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(54) **Form, fill and seal wrapping machine.**

(57) A form, fill and seal wrapping machine (1), wherein a strip (11) of wrapping material is wound off an input reel (24) and fed along a substantially U-shaped path (P) to a traction unit (16) via an adjusting unit (30) for adjusting the tension of the strip

(11); the adjusting unit (30) presenting a vacuum chamber (44) in turn presenting an opening (48) located along the path (P) of the strip (11) and by which the strip (11) is exposed to an adjustable vacuum inside the chamber (44).

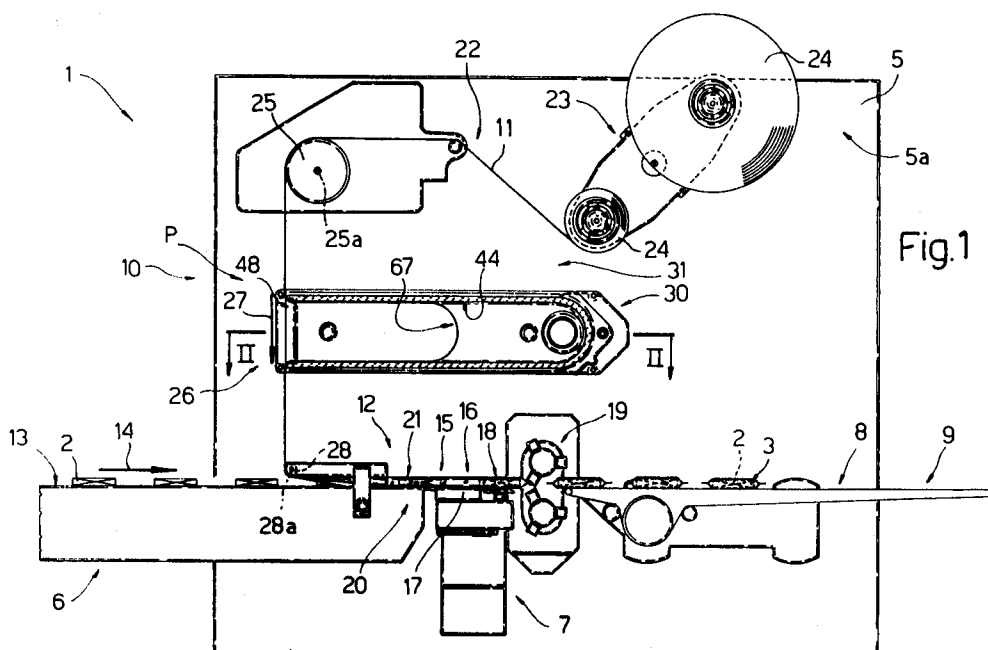


Fig.1

EP 0 670 278 A1

The present invention relates to a so-called form, fill and seal wrapping machine.

Wrapping machines of the aforementioned type normally comprise a wrapping beam, the input of which is supplied simultaneously with a continuous strip of wrapping material and a succession of products. Along the wrapping beam, the strip is first folded in a U on to and about the products; the lateral edges of the strip are joined beneath the products by a strip traction unit; the continuous tubular wrapping so formed is cut into portions; and the ends of the portions are closed to form a succession of products wrapped individually in so-called "pillow pack" wrappings.

On machines of the above type, a given tension must be imparted to the strip at the input of the wrapping beam, which function is normally performed by an adjusting unit comprising a brake located along the path of the strip and which provides for reducing the traveling speed of the strip in relation to the speed imparted by the strip traction unit, and so tensioning the strip for ensuring it is properly folded, i.e. with no creases which would result in rejection of the product.

The above strip tensioning method presents several drawbacks.

Firstly, the tension of the strip is adjusted working substantially on the stretch and deformation capacity of the material, i.e. by means of a variation in length, and therefore on the basis of the relationship between two diverse quantities: tension and length, which diversity does not allow of accurate tension adjustment. Indeed, even a small adjustment to the brake, and hence a small increase in the length of the strip, may result in a considerable variation in tension.

Secondly, as the tension of the strip at the input of the wrapping beam must be maintained constant or, at most, fluctuate within a very narrow range, whereas the characteristics of the strip material may vary widely not only from one reel to another but also within the same reel, devices of the aforementioned type require continual adjustment, even during operation of the machine. Factors affecting the characteristics of the material and the strip itself may be atmospheric, such as the degree of humidity in storage and working premises, or geometrical, such as the shape of the reel or misaligned machine axes.

It is an object of the present invention to provide a form, fill and seal wrapping machine designed to overcome the aforementioned drawbacks.

According to the present invention, there is provided a form, fill and seal wrapping machine comprising a product input device; a product wrapping device for receiving said products in succession from said product input device; an output conveyor for receiving wrapped products from said

product wrapping device; and a supply line for feeding a continuous strip of wrapping material to, and through, the product wrapping device; the supply line comprising a strip traction unit, guide means defining a given path along which the strip is fed to the traction unit, and adjusting means for adjusting the tension of the strip along said path; characterized in that said adjusting means comprise a chamber; and vacuum means connected to, and for forming an adjustable vacuum inside, the chamber; the chamber presenting an opening defining a portion of said path.

According to a preferred embodiment of the above line, the traction unit defines an output end of said path; the path being substantially U-shaped, and the chamber being located at the concave portion of the path.

The chamber preferably presents further adjusting means for adjusting the size of said opening in a direction crosswise to said path.

The chamber preferably also presents yet further adjusting means for adjusting the position of said opening in a direction crosswise to said path.

A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic side view, with parts in section and parts removed for clarity, of a preferred embodiment of the line according to the present invention;

Figure 2 shows a larger-scale section along line II-II in Figure 1;

Figure 3 shows a section along line III-III in Figure 2;

Figures 4 and 5 show larger-scale views of a detail in Figure 2 in two different operating positions.

Numeral 1 in Figure 1 indicates a so-called "form, fill and seal" wrapping machine for wrapping products 2 inside respective so-called "pillow pack" wrappings 3.

Machine 1 comprises a load-bearing frame 5 supporting a known product input device 6, a known product wrapping device 7, and a known output conveyor 8 for receiving the wrapped products 2 from device 7 and feeding them to the output station 9 of machine 1, which also comprises a supply line 10 supported on frame 5 and at least partly over devices 6 and 7, for feeding a continuous strip 11 of wrapping material to the input 12 of, and through, device 7.

Input device 6 comprises a known substantially horizontal conveyor 13 for feeding an orderly succession of products 2 to input 12 of device 7 in a direction 14 parallel to conveyor 13.

Wrapping device 7 is supplied simultaneously with products 2 and strip 11, and comprises a known wrapping beam 15 located at input 12 and

which provides for folding strip 11 in a U on to and about products 2. Device 7 also comprises a known traction unit 16 located downstream from beam 15 and constituting the output element of line 10, and in turn comprising two rollers 17 (only one shown) which provide for pulling and imparting a given tension to strip 11, as well as for joining the lateral edges of strip 11 beneath products 2 to form a continuous tubular wrapping 18. Device 7 also comprises a known closing and cutting unit 19 for receiving wrapping 18 from unit 16, cutting wrapping 18 in known manner into a succession of wrapped products 2, and feeding products 2 to conveyor 8 by which they are fed to station 9 in a direction parallel to direction 14. Line 10 defines, for strip 11, a substantially U-shaped path P comprising an output arm 20 extending in direction 14 and defined by the output portion 21 of conveyor 13 and by wrapping device 7; and an input arm 22 extending, parallel to direction 14 and over arm 20, from a known unwinding device 23 for reels 24 of strip 11. At a guide roller 25 fitted to frame 5 and rotating about an axis 25a perpendicular to the front vertical surface 5a of frame 5, arm 22 is connected to an intermediate arm 26 extending, in direction 27 substantially perpendicular to direction 14, from roller 25 to a guide roller 28 connecting arm 22 to arm 20. Roller 28 is located beneath roller 25 and over conveyor 13, and rotates about an axis 28a parallel to axis 25a.

Supply line 10 also comprises an adjusting unit 30 for adjusting the tension of strip 11 when this is subjected to traction by unit 16, and which is located along arm 26, between arms 20 and 22, i.e. inside a space 31 substantially surrounded by path P.

As shown in Figure 2, unit 30 comprises a casing 32 integral with surface 5a of frame 5 and presenting a tubular body 33 with its axis 34 perpendicular to surface 5a and to direction 27 (Figure 3). Unit 30 also comprises a tubular guide rod 35 extending coaxially with axis 34 and supported by body 33; and a container 36 substantially in the form of a rectangular parallelepipedon and connected in sliding manner to rod 35 via the interposition of a bush 37.

Container 36 comprises two lateral walls 38 and 39 perpendicular to axis 34 and parallel to surface 5a, and of which wall 38 is arranged facing surface 5a; and a substantially U-shaped wall 40 located between walls 38 and 39 and presenting two facing portions 41 and 42 (Figure 3) parallel to each other and perpendicular to surface 5a and direction 27. Container 36 houses a plate 43 extending parallel to and between plates 38 and 39, and movable parallel to itself to define, with walls 39 and 40, a chamber 44 presenting a longitudinal axis 45 perpendicular to axis 34. Chamber 44 is

connected to a known suction device 46, the inlet end of which is defined by two tubular bodies 47a and 47b connected telescopically to each other, respectively integral with plate 43 and casing 32, and defining, together with bush 37, a device for guiding container 36 as it is moved parallel to axis 34. Chamber 44 also presents an opening 48 crosswise to axis 45 and surface 5a, and located along a portion of path P.

As shown in Figure 2, unit 30 comprises two adjusting devices 49 housed parallel to each other inside the space between casing 32 and wall 38, and which provide for adjusting the size of opening 48 in a direction 48a parallel to axis 34 and crosswise to path P.

As shown more clearly in Figures 4 and 5, each adjusting device 49 comprises a differential joint 50 defined by a driven screw 51 integral with plate 43; an internally threaded driven bush 52 integral with wall 38 of container 36; and a tubular body 53 presenting an axis 54 perpendicular to surface 5a and coaxial with screw 51 and bush 52. Body 53 presents an internal thread 55 connected for rotation to screw 51, and a first external thread 56 connected for rotation to bush 52, and is rotated about axis 54 by a first chain drive 57 housed in casing 32 and comprising a gear 58 fitted in axially-sliding and angularly-fixed manner to body 53. When body 53 is rotated about axis 54, screw 51 and bush 52 move axially in opposite ways in direction 48a, thus resulting in opposite displacement of plate 43 and wall 38 which takes the rest of container 36, i.e. walls 39 and 40, along with it.

Body 53 presents a second external thread 59 located on the opposite side of gear 58 to first thread 56, and connected to the internal thread 60 of a gear 61 which, by means of a second chain drive 62 housed inside casing 32, provides for so moving joint 50, i.e. wall 38 and container 36, as to vary the position of axis 45 in direction 48a.

As shown in Figure 2, drives 57 and 62 are driven by respective gears 63 and 64 coaxial with axis 34 and fitted to respective drive shafts 65 and 66 extending along tubular body 33 and coaxial with axis 34.

In actual use, strip 11 is pulled and fed by traction unit 16 along supply line 10 and through input 12 of wrapping device 7 simultaneously with products 2, which in turn are fed to input 12 by conveyor 13 of device 6, and are wrapped in strip 11 to form continuous wrapping 18 and subsequently pillow pack wrappings 3.

To ensure the products are wrapped correctly along beam 15, the tension of strip 11 is adjusted by means of adjusting unit 30, for which purpose, strip 11, as it runs past opening 48, is sucked into chamber 44 by suction device 46 to form a bend 67 with its concavity facing opening 48.

By means of suction device 46 connected to chamber 44 by tubular bodies 47a and 47b, an adjustable vacuum is formed inside chamber 44 to adjust the tension of strip 11. Unlike previous adjusting devices by which the tension of strip 11 was regulated working on the elasticity of the strip material, unit 30 provides for regulating the tension of strip 11 on the basis of the vacuum inside chamber 44, i.e. on the basis of a quantity related to the tension of strip 11 and therefore allowing of highly accurate tension adjustment.

Unit 30 also provides for applying a given tension to strip 11 without necessarily stretching it, thus enabling the use of strips 11 of not only substantially elastic material but also substantially nonelastic material such as paper.

A further advantage of unit 30 is that, being formed by a fluidstatic vacuum inside chamber 44, the tension imparted to strip 11 is distributed substantially evenly over the entire width of the strip.

Unit 30 also provides for continuously correcting alignment of strip 11 in relation to wrapping beam 15, and so compensating for any misalignment of the machine axes and any defects in the geometry of reel 24 or in the elasticity of the strip material.

In the event of a change in the size, i.e. width, of strip 11, the above tension and alignment adjustments may be effected using the same unit 30 which, as stated, presents two adjusting devices 49 for adjusting the size of chamber 44 and opening 48 in direction 48a, and so ensuring sliding contact between the lateral edges of strip 11 and wall 39 and plate 43, which sliding contact is required for both aligning the strip and sealing the opening for maintaining a given vacuum inside chamber 44.

Devices 49 provide for shifting axis 45 in direction 48a and so moving strip 11 parallel to itself to adjust its alignment in relation to wrapping beam 15.

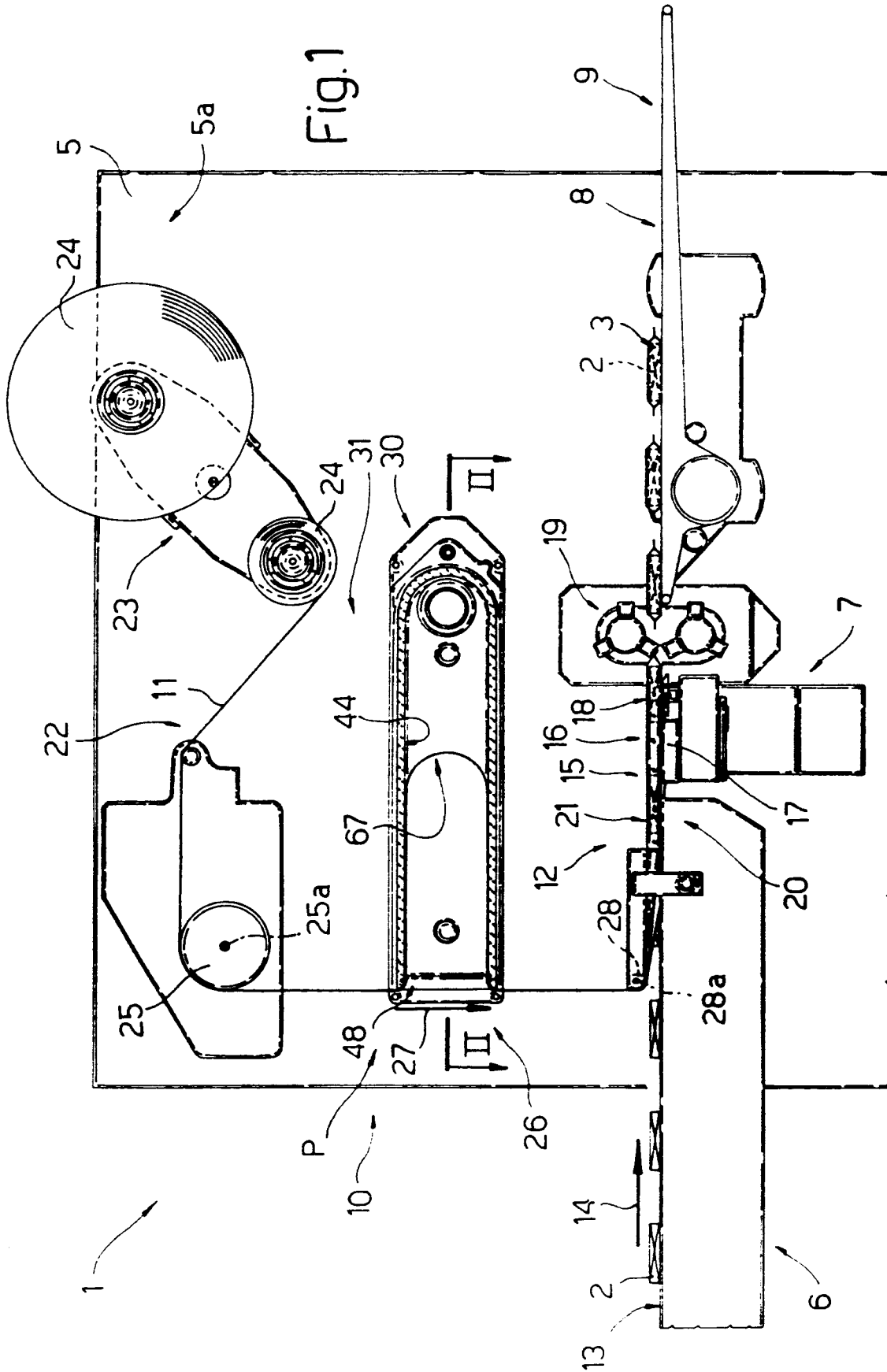
Finally, the substantially U shape of path P is particularly advantageous when using strips 11 gummed on one side, by preventing any contact between the gummed surface and the guide rollers in the event strip 11 is mounted with the gummed surface outwards.

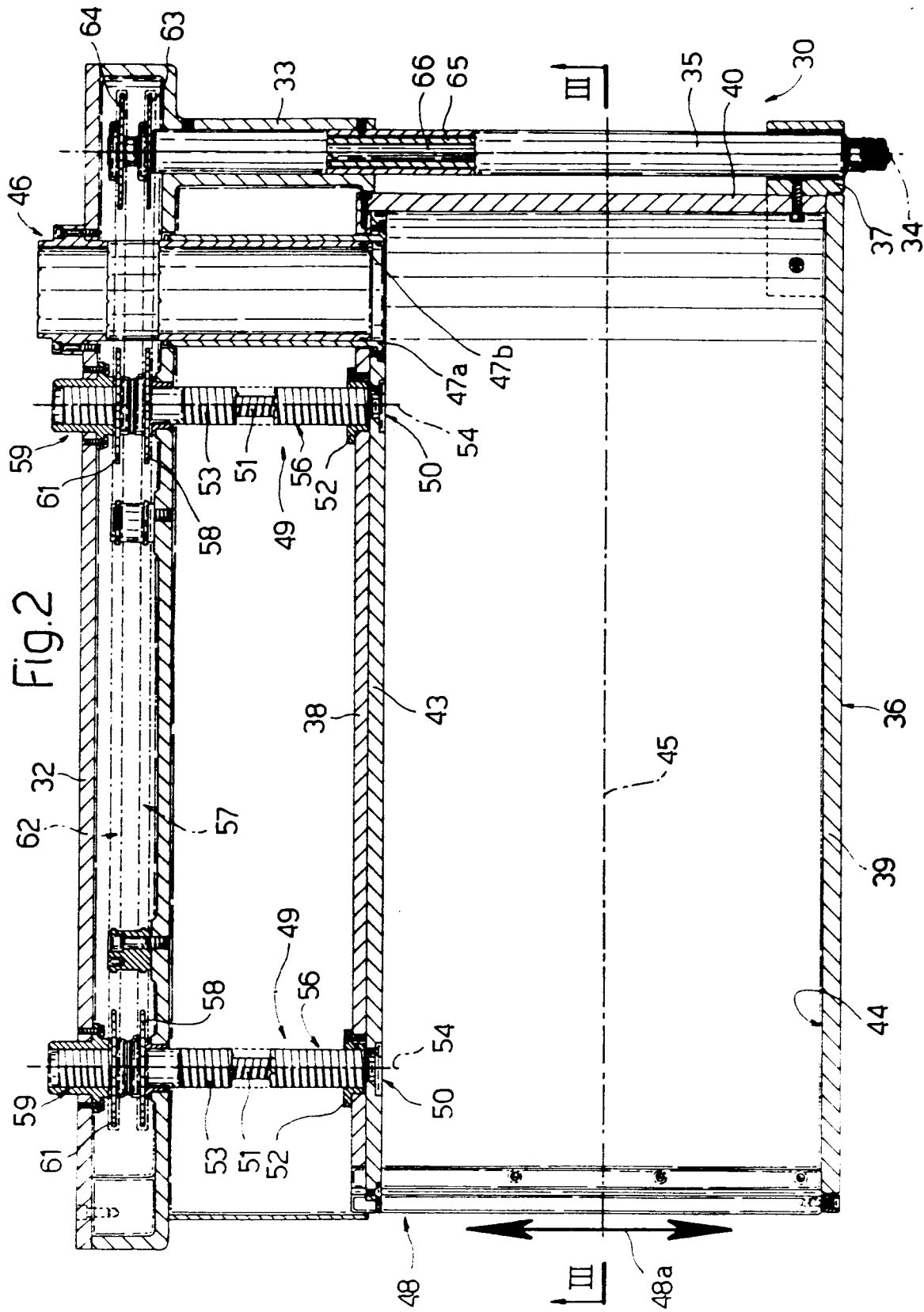
device (7); the supply line (10) comprising a strip traction unit (16), guide means (25, 28) defining a given path (P) along which the strip (11) is fed to the traction unit (16), and adjusting means (30) for adjusting the tension of the strip (11) along said path (P); characterized in that said adjusting means (30) comprise a chamber (44); and vacuum means (46) connected to, and for forming an adjustable vacuum inside, the chamber (44); the chamber (44) presenting an opening (48) defining a portion of said path (P).

2. A machine as claimed in Claim 1, characterized in that the traction unit (16) defines an output end of said path (P); the path (P) being substantially U-shaped, and the chamber (44) being located at the concave portion (31) of the path (P).
3. A machine as claimed in Claim 2, characterized in that the chamber (44) presents further adjusting means (50, 57, 58, 63) for adjusting the size of said opening (48) in a direction (48a) crosswise to said path (P).
4. A machine as claimed in Claim 2 or 3, characterized in that the chamber (44) presents yet further adjusting means (53, 61, 62, 64) for adjusting the position of said opening (48) in a direction (48a) crosswise to said path (P).

Claims

1. A form, fill and seal wrapping machine (1) comprising a product input device (6); a product wrapping device (7) for receiving said products (2) in succession from said product input device (6); an output conveyor (8) for receiving wrapped products (2) from said product wrapping device (7); and a supply line (10) for feeding a continuous strip (11) of wrapping material to, and through, the product wrapping





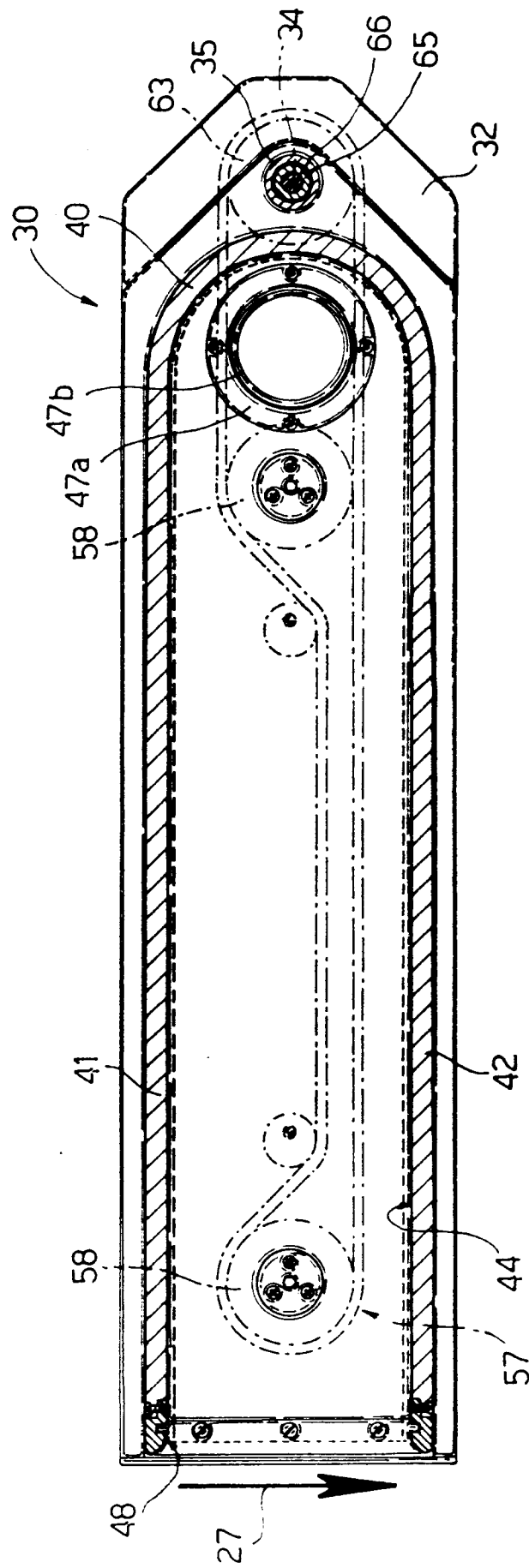


Fig.3

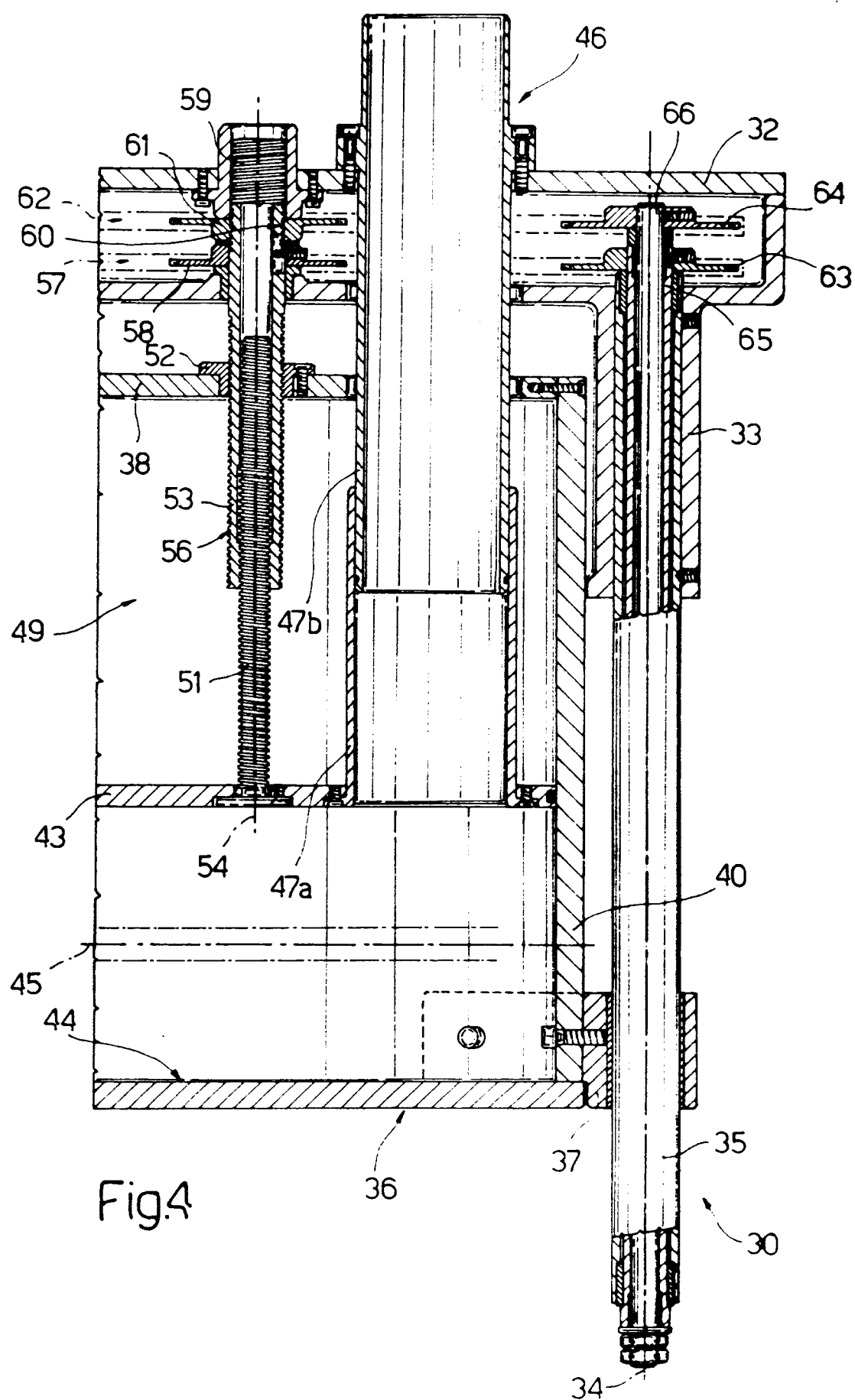
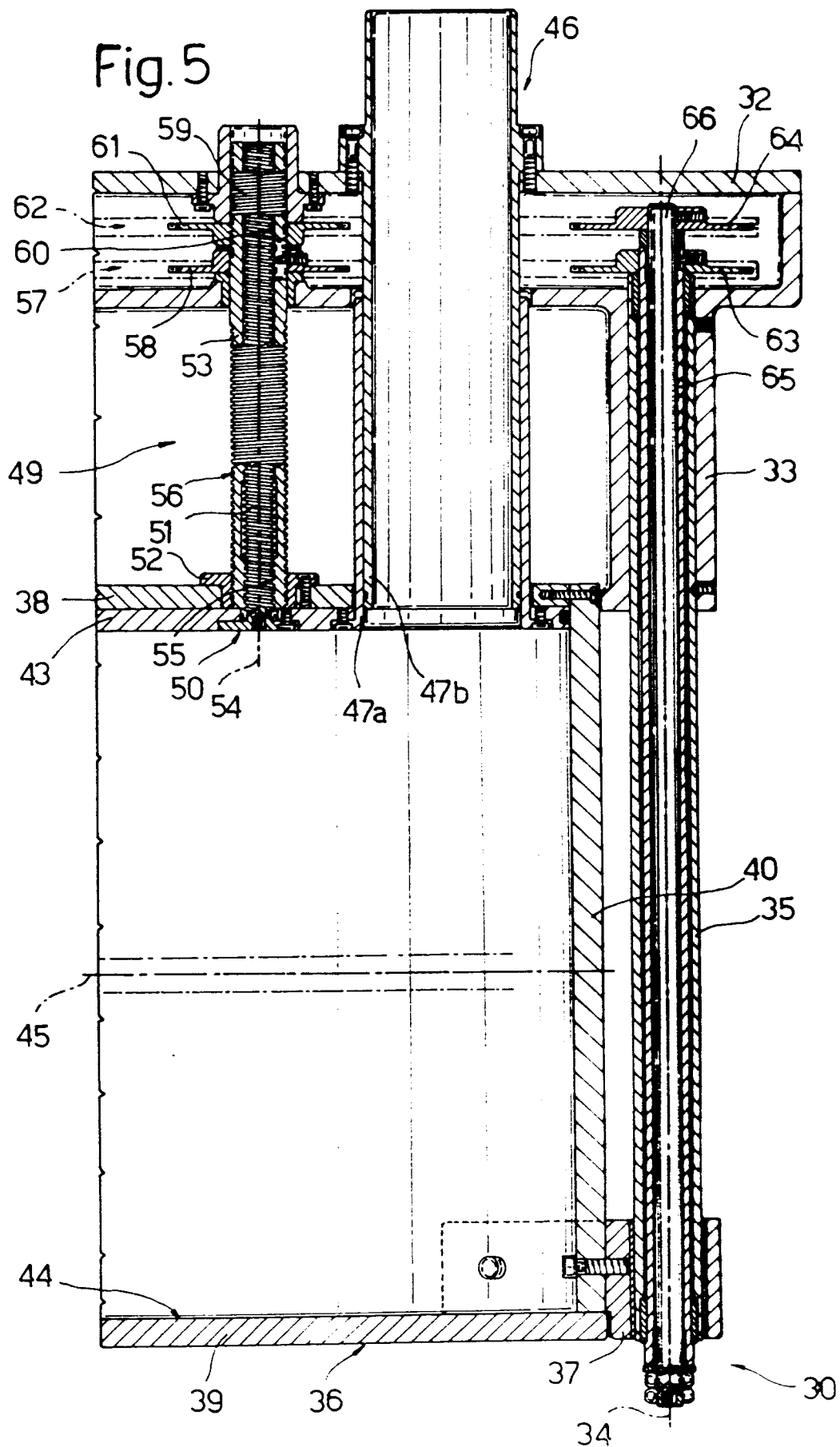


Fig. 5





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EUROPEAN SEARCH REPORT

Application Number
EP 95 10 2624

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X	GB-A-2 249 782 (TOKYO AUTOMATIC MACHINERY WORKS LIMITED) * figures 1,2 * * page 6, line 14 - page 8, line 22 * * page 11, line 21 - page 12, line 13 *	1-3	B65H23/24 B65H23/188 B65H20/24 B65B9/10 //B65H23/02
Y	---	4	
Y	US-A-5 079 569 (E.B. BUNCH, JR.) * figure 2 * * column 4, line 54 - line 60 * * column 5, line 1 - line 17 * * column 6, line 34 - line 39 * * column 6, line 61 - line 68 *	4	
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A	US-A-2 710 154 (W. BAUMRUCKER ET AL.) 7 June 1955 * claims 1,2,5; figures 1,6 * * column 1, line 21 - line 32 * * column 3, line 33 - line 59 * * column 4, line 19 - line 39 *	1,2	TECHNICAL FIELDS SEARCHED (Int.Cl.6) B65H
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 June 1995	Examiner Häusler, F.U.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



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EUROPEAN SEARCH REPORT

Application Number
EP 95 10 2624

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	US-A-2 796 223 (A.L. DETWEILER) 18 June 1957 * claim 1; figures 1,11 * * column 2, line 46 - line 50 * * column 5, line 28 - line 37 * ---	1	
A	EP-A-0 176 905 (GRAPHIA-HOLDING AG) 9 April 1986 * claim 1; figure 1 * * page 3, line 10 - page 4, line 10 * ---	1	
A	FR-A-2 289 345 (J.A. BLACK) 28 May 1976 ---		
A	US-A-4 299 458 (J.S. BURTON) 10 November 1981 -----		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
Place of search THE HAGUE			Date of completion of the search 21 June 1995
Examiner Häusler, F.U.			
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			