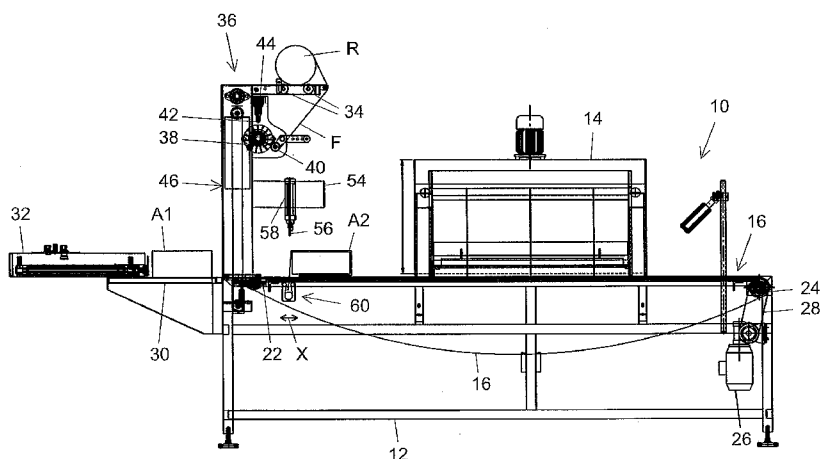


Fig. 1

(57) **Abstract:** Shrink wrapping apparatus is disclosed which comprises a conveyor (16) comprising an apertured belt for supporting articles A to be wrapped and for conveying wrapped articles through a shrink tunnel (14). Belts (48) are provided suspending a sheet of shrink wrap film F as a curtain in the path of an article to be wrapped. The article A presses against the curtain as it moves onto the conveyor belt whereby the sheet lies against the bottom face, front face and top face of the article. A blade (56) moves up and down and inserts the part of the sheet which trails behind the article through a transversely extending slit defined by the conveyor belt. A carriage (60) comprising two horizontally spaced transversely extending upper guides (62,64) and a lower guide (66) is provided. The part of the conveyor belt extending between the upper guides (62,64) is entrained around the lower guide (66). The carriage in use is displaced in a forward motion at a speed faster than the rate of travel of the belt thereby to overlap the trailing part of the sheet with the part of the sheet that lies between the article and the belt.

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SHRINK WRAPPING APPARATUS AND SHRINK WRAPPING METHOD

FIELD OF THE INVENTION

5 THIS INVENTION relates to shrink wrapping apparatus and to a shrink wrapping method.

BACKGROUND TO THE INVENTION

10 It is possible to distinguish between two forms of shrink wrapping apparatus.

 In the first form of apparatus webs of heat shrink material are fed to the article being wrapped from above and below. The webs are brought into contact ahead of the article and a seal bar simultaneously cuts the webs and seals them together. The webs are then brought into contact to the rear of the article and the webs are cut and sealed again. The article thus has an open ended sheath of shrink wrap material around it with transverse seals both ahead of, and to the rear of, the article. The article now enters the heating tunnel.

20 In the second form a sheet of shrink wrap material is used which is cut from a web. The sheet is fed from below by a vacuum belt and the article is fed by a conveyer onto the sheet. The leading edge of the sheet is below the article. A flight bar on a conveyer picks up the trailing end of the sheet, which initially lies behind the article, and carries it over the article. By manipulating the trailing end of the sheet,

which is now ahead of the article, to a position below the conveyer and then causing the article to overrun the trailing end, an overlap between the leading and trailing ends is created.

5 The loosely sheathed article is then transferred from the conveyer on which the sheet and article were manipulated to create the overlap, onto a further conveyer which carries it to the tunnel where shrinking occurs and the overlap is welded.

10 The present invention relates to shrink wrap material of the latter type which uses a sheet of shrink wrap material and creates an overlap between the leading and trailing ends of the sheet.

 A primary object of the present invention is to provide shrink wrapping
15 apparatus of this form which is capable of shrink wrapping an array of discrete containers without the necessity of locating the containers on a base tray.

BRIEF DESCRIPTION OF THE INVENTION

 According to one aspect of the present invention there is provided
20 shrink wrapping apparatus which comprises a conveyor belt for supporting articles to be wrapped and for conveying wrapped articles through a shrink tunnel, means for suspending a sheet of shrink wrap film as a curtain in the path of an article to be wrapped so that the article presses against the curtain as it moves onto said conveyor belt whereby the sheet lies against the bottom face, front face and top face

of the article and trails behind the article, means for inserting the part of the sheet which trails behind the article through a transversely extending slit defined by the conveyor belt, a carriage comprising two horizontally spaced transversely extending upper belt guides, the parts of the belt adjacent said guides defining said slit and there being a lower belt guide around which the part of the belt extending between the upper guides is entrained, and means for displacing the carriage in a forward motion at a speed faster than the rate of travel of the belt thereby to overlap the part of the sheet that has been inserted through said slit with the part of the sheet that lies between the article and the belt.

To provide the desired sheet of film the apparatus can include a film cutting mechanism comprising a drum about which the film is entrained, a film cutting blade, and means for displacing said film cutting blade into contact with said drum. In this form said film cutting blade and the displacing means can be mounted for movement along an arcuate path at a speed equal to the speed of the periphery of the drum. Preferably, said drum is perforated and the interior of the drum is connected to means for sucking air from the drum whereby film entrained around the drum is sucked against the drum.

To deliver the sheet, a pair of perforated, laterally spaced belts constituting said means for suspending said sheet can be provided, there being means for sucking air through the belts to draw the film against the belts, the belts in use being driven so that film sucked against the belts is fed downward and suspended by the belts as said curtain. To enable apparatus of lower overall height

to be provided, said laterally spaced belts can be guided along a path including a vertical portion and a horizontal portion, the vertical portion extending downwards from the horizontal portion.

5 In one form the inserting means comprises a blade and means for reciprocating said blade vertically, said blade, when in use, moving downward and inserting said trailing end through said slit.

10 In a further form the inserting means comprises a flight bar and means for displacing said flight bar through said slit from a position above the conveyor belt to a position below the conveyor belt thereby to insert said trailing end through said slit.

15 The displacing means can move the flight bar in a downward direction from a start position above the conveyor belt and through the slit to a position below the conveyor belt, and then in an upward motion through the slit back to its starting position

20 According to another aspect of the present invention there is provided a method of shrink wrapping an article which comprises suspending a sheet of shrink wrap film as a curtain, pushing an article into the curtain so that the article moves onto a moving conveyor belt whereby the shrink wrap film sheet lies against the bottom face, the front face and the top face of the article and trails behind the article, the part of the film against the bottom face of the article being between said bottom

face and the conveyor belt and the trailing end of the film being rearwardly of said top face, inserting the trailing end of the film into a slit defined by the conveyor belt so that it hangs down below the conveyor belt's top run, and displacing said trailing end of the sheet in the same direction as the direction of travel of the belt but at a faster speed whereby the trailing end of the film is overlapped with the part of the film which is between the bottom face of the article and the belt.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a side elevation of shrink wrapping apparatus;

Figures 2 and 3 are sequence drawings illustrating the manner in which the apparatus operates;

Figure 4 is a side elevation of a modified form of the shrink wrapping apparatus of Figure 1;

Figure 5 is a side elevation of shrink wrapping apparatus which has a different mechanism for handling the shrink wrap film;

Figure 6 illustrates, to a larger scale the right hand portion of the apparatus of Figure 5, and

Figure 7 and 8 diagrammatically illustrate the way in which the film is handled by the apparatus of Figures 5 and 6.

DETAILED DESCRIPTION OF THE DRAWINGS

The shrink wrapping apparatus 10 illustrated in Figure 1 comprises a frame 12 on which a heat shrink tunnel 14 is mounted. A conveyor generally designated 16 is provided for moving articles to be wrapped through the tunnel 14 and for performing some of the steps of the wrapping operation. The conveyor 16 in the form of an apertured belt 20 of a material which can withstand the heating to which it is subjected as will be described. The belt 20 is entrained around drive rollers 22, 24 which are on cross shafts mounted in bearings carried by the frame 12. An electric motor with integral gearbox is shown at 26. This drives a chain 28 which is entrained around a chain sprocket on the shaft which carries the roller 24.

Articles to be wrapped are shown at A1, A2. In the condition of the apparatus illustrated in Figure 1, there is an article at A1 on a table 30 and a further article at A2 on the belt 20. A transverse feed conveyor (not shown) conveys a series of spaced apart articles A1, A2 etc onto the table 30.

A pusher 32, which can be pneumatically operated, is provided for pushing the left hand article from position A1 to the right, as viewed in Figure 1, onto the belt 20 where it takes up position A2.

Two rollers 34 constitute a cradle for a reel R of shrink wrap film. The film itself is designated F.

A film cutting mechanism is illustrated at 36, the mechanism 36 comprising a rubber sheathed perforated drum 38 and a pressure roller 40 which guides the film F onto the drum 38. The mechanism 36 further comprises a cutting blade 42 which is reciprocated in a vertical direction by pneumatic cylinders 44. The blade 42 moves along a vertical line which intersects the axis of the drum 38. The interior of the drum 38 is connected to a suction pump (not shown).

An arch 46 straddles the article input end of the apparatus. Each column of the arch includes a vertically extending tube with a slot extending along it. The interiors of the tubes are connected to a suction pump (not shown).

Two laterally spaced perforated belts 48 (best illustrated in the embodiment of Figure 4) are each entrained around pulleys which in the embodiment of Figure 1 are arranged as an upper pair and a lower pair. The tubes are between the vertical runs of the belts 48, one vertical run of each belt covering the slot in the respective tube so that suction is applied to the perforations in the belts.

Two laterally spaced plates 54 extend horizontally from the arch 46. The plates 54 mount a film inserting blade 56 and a pair of cylinders 58 which reciprocate the blade 56 vertically.

A carriage 60 is provided below the upper run of the belt 20. The carriage 60 is on horizontally extending guides (not shown) and is in use

reciprocated, as shown by the double headed arrow X, by pneumatic cylinders (not shown).

The carriage includes three bars 62, 64 and 66 (see Figures 2 and 3) arranged in a triangular formation. The bars 62, 64 are close together and the bar 66 is vertically below the transverse slit between the bars 62, 64.

The belt 20 passes around the bar 62, extends downwardly to the bar 66, passes around the bar 66, extends upwardly to the bar 64, and curves around the bar 64.

The bars can be in the form of rollers or otherwise configured, such as being, for example, bull noses so that the belt slides smoothly over them with a minimum of friction. The transverse slit between the parts of the belt passing around the bars 62, 64 is small and is in the order of a few mm, say 3mm.

As illustrated in Figure 1, there is an article at A1 on the table 30 and positioned so that it can be propelled by the pusher 32 onto the belt 20. Before this happens a sheet of shrink wrap film F is pulled from the reel R by the downwardly moving belts 48 and positioned as a curtain in front of the article A1. The belts 48 then stop. The cutting blade 42 is moved down, pressed into the rubber sheath of the drum 38 to cut the film and retracted to its upper position. The length of film cut-off is such that the sheet extends from below the belt 20 to the axially extending top dead centre position of the drum 38. This length is sufficient to wrap the article A and provide sufficient film for the overlap seal.

As the article is propelled by the pusher 32 from position A1 to position A2 as shown in Figure 2, the part of the sheet below the level of the belt 20 is pulled up from below the belt and lies horizontally between the bottom surface of the article at position A2 and the top surface of the belt 20. For ease of description, this part of the sheet will be called its leading end. The part of the sheet which was above the article A, and was held in place by the belts 48, is dragged by the moving article A off the drum 38 and belts 48 and falls down behind the article as shown in Figure 2. This part of the sheet will for convenience be referred to as its trailing end. The trailing end extends across the slit between the bars 62, 64, as shown by the dashed line in Figure 2.

The blade 56 is displaced downwardly from the position shown in Figure 1 to push the trailing end through the slit between the bars 62, 64 as shown by the solid line in Figure 2. At this stage the carriage 60 is stationary and the slit is immediately below the blade 56. The blade 56 then lifts back to the position shown in Figure 1.

The sheet now has the full line configuration shown in Figure 2. The leading end of the sheet is between the article and the conveyer belt 20 and the trailing end hangs down into the carriage 60.

The carriage 60 then moves to the right at a speed faster than the movement of the belt 20 dragging the trailing end forward (see Figure 3) underneath

the article and overlapping it with the leading end. Figure 3 shows the position of the carriage shortly before it reaches its extreme right hand position. The overlap has, in the illustrated position, not quite been completed. The carriage 60 after completing its movement to the right then returns to its starting position below the blade 56 in preparation for the next cycle.

Shrinking of the film F around the article A, and sealing together of the overlapped leading and trailing ends of the film F, takes place in the tunnel.

Whilst the articles are shown as boxes, the apparatus illustrated can handle a group of discrete, unconnected, containers which have been arranged in transverse and longitudinal rows by suitable handling means. Thus whilst the apparatus can handle small cans, bottles or other containers which are standing as a group on a tray, it can also handle small cans, bottles or other containers which are not in any way held in place by a tray or other form of locating means. This is made possible by the small dimensions of the slit between the bars 62; 64 which the containers can transverse without being displaced or toppling over.

To ensure that the blade 56 is always properly aligned with the slit between the bars 62, 64, the blade can be mounted on an upward extension of the carriage 60.

The apparatus 10 of Figure 4 is in most respects identical to that of Figure 1. To enable lower overall height to be achieved the belts 48 are driven along

a path which includes a vertical portion 48.1 that extends downwards from a horizontal portion 48.2. The rollers about which the belts are entrained are designated 68 and 70 and there are guides at 72 where the belts are in transition between their vertical and horizontal portions.

5

A roller 74 is provided to ensure that the film F does not feed off the belts where the belts are leaving the portions 48.2 and entering the portions 48.1.

Turning to Figures 5 and 6, the apparatus illustrated has many components in common with the apparatus of Figure 1 and, where applicable, like references have been used. Reference letter R1 designates a spare reel of wrapping film, and reference numerals 76 designate dancer rollers for tensioning the web of film F.

15 The blade 56, and its operating mechanism, are replaced by two horizontally spaced chains 78 which are entrained around a pair of sprockets 80. The sprockets 80 are driven by a motor (not shown). The motor can be reversible or undirectional.

20 The chains 78 pass around idler sprockets designated 82, 84 and 86. A flight bar is shown at 88, this extending between the chains 78. The carriage 60 includes bearings 90 which slide along guide rods 92. The bearings 90 are below a plate 94 which supports the belt 20. The plate 94 is in two parts, designated 94.1 and 94.2, and there is a slit 96 between the parts 94.1 and 94.2. The edges of the parts

94.1 and 94.2 which bound the slit 96 are rounded and, in this embodiment, serve the same function as the bars 62, 64 of Figures 1 to 4. It will be understood that the chains 78 and sprockets 80, 82, 84 and 86 are all carried by the carriage 60. The drive for the carriage 60 is shown as including a pair of horizontally spaced chains 98 which are entrained around a driven sprocket 100 and an idler sprocket 102. The sprocket 100 is driven by a reversible motor (not shown). The chains 98 pull the carriage to the left or to the right depending on the direction of rotation.

In Figure 7 the article A is shown as having the leading end of the film between itself and the belt 20. The leading end is constituted by that part of the curtain that hung below the belt 20. The film is against the bottom, front and top faces of the article, and trails behind the article. The flight bar 88 is in its starting position.

The chains 78 are then driven so that the flight bar 88 moves from its position above the belt 20 to a position below the belt, passing through the slit. During this movement of the flight bar 88 it encounters the trailing end of the film which is moved downwards until it hangs through the slit 96. This is shown in Figure 8.

At this stage the carriage 60 moves to the left at a faster rate than the belt 20 is travelling. The slit 96, in effect, overtakes the article thereby carrying the trailing end of film which has been inserted into the slit under the article and overlapping it with the leading end.

The carriage 60 then reverses its direction of travel and returns to its starting position. The flight bar 88 moves in the opposite direction and returns to its starting position, as shown in Figure 7, after each operation.

CLAIMS

1. Shrink wrapping apparatus which comprises a conveyor belt for supporting articles to be wrapped and for conveying wrapped articles through a shrink tunnel, means for suspending a sheet of shrink wrap film as a curtain in the path of an article to be wrapped so that the article presses against the curtain as it moves onto said conveyor belt whereby the sheet lies against the bottom face, front face and top face of the article and trails behind the article, means for inserting the part of the sheet which trails behind the article through a transversely extending slit defined by the conveyor belt, a carriage comprising two horizontally spaced transversely extending upper belt guides, the parts of the belt against the upper guides defining said slit and there being a lower belt guide around which the part of the belt extending between the upper guides is entrained, and means for displacing the carriage in a forward motion at a speed faster than the rate of travel of the belt thereby to overlap the part of the sheet that has been inserted through said slit with the part of the sheet that lies between the article and the belt.

2. Apparatus as claimed in claim 1 and including a film cutting mechanism comprising a drum about which the film is entrained, a film cutting blade, and means for displacing said film cutting blade into contact with said drum.

3. Apparatus as claimed in claim 2, wherein said film cutting blade and the displacing means are mounted for movement along an arcuate path at a speed equal to the speed of the periphery of the drum.

4. Apparatus as claimed in claim 2 or 3, wherein said drum is perforated and the interior of the drum is connected to means for sucking air from the drum whereby film entrained around the drum is sucked against the drum.

5. Apparatus as claimed in any preceding claim and further comprising a pair of perforated, laterally spaced belts constituting said means for suspending said sheet, there being means for sucking air through the belts to draw the film against the belts, the belts, in use, being driven so that film sucked against the belts is fed downward and suspended by the belts as said curtain.

6. Apparatus as claimed in claim 5, wherein said laterally spaced belts are guided along a path including a vertical portion and a horizontal portion, the vertical portion extending downwards from the horizontal portion.

7. Apparatus as claimed in any preceding claim, wherein the inserting means comprises a blade and means for reciprocating said blade vertically, said blade, when in use, moving downward and inserting said trailing end through said slit.

8. Apparatus as claimed in any one of claims 1 to 6, wherein the inserting means comprises a flight bar and means for displacing said flight bar through said slit from a position above the conveyor belt to a position below the conveyor belt thereby to insert said trailing end through said slit

9. Apparatus as claimed in claim 8, wherein the displacing means for the flight bar moves it in a downward direction from a start position above the conveyor belt and through the slit to a position below the conveyor belt, and then in a upward motion through the slit back to its starting position.

5

10. A method of shrink wrapping an article which comprises suspending a sheet of shrink wrap film as a curtain, pushing an article into the curtain so that the article moves onto a moving conveyor belt whereby the shrink wrap film sheet lies against the bottom face, the front face and the top face of the article and trails behind the article, the part of the film against the bottom face of the article being between said bottom face and the conveyor belt and the trailing end of the film being rearwardly of said top face, inserting the trailing end of the film into a slit defined by the conveyor belt so that it hangs down below the conveyor belt's top run, and displacing said trailing end of the sheet in the same direction as the direction of travel of the belt but at a faster speed whereby the trailing end of the film is overlapped with the part of the film which is between the bottom face of the article and the belt.

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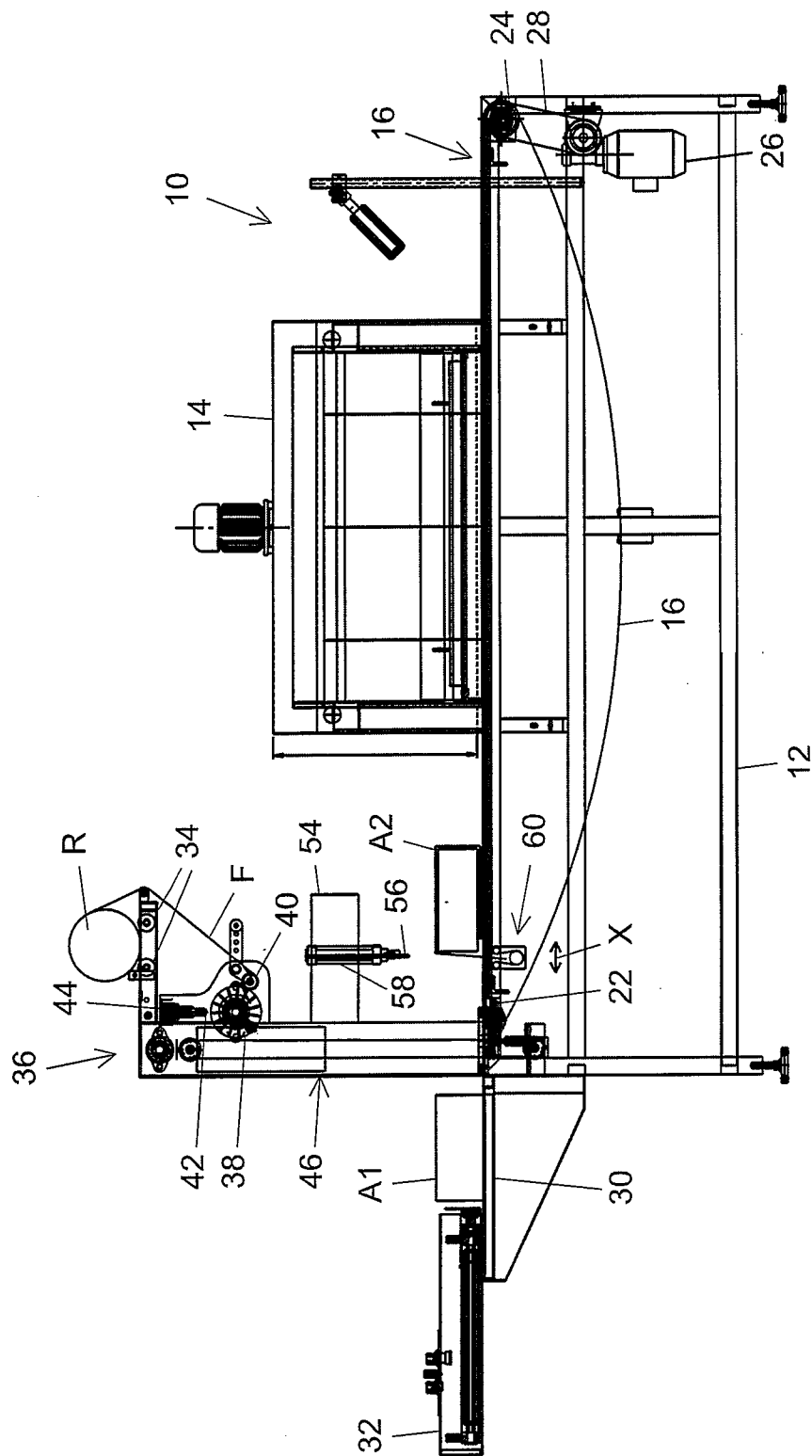
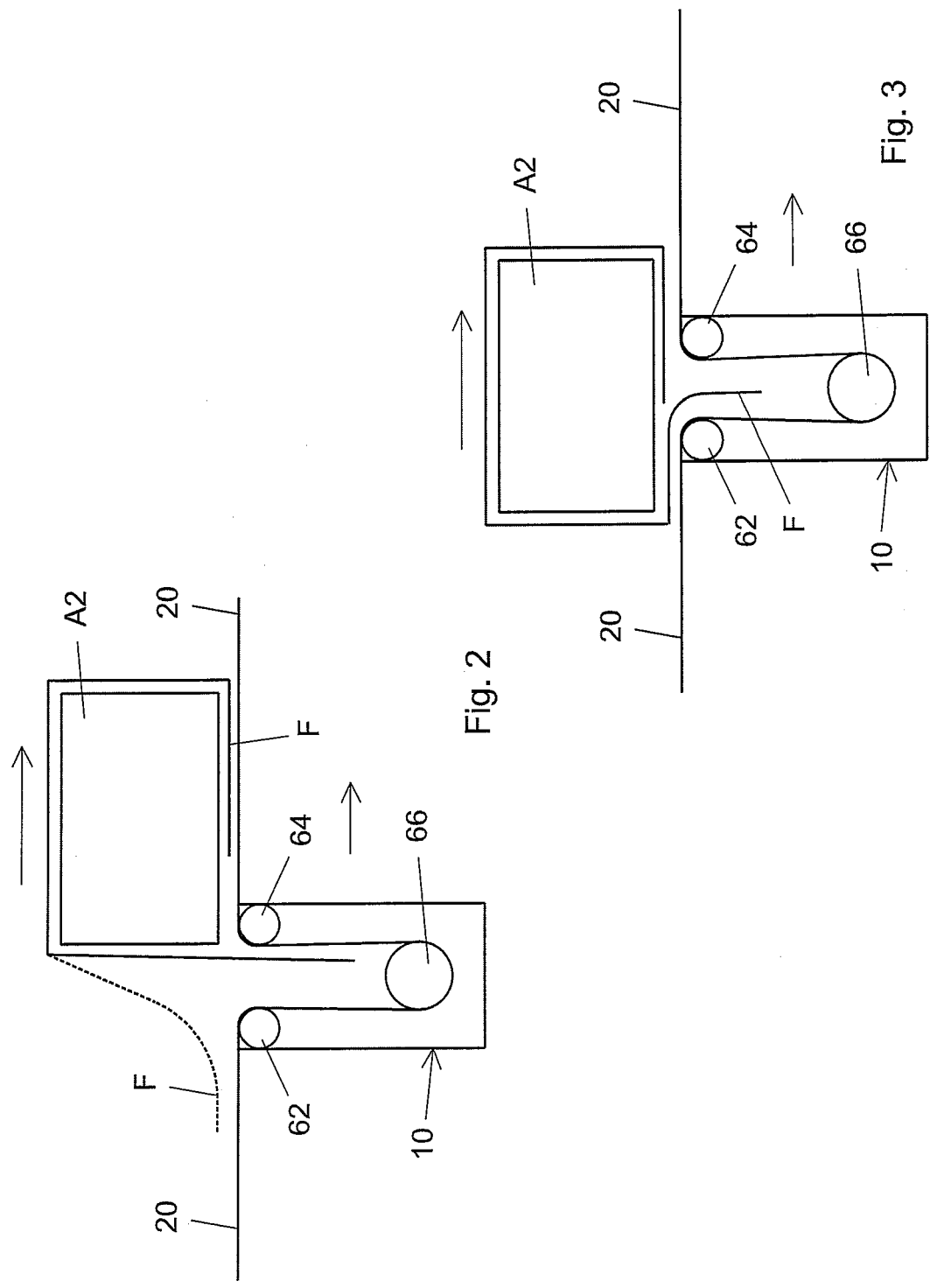


Fig. 1



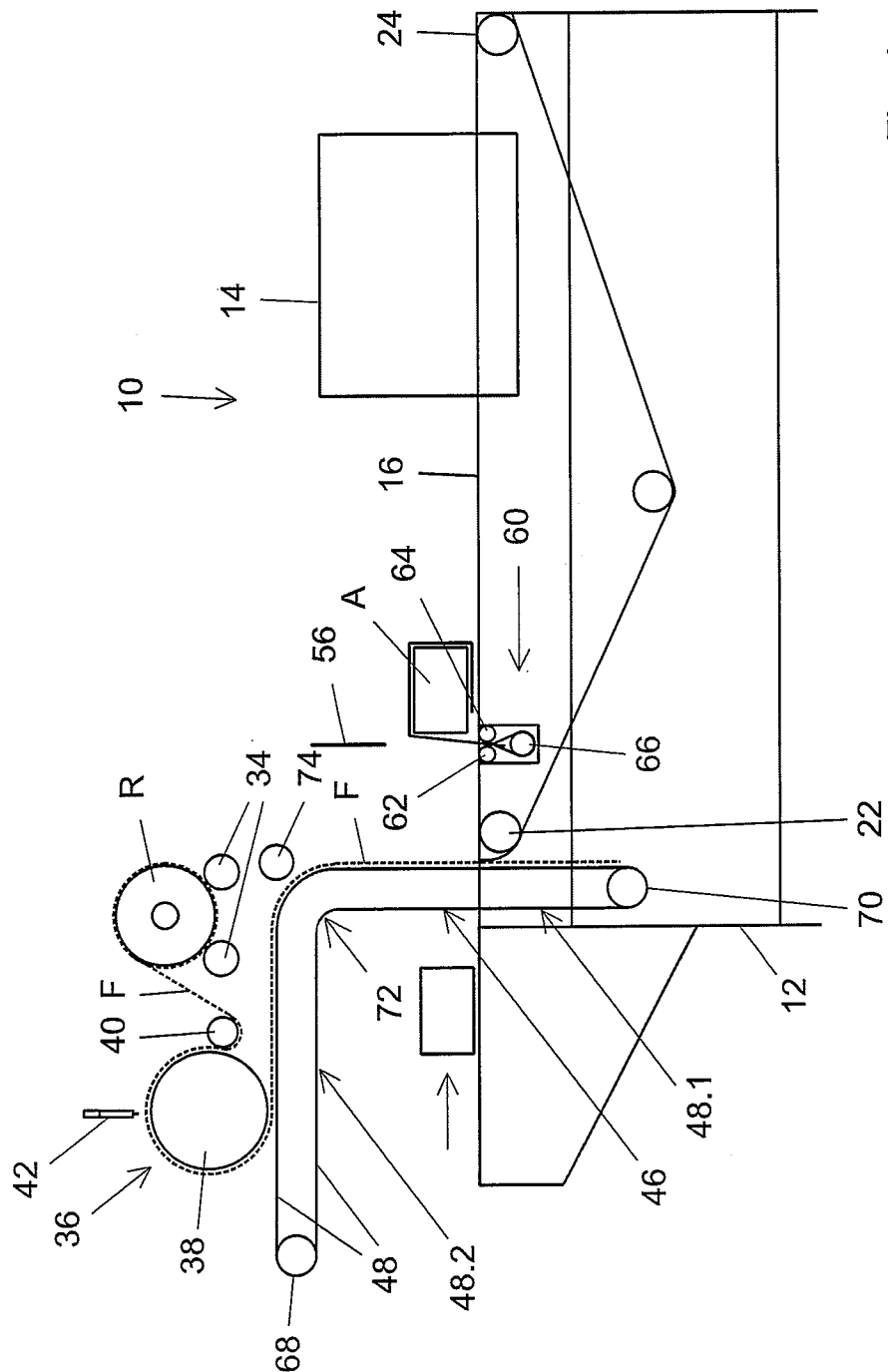


Fig. 4

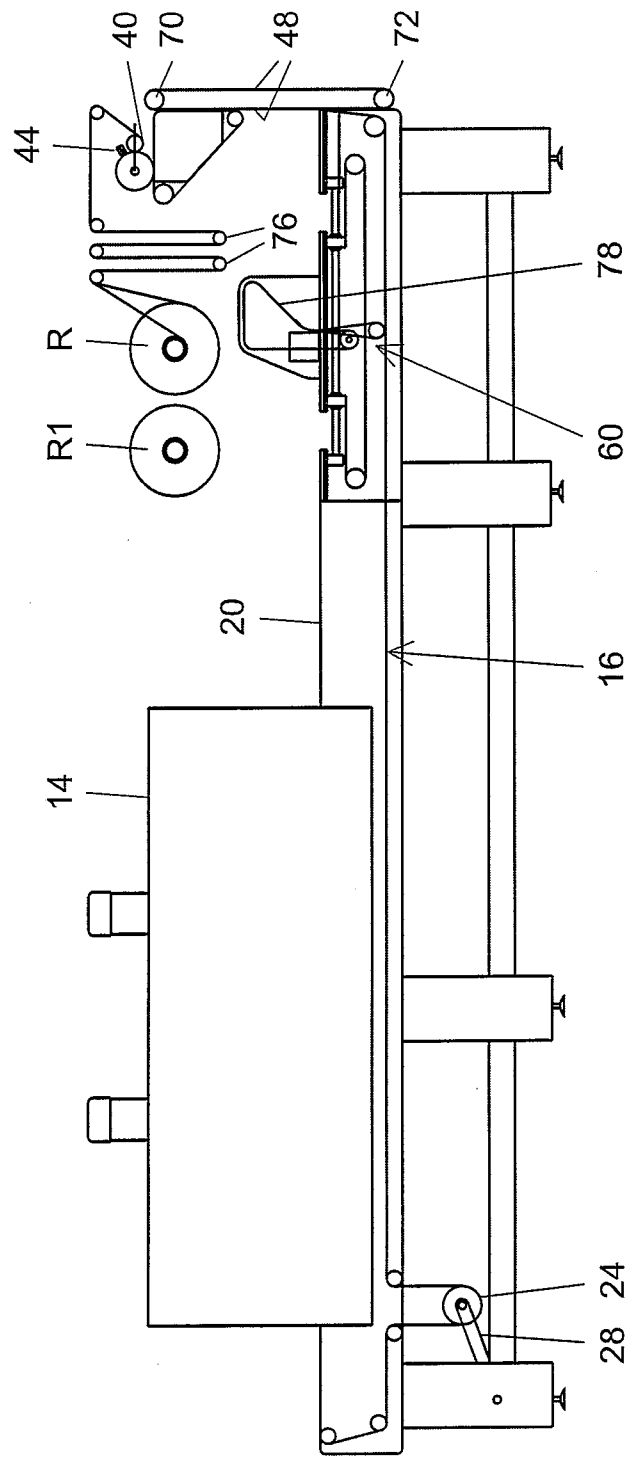


Fig. 5

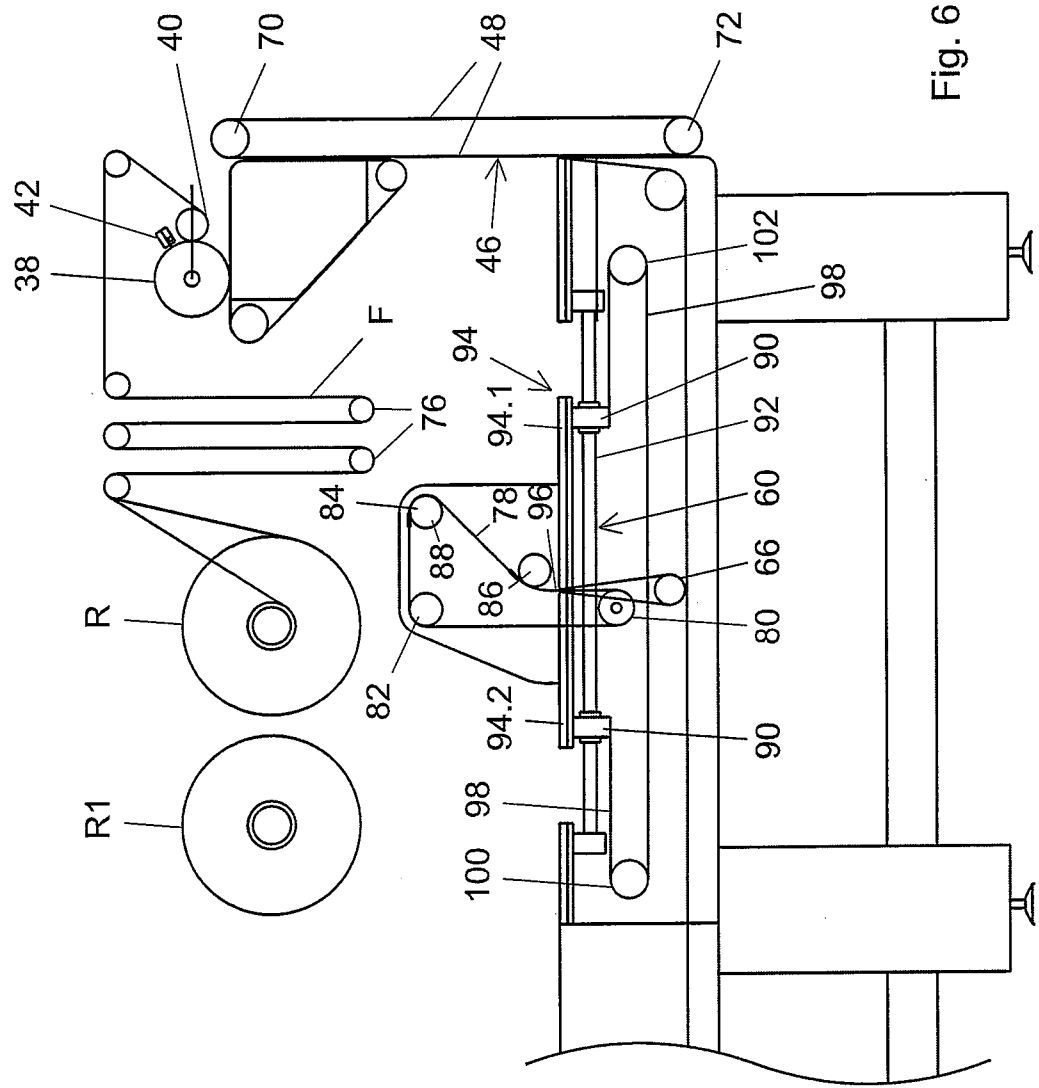


Fig. 6

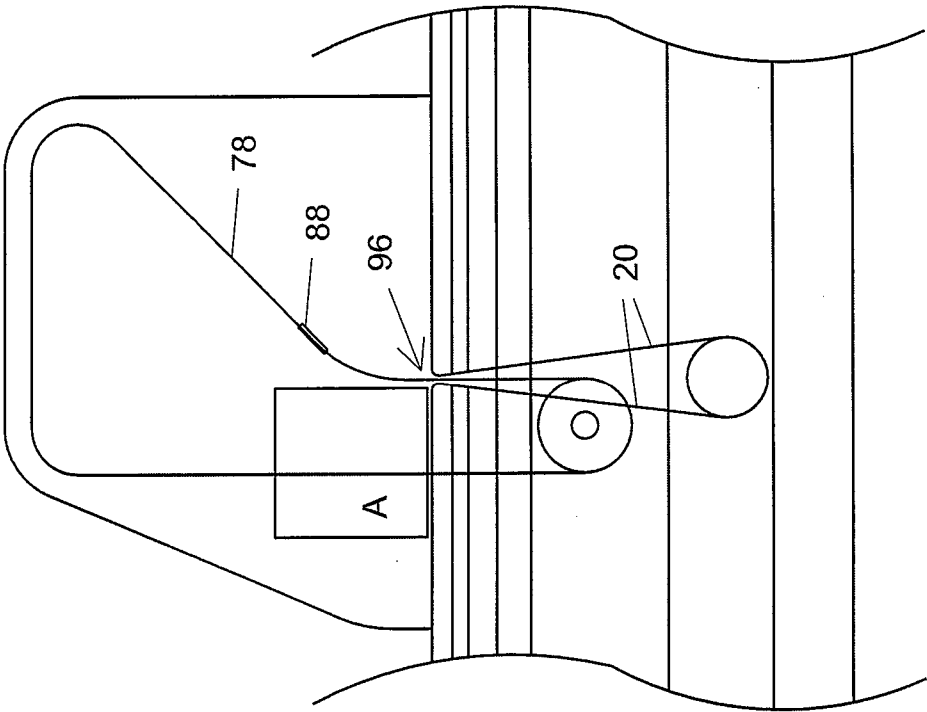


Fig. 7

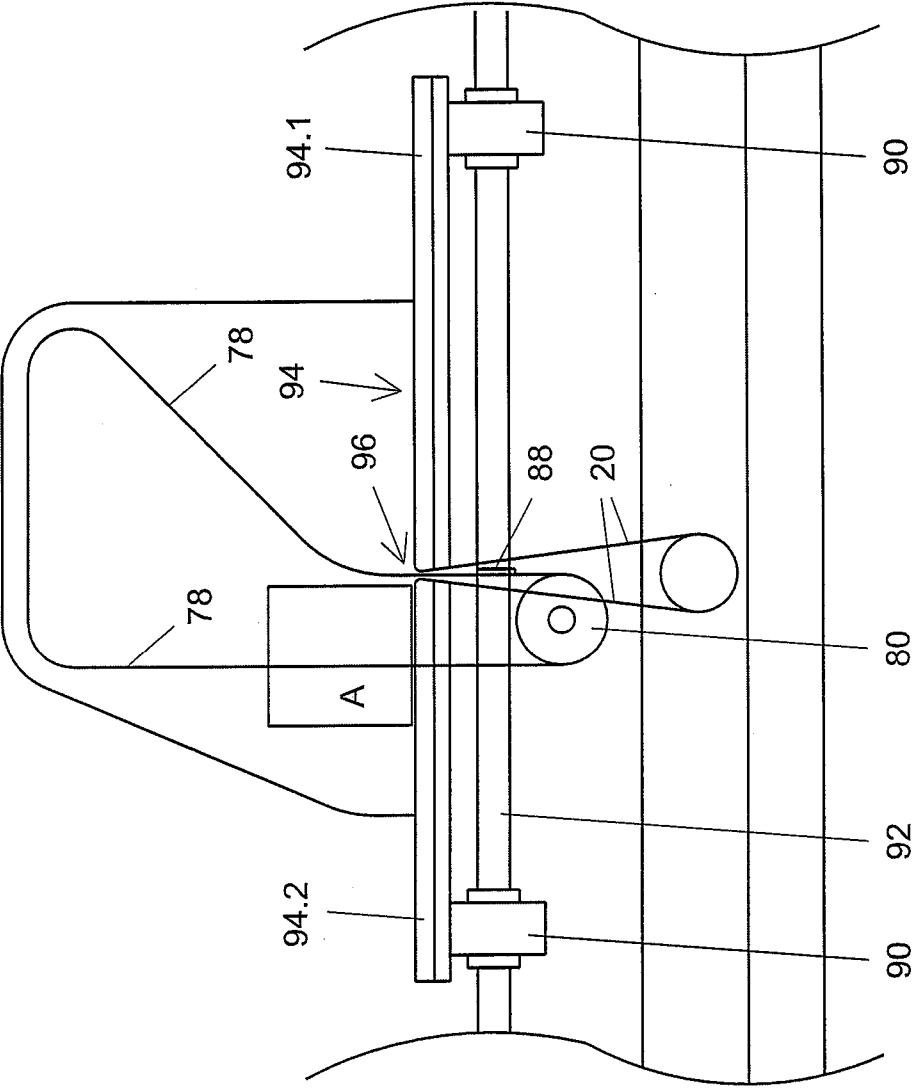


Fig. 8