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(54) **Carton forming machine**

(57) A compact carton forming machine (20), with a low level carton blank magazine (23) adapted for reloading by an attendant stationed at one side (24) only of the machine, comprises a carton forming line (21), a product conveyor (22) running parallel alongside the carton forming line, a carton blank magazine (23) extending to an input end of the carton forming line from the opposite side (24) of the product conveyor, with the magazine (23) spaced above the product conveyor (22) by an amount affording limited clearance over the product (25), pick-out mechanism (26) for transferring carton

blanks (27) from the magazine to the input end of the carton forming line, carton forming mechanism (28) situated downstream from the pick-out mechanism (26), shuttle mechanism (29) for moving the carton blanks (27) from the pick-out mechanism (26) to the forming mechanism (28), a carton forwarding conveyor (30) situated downstream from the carton forming mechanism (28) and running in parallel alongside the product conveyor (22), and a transfer mechanism (31) for the formed cartons (32) between the forming mechanism (28) and the carton forwarding conveyor (30).

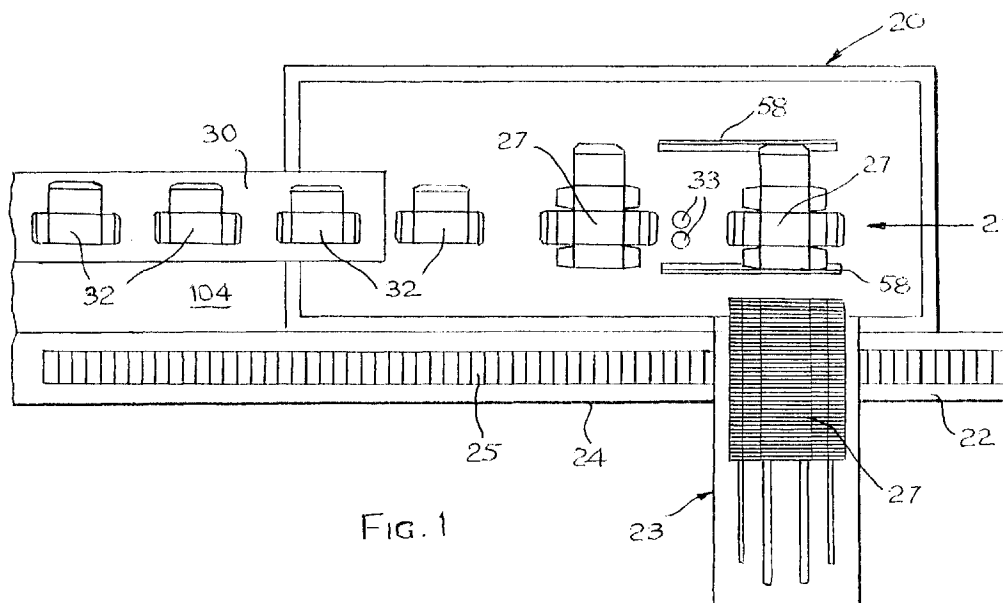


FIG. 1

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Description

This invention relates to carton forming machines and has for one of its objects the provision of a compact machine with a low level carton blank magazine adapted for reloading by an attendant stationed at one side only of the machine.

According to the present invention, a carton forming machine comprises a carton forming line, a product conveyor running parallel alongside the carton forming line, a carton blank magazine extending to an input end of the carton forming line from the opposite side of the product conveyor, with the magazine spaced above the product conveyor by an amount affording limited clearance over the product, pick-out mechanism for transferring carton blanks from the magazine to the input end of the carton forming line, carton forming mechanism situated downstream from the pick-out mechanism, shuttle mechanism for moving the carton blanks from the pick-out mechanism to the forming mechanism, a carton forwarding conveyor situated downstream from the carton forming mechanism and running in parallel alongside the product conveyor, and a transfer mechanism for the formed cartons between the forming mechanism and the carton forwarding conveyor.

With the usual level of the product conveyor, the carton blank magazine - being higher by little more than the height of the product - is at a convenient height for reloading by an attendant stationed alongside the product conveyor from where, not only the product can be readily observed, but also the carton forming mechanism beyond the product conveyor and unobscured by the magazine. The lateral width of the installation need be little more than the width of the carton forming machine plus the length of the blanks magazine, and the requirement for an attendant at the one side only of the machine limits the overall floor area occupied by the machine and personnel, while an attendant is able both to hand load the product into the cartons and replenish packaging materials (i.e., load carton blanks into the magazine and, if employed, fill up glue applicators) from the one side of the machine.

Although the magazine may to some extent obscure the attendant's view of the pick-out mechanism, this can be of simple tried-and-trusted construction, such as a swinging arm or arms carrying suction cups and depositing each blank on to horizontal support rails, along which the shuttle mechanism moves the blank to the forming mechanism.

If the cartons are to be glue-formed, each blank is preferably pushed by fingers projecting from the shuttle mechanism under glue nozzles; and the shuttle mechanism preferably comprises a carriage for the fingers slidable along horizontal guidebars by means of a chain drive carrying a follower engaged in a slot in the carriage, whereby the fingers have a constant speed over the major part of their fore and aft movements.

The carton forming mechanism, may comprise a

vertically reciprocable plunger and a die cavity vertically reciprocable in opposition to the plunger, whereby the travel of the plunger is reduced compared with the conventional arrangement with a stationary die cavity (thus affording compactness), and whereby the forming operation may be speeded up (because of the lesser distance of travel of the plunger).

As the plunger and die cavity separate, the formed carton is stripped mechanically from the plunger or by vacuum through the transfer mechanism, and the carton is carried by the transfer mechanism to the carton conveyor. The transfer mechanism preferably comprises a horizontal arm with suction cups facing upwardly to grip the bottom of the carton, with the arm projecting upstream from a carriage slidable on vertical guidebars extending between slides on horizontal guidebars, the carriage being moved by a chain drive carrying a follower engaged in a hole in the carriage, whereby the suction cups move vertically between carton-forwarding and return runs of the chain drive.

Loading of the product into the cartons may be effected manually or by pick-and-place (or other) mechanism, and from the filling station the filled cartons proceed to closing and sealing mechanisms.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a diagrammatic plan of a carton forming machine in accordance with the present invention; Figure 2 is a diagrammatic elevation from the left hand end of Figure 1;

Figure 3 is a diagrammatic (but somewhat more detailed) elevation from the left hand side of Figure 2 showing the main drives of the machine;

Figure 4 is an elevation of a pick-out mechanism for use in the carton forming machine viewed from the same side as Figure 3;

Figure 5 is an elevation of the pick-out mechanism as viewed from the left hand side of Figure 4;

Figure 6 is an elevation of the essential components of a shuttle mechanism for use in the carton forming machine viewed from the same side as Figure 3;

Figure 7 is a part sectional view taken from the line VII - VII of Figure 6;

Figure 8 is an elevation of a carton forming mechanism for use in the carton forming machine viewed from the same side as Figure 3;

Figure 9 is an elevation of the carton forming mechanism as viewed from the right hand side of Figure 8;

Figure 10 is an elevation of the essential components of a transfer mechanism for the formed cartons in the machine of the present invention, again viewed from the same side as Figure 3; and

Figure 11 is a part-sectional view taken from the line XI - XI of Figure 10.

In Figures 1 to 3, a carton forming machine 20 comprises a carton forming line 21, a product conveyor 22 running parallel alongside the carton forming line, a carton blank magazine 23 extending to an input end of the carton forming line from the opposite side 24 of the product conveyor, with the magazine spaced above the product conveyor by an amount affording limited clearance up over the product 25, pick-out mechanism 26 (see Figures 4 and 5) for transferring carton blanks 27 from the magazine 23 to the input end of the carton forming line, carton forming mechanism 28 (see Figures 8 and 9) situated downstream from the pick-out mechanism, shuttle mechanism 29 (see Figures 6 and 7) for moving the carton blanks from the pick-out mechanism to the forming mechanisms, a carton forwarding conveyor 30 situated downstream from the carton forming mechanism and running in parallel alongside the product conveyor 22, and a transfer mechanism 31 (see Figures 10 and 11) for the formed cartons 32 between the forming mechanism 28 and the carton forming mechanism.

The flaps of the carton blanks may be such that they are mechanically interlocked by the carton forming mechanism 28, but glue applicators 33 are indicated in Figures 1 and 3 (between the blanks input end of the carton forming line and the forming mechanism) for use when necessary.

Referring to Figure 3, a motor 34 drives a gearbox 35 from which extends shafting 36 carrying a sprocket 37, for a chain drive 38 to the pick-out mechanism 26 (see Figures 4 and 5) and a cam 39 for operating the carton forming mechanism 28 (see Figures 8 and 9). A chain drive 40 from the gearbox 35 drives the transfer mechanism 31 (see Figures 10 and 11) and a chain drive 41 from the transfer mechanism drive drives the shuttle mechanism 29 (see Figures 6 and 7). A gearbelt drive 42 off the transfer mechanism 31 (Figures 10 and 11) drives the carton forwarding conveyor 30, while the product conveyor 22 is independently driven by means not shown. Starting and stopping of the drives and control of the speeds thereof is effected by means of a control box 43 (Figures 1 and 3).

The pick-out mechanism 26 (Figures 4 and 5) comprises an arm 44 on a fixed pivot 45 at one end and carrying a square tube 46 at the other end, which tube carries and communicates with three suction cups 47 and has a nipple 48 for connection by flexible piping (not shown) to a source of suction with a timed valve control (none of which is shown but is of conventional design). The arm 44 is provided with a crank lever 49 that is connected by a length-adjustable link 50 to one end of an oscillatable lever arm 51 the other end of which is carried by a fixed pivot 52, oscillation of the lever arm 51 being effected by an intermediately mounted follower roller 53 engaging in a track 54 in a cam 55 rotated by the chain drive 38 through sprocket 56 secured to a shaft 57 to which the cam is also secured. Adjustment of the swing of the arm 44 is effected by means of the length-adjustable link 50 so that the suction cups 47 are pressed to

the foremost blank 27 in the magazine 23 and, while suction is applied to the cups 47 to hold that blank, the tube 46 is swung with the arm 44 to place the blank on support rails 58 (Figures 1, 6 and 7) extending towards but ending short of the carton forming mechanism 28. In Figure 4, no attempt has been made to show the full length of the tube 46 as this (and the number and positions of the suction cups 47) will depend on the size and shape of the carton blanks 27. Likewise, in Figure 5 only the planes of the blank 27 have been indicated, without any attempt to show its full length. In Figure 4 the full line positions of the components represent their positions with the suction cups 47 pressed to the foremost blank (not shown), while in Figure 5 the full line positions correspond to their positions with the carton blank brought down on to the support rails.

In Figure 7 the support rails 58 are shown in their positions of closest approach; they are mounted on adjusting screws 59 which are rotatable by hand-wheels (not shown) at the respective sides of the machine. Figure 7 also shows a sprocket 60 driven by the chain drive 41, and this sprocket is mounted on one end of a shaft 61 the other end of which carries a sprocket 62 for a chain drive 63 also trained round a sprocket 64 (see Figure 6). The chain drive 63 carries a follower 65 engaged in a vertical slot 66 in a carriage 67 which is slidable along horizontal guidebars 68 and carries fingers 69 projecting above and between the guides 58, whereby the fingers have a constant speed over the major part of their fore and aft movements. As indicated in Figure 7, the square tube 46 and the suction cups 47 swing down between the fingers 69 of the shuttle mechanism 29, to deposit the carton blank 27 (not shown) on the guides 58 ahead of the fingers when they are in their extreme left hand end position with reference to Figure 6, and the fingers push the blank along and beyond the support rails 58 into position in the carton forming mechanism 28 as the carriage 67 moves from left to right. The tube 46 and suction cups 47 are then able to be swung back up to extract another blank 27 from the magazine 23, and that next blank is brought down on to the support rails 58 when the fingers have been retracted to their extreme left hand position again.

The carton forming mechanism 28 (Figures 8 and 9) comprises a vertically reciprocable plunger 70 and a die cavity 71 vertically reciprocable in opposition to the plunger, both being mounted on brackets between respective pairs of slides 72, 73 slidable on vertical guidebars 74. The plunger is connected by a length adjustable link 75 to one end of an oscillatable lever arm 76 the other end of which is carried by a fixed pivot 77, and the arm 76 is oscillated by an intermediately disposed follower roller 78 engaging in a track 79 in one face of the cam 39. Similarly, the cavity 71 is connected by a length-adjustable link 80 to one end of another oscillatable lever arm 81 the other end of which is also carried by the fixed pivot 77, and the arm 81 is oscillated by an intermediately disposed follower roller 82 engaging in a track

83 in the other face of the cam 39. In Figure 9 the plunger and cavity are shown in their positions of greatest separation, and a carton blank 27 is shown supported by upwardly spring-loaded swing fingers 84 across the cavity proper between guides 85, none of which is shown in Figure 8 and in which the plunger 70 is shown entering the cavity proper.

Upon retraction of the plunger from the cavity the formed carton 32 can be stripped from the plunger mechanically and/or with the aid of vacuum from the transfer mechanism 31 (Figures 10 and 11) which comprises a horizontal arm 86 formed of square tube with upwardly facing suction cups 87 at one end and a nipple 88 at the other end for connection by flexible piping (not shown) to a source of suction with a timed valve control (none of which is shown but, again, is of conventional design), with the arm projecting upstream from a carriage 89 slidable on vertical guidebars 90 extending between slides 91 on horizontal guidebars 92, the carriage being moved by a chain drive 93 carrying a follower roller 94 engaged in a hole 95 in the carriage, whereby the suction cups move vertically between a carton-forwarding run, with the bottom of a carton 32 held by the suction cups 87, and a return run after the suction to the cups has been cut off to release the carton to the carton forwarding conveyor 30.

The movement of the suction cups 87 from the return run to the carton-forwarding run is modified by mounting the arm 86 on a slide 96 on horizontal guidebars 97 on the carriage 89, and providing the slide 96 with a follower roller 98 for engagement with a fixed cam 99, springs 100, 101 being provided on the upper guidebar 97 one at each end of the slide 96, with the spring 100 having a higher rating than the spring 101, whereby a deceleration occurs in the horizontal movement of the suction cups 87 as the follower roller 98 runs round a curved part 102 of the cam track, followed by a short swift upward vertical movement as the follower roller 98 runs on to a vertical part 103 of the cam track, this final vertical movement of the suction cups 87 bringing them swiftly into holding contact with the bottom of a formed carton 32 as the forwarding movement commences.

Loading of the product 25 into the cartons 32 may be effected manually, and closing of the cartons may be effected manually, by packers situated along the side 24 of the product conveyor 22, and the cartons 32 may be pulled on to a deadplate 104 between the conveyors 22, 30 while loading is effected. Alternatively, the product 25 may be loaded into the cartons 32 by pick-and-place (or other) mechanism (not shown) and from the filling station the filled cartons proceed to closing and sealing mechanisms.

With the usual level of the product conveyor 22, the carton blank magazine 23 - being higher by little more than the height of the product 25 - is at a convenient height for reloading by an attendant stationed alongside the side 24 of the product conveyor from where, not only the product can be readily observed, but also the carton

forming mechanism 28 beyond the product conveyor and unobscured by the magazine.

The lateral width of the installation need be little more than the width of the carton forming machine 20 plus the length of the blanks magazine 23, and the requirement for an attendant at the one side only of the machine limits the overall floor area occupied by the machine and personnel, while an attendant is able both to hand load the product 25 into the cartons 32 and load carton blanks 27 into the magazine and, if employed fill up glue applicators, all from the one side of the machine.

Claims

1. A carton forming machine characterized by a carton forming line (21), a product conveyor (22) running parallel alongside the carton forming line, a carton blank magazine (23) extending to an input end of the carton forming line from the opposite side (24) of the product conveyor, with the magazine spaced above the product conveyor by an amount affording limited clearance over the product (25), pick-out mechanism (26) for transferring carton blanks (27) from the magazine (23) to the input end of the carton forming line (21), carton forming mechanism (28) situated downstream from the pick-out mechanism, shuttle mechanism (29) for moving the carton blanks (27) from the pick-out mechanism (26) to the forming mechanism (28), a carton forwarding conveyor (30) situated downstream from the carton forming mechanism and running in parallel alongside the product conveyor (22), and a transfer mechanism (31) for the formed cartons (32) between the forming mechanism (28) and the carton forwarding conveyor (30).
2. A machine as in Claim 1, characterized in that the pick-out mechanism (26) comprises a swinging arm (44) carrying suction cups (47) and depositing each blank (27) on to horizontal support rails (58), along which the shuttle mechanism (29) moves the blank to the forming mechanism (28).
3. A machine as in Claim 1, characterized in that glue applicators (33) are provided between the pick-out mechanism (26) and the carton forming mechanism (28).
4. A machine as in Claim 1 or Claim 2, characterized in that the shuttle mechanism (29) comprises a carriage (67) for fingers (69) slidable along horizontal guidebars (68) by means of a chain drive (63) carrying a follower (65) engaged in a slot (66) in the carriage, whereby the fingers have a constant speed over the major part of their fore and aft movements.

5. A machine as in any one of Claims 1 to 4, characterized in that the carton forming mechanism (28) comprises a vertically reciprocable plunger (70) and a die cavity (71) vertically reciprocable in opposition to the plunger. 5

6. A machine as in any one of Claims 1 to 5, characterized in that the transfer mechanism (31) comprises a horizontal arm (86) with suction cups (87) facing upwardly to grip the bottom of the carton (32), with the arm projecting upstream from a carriage (89) slidable on vertical guidebars (90) extending between slides (91) on horizontal guidebars (92), the carriage being moved by a chain drive (93) carrying a follower (94) engaged in a hole (95) in the carriage, whereby the suction cups move vertically between carton-forwarding and return runs of the chain drive. 10 15

7. A machine as in Claim 6, characterized in that the movement of the suction cups (87) from the return run to the carton-forwarding run is modified by mounting the arm on a slide (96) on horizontal guidebars (97) on the carriage (89), and providing the slide with a follower roller (98) for engagement with a fixed cam (99), springs (100, 101) being provided on the upper guidebar (97) one at each end of the slide (96), with one spring (100) having a higher rating than the other spring 101, whereby a deceleration occurs in the horizontal movement of the suction cups (87) as the follower roller (98) runs round a curved part (102) of the cam track, followed by a short swift upward vertical movement as the follower roller runs on to a vertical part (103) of the cam track, this final vertical movement of the suction cups bringing them swiftly into holding contact with the bottom of a formed carton (32) as the forwarding movement commences. 20 25 30 35

8. A machine as in any one of Claims 1 to 7, characterized in that loading of the product (25) into the cartons (32) is effected manually. 40

9. A machine as in Claim 8, characterized in that the cartons (32) are closed manually. 45

10. A machine as in any one of Claims 1 to 7, characterized in that loading of the product (25) into the cartons (32) is effected by pick-and-place mechanism. 50

11. A machine as in Claim 10, characterized in that the filled cartons (32) proceed to closing and sealing mechanisms. 55

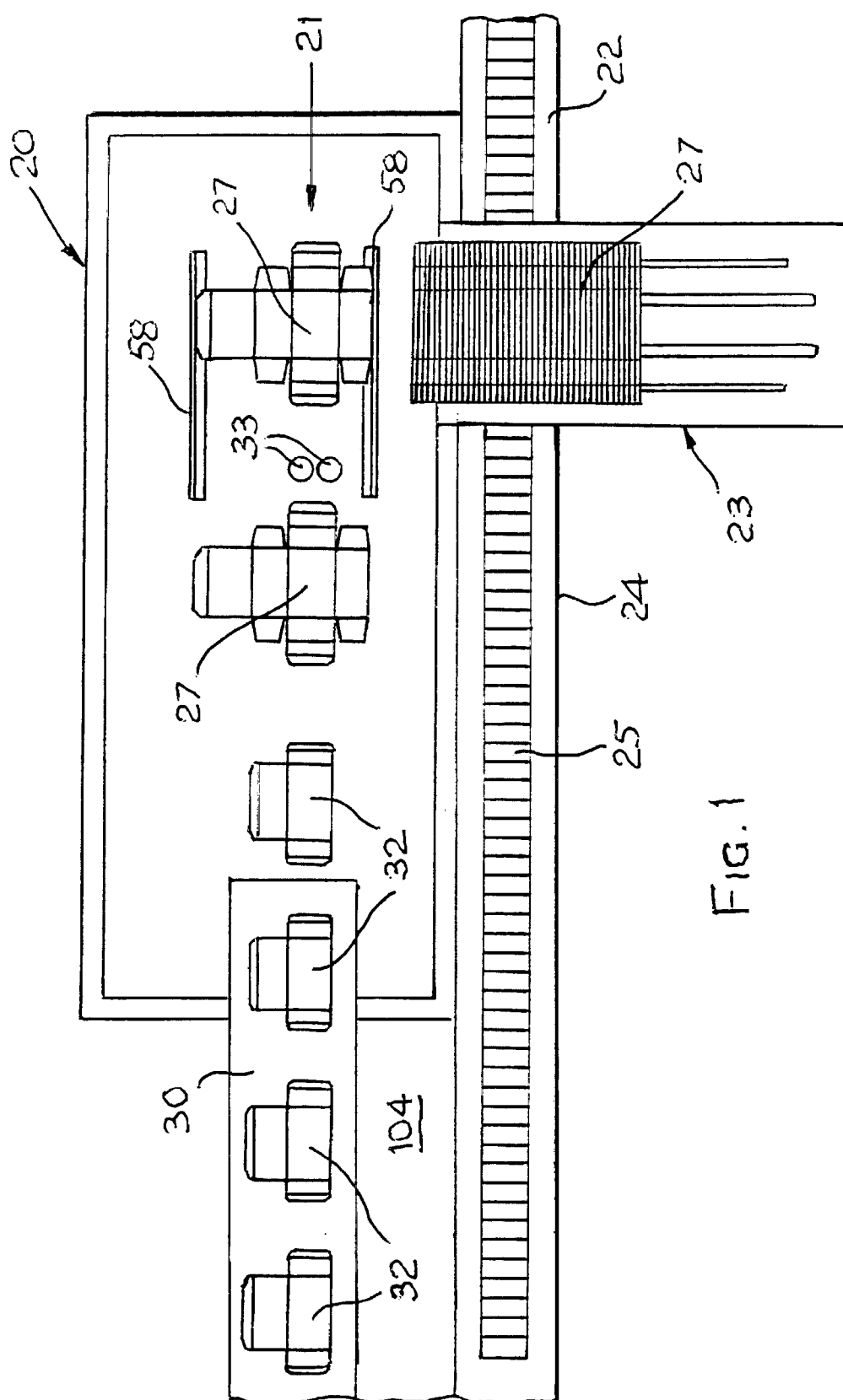


Fig. 1

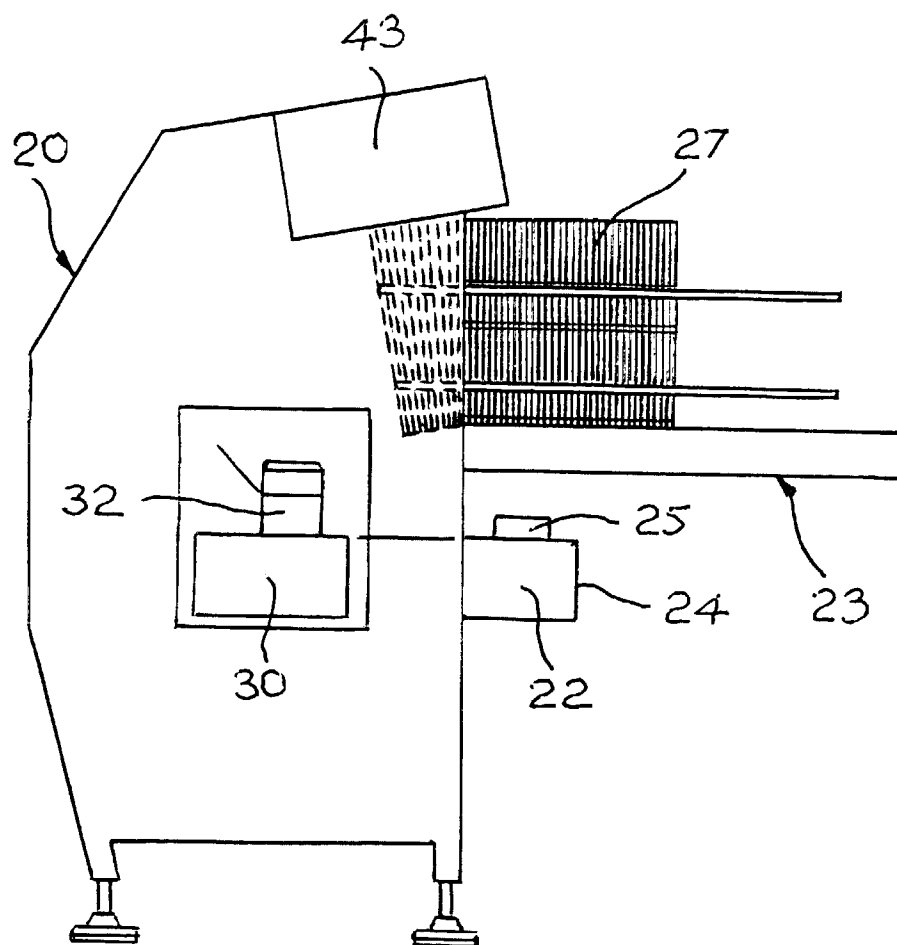


FIG. 2

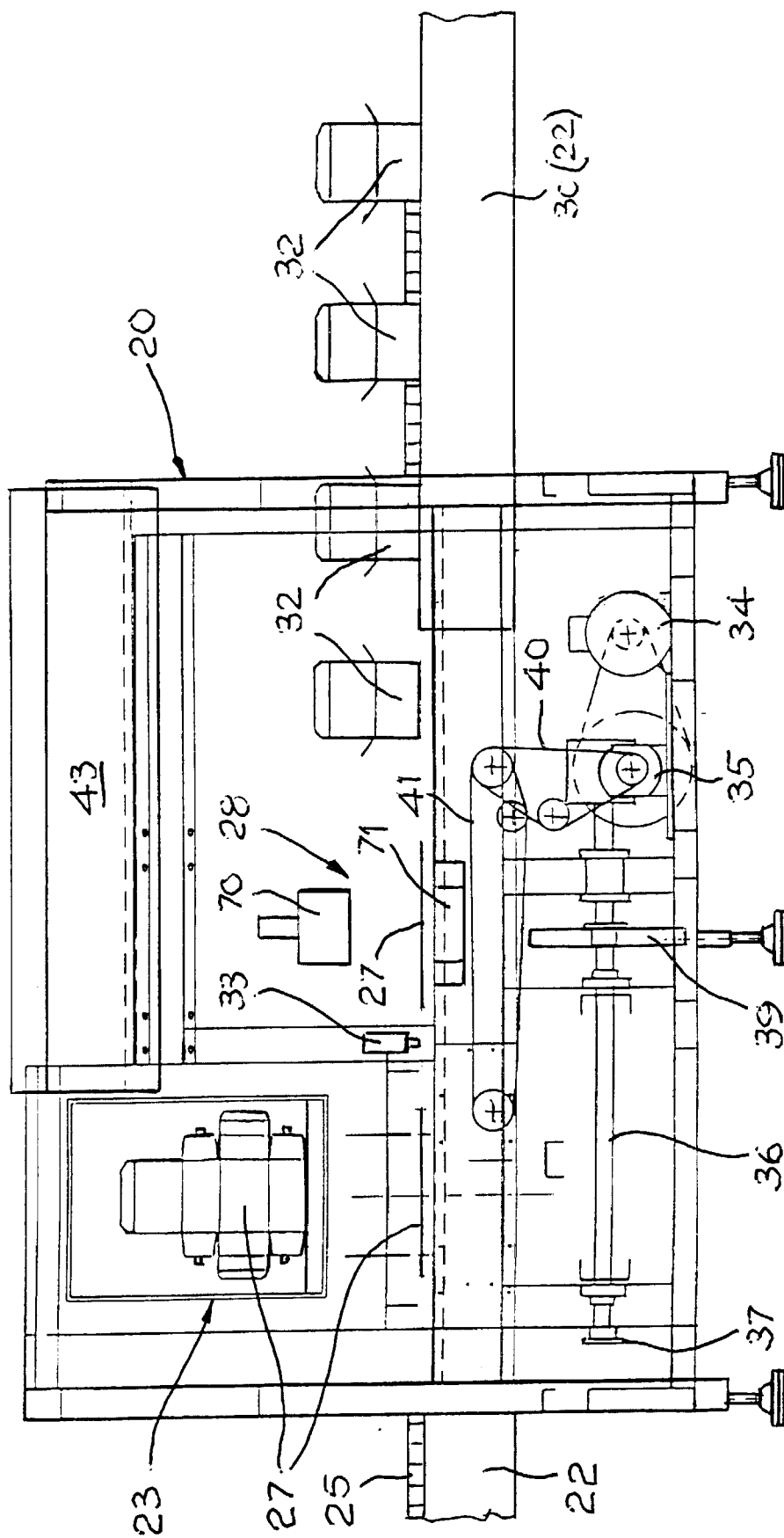


FIG. 3

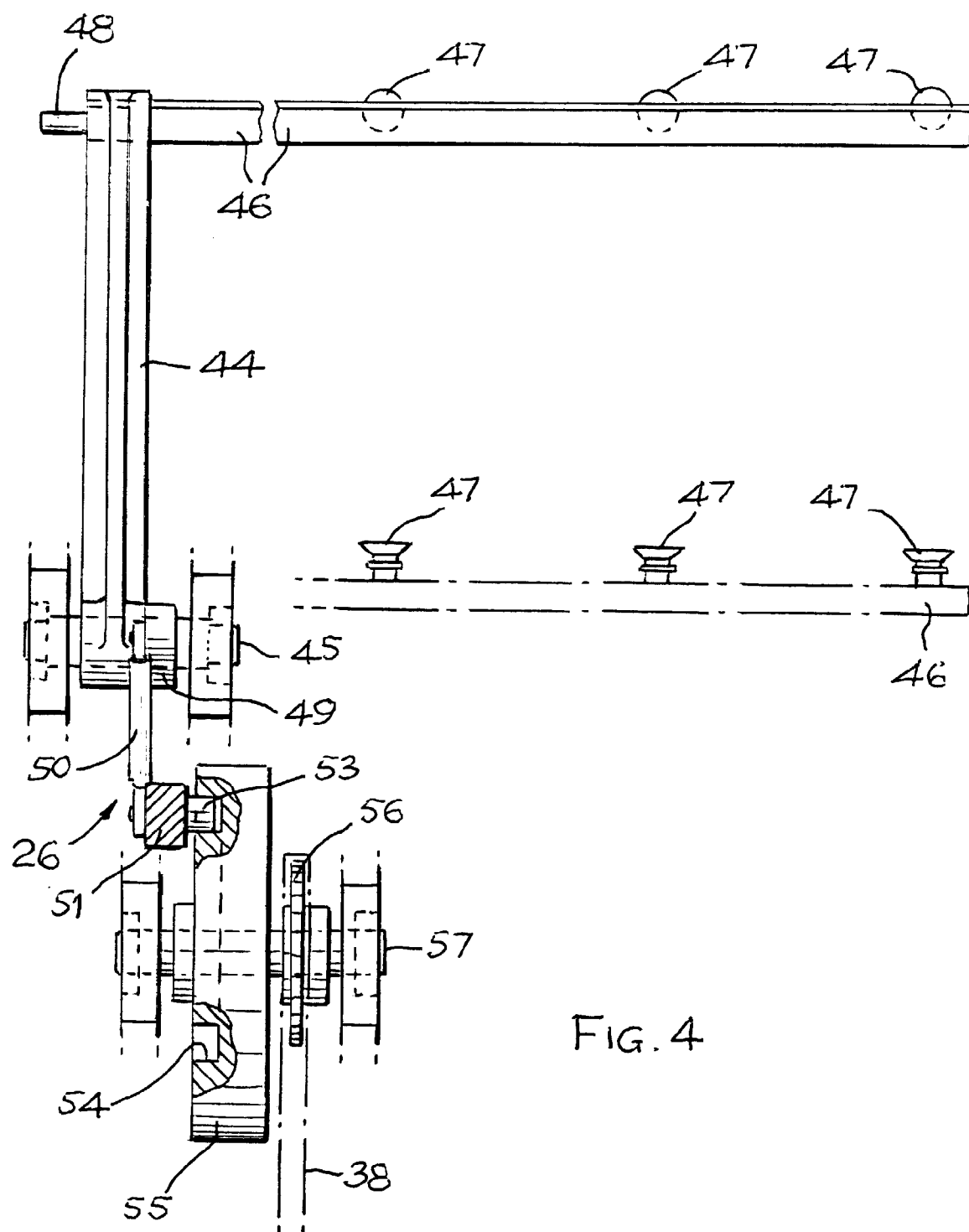


FIG. 4

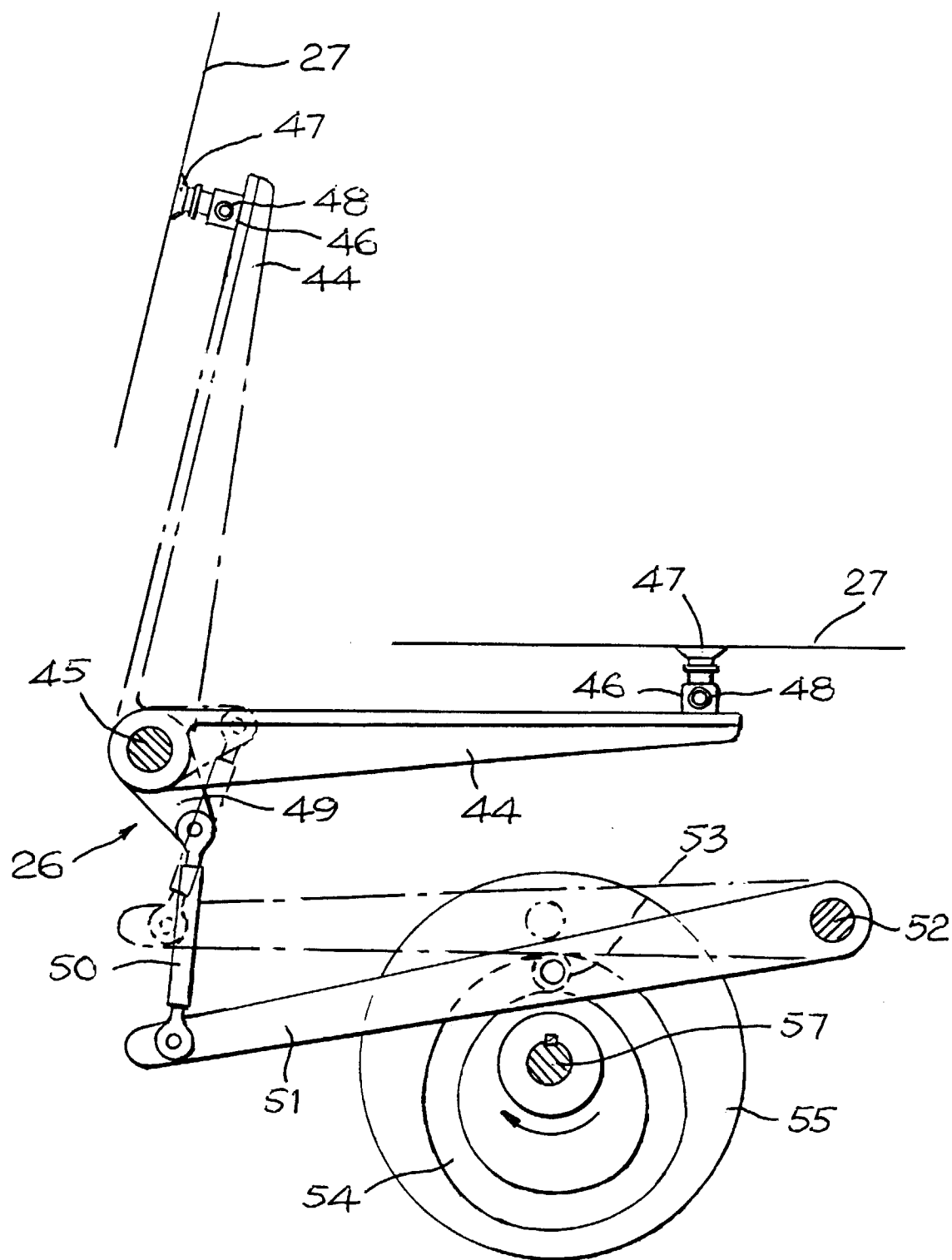
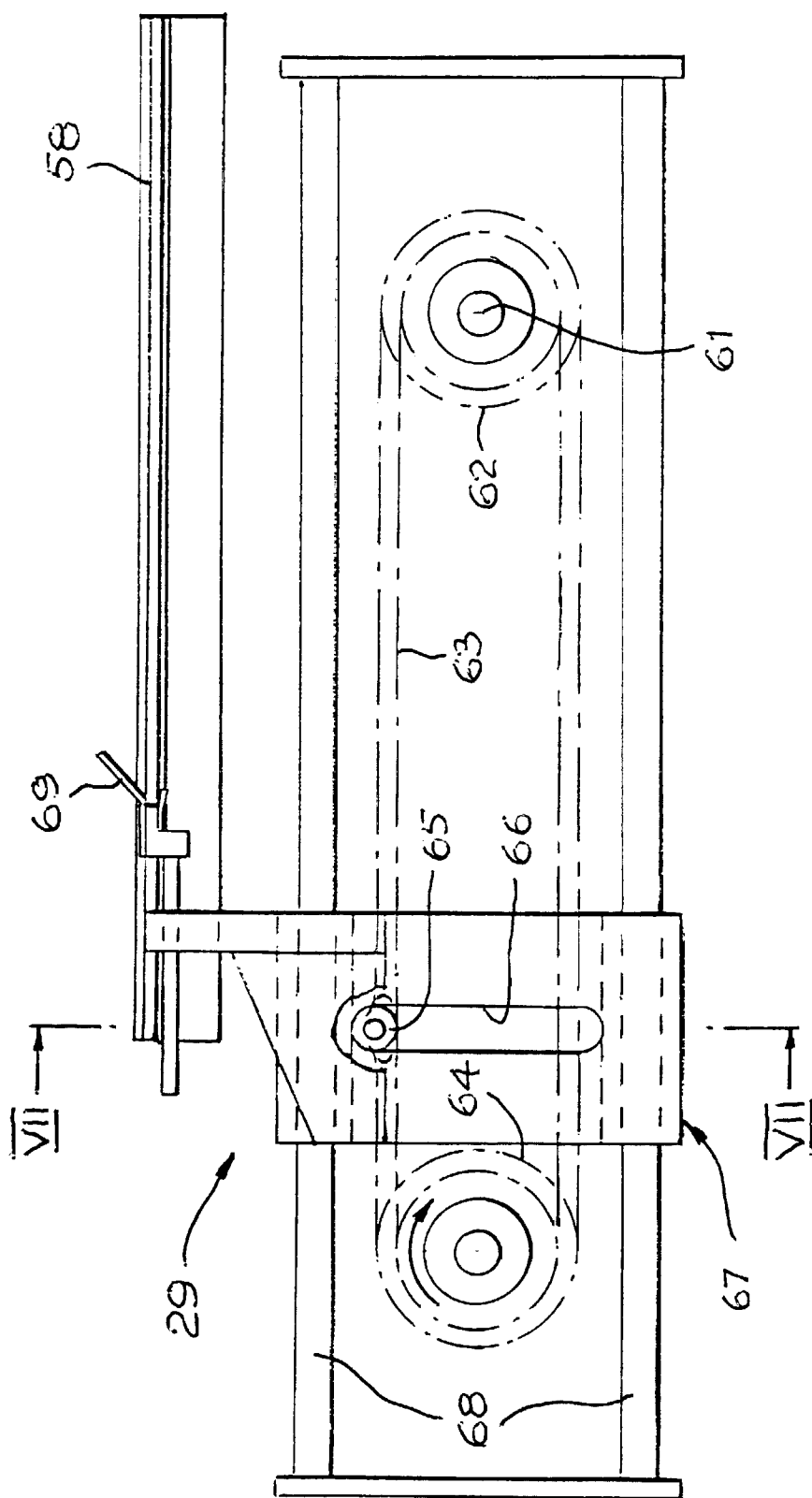


FIG. 5



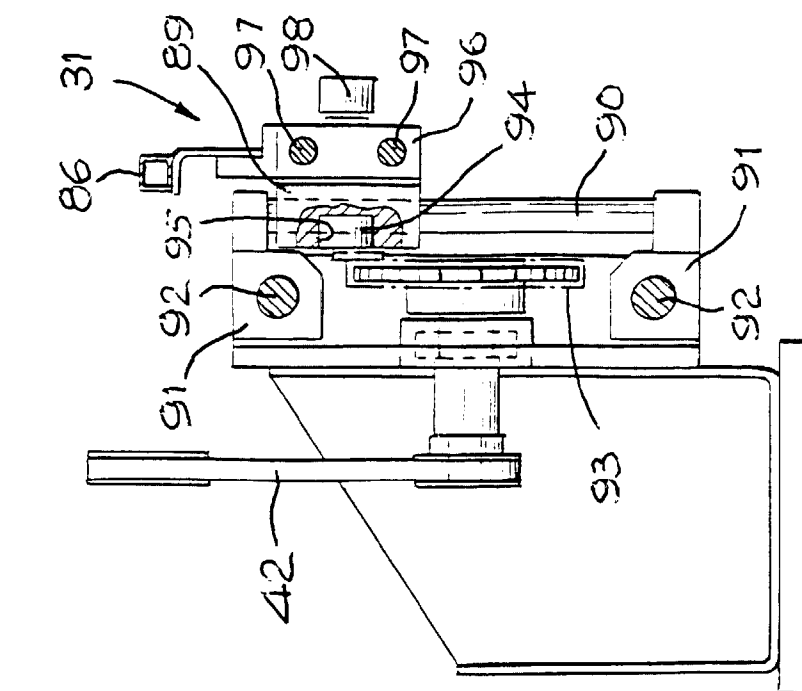


FIG. 11

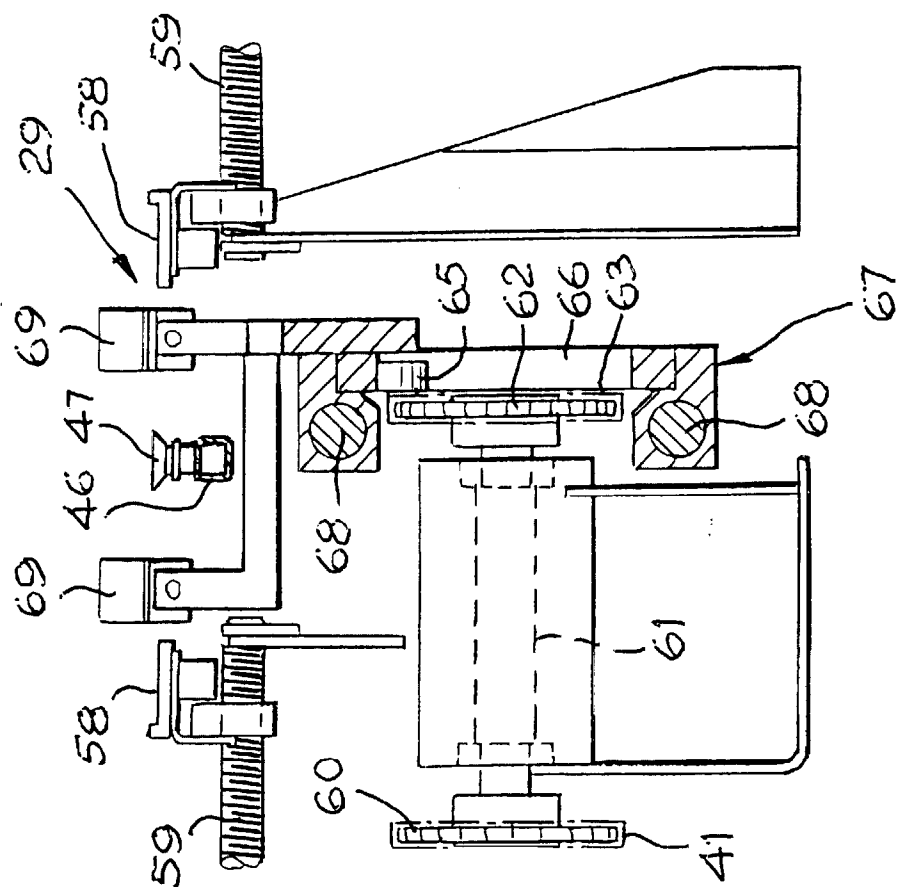


FIG. 7

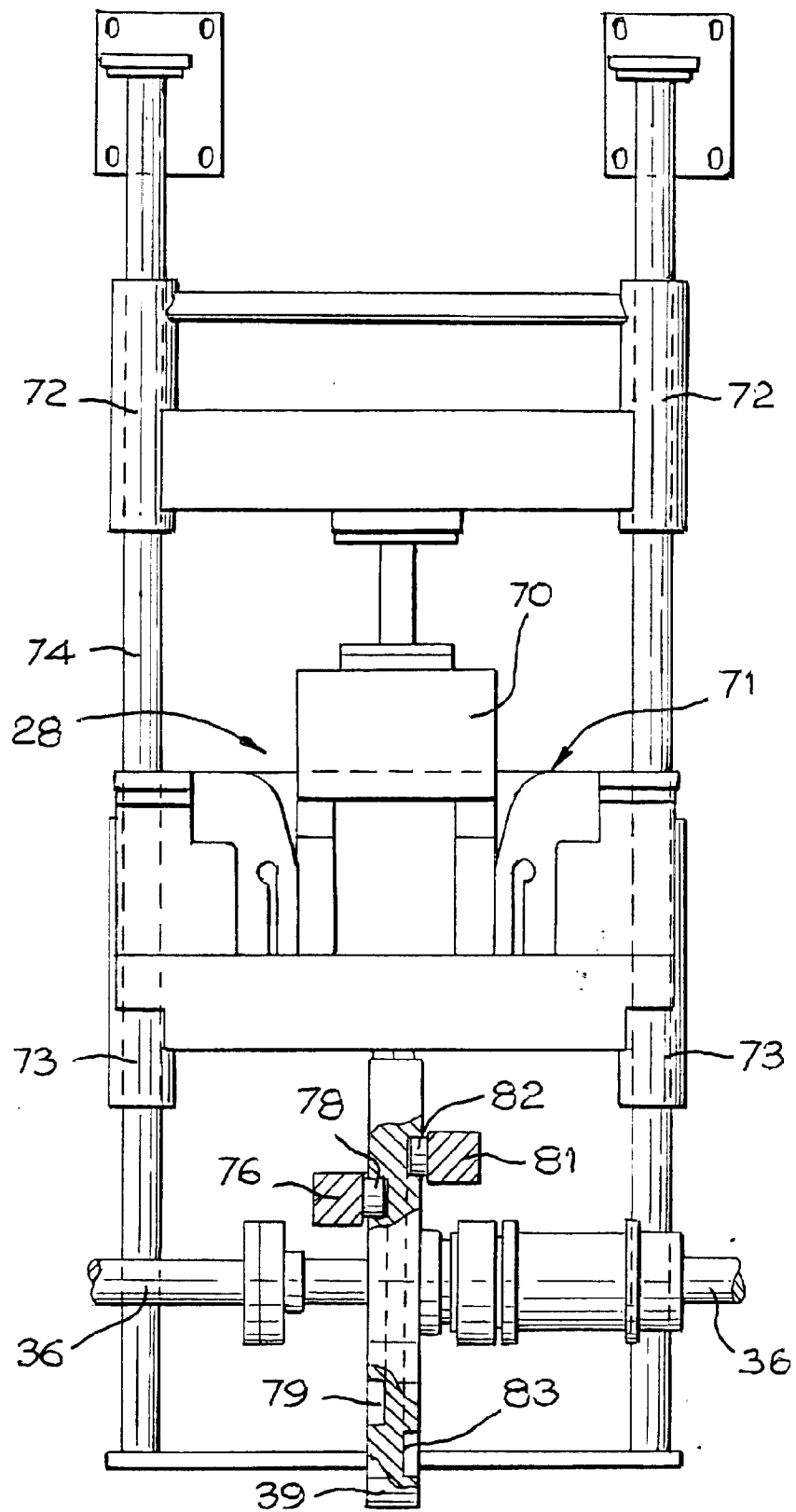


FIG. 8

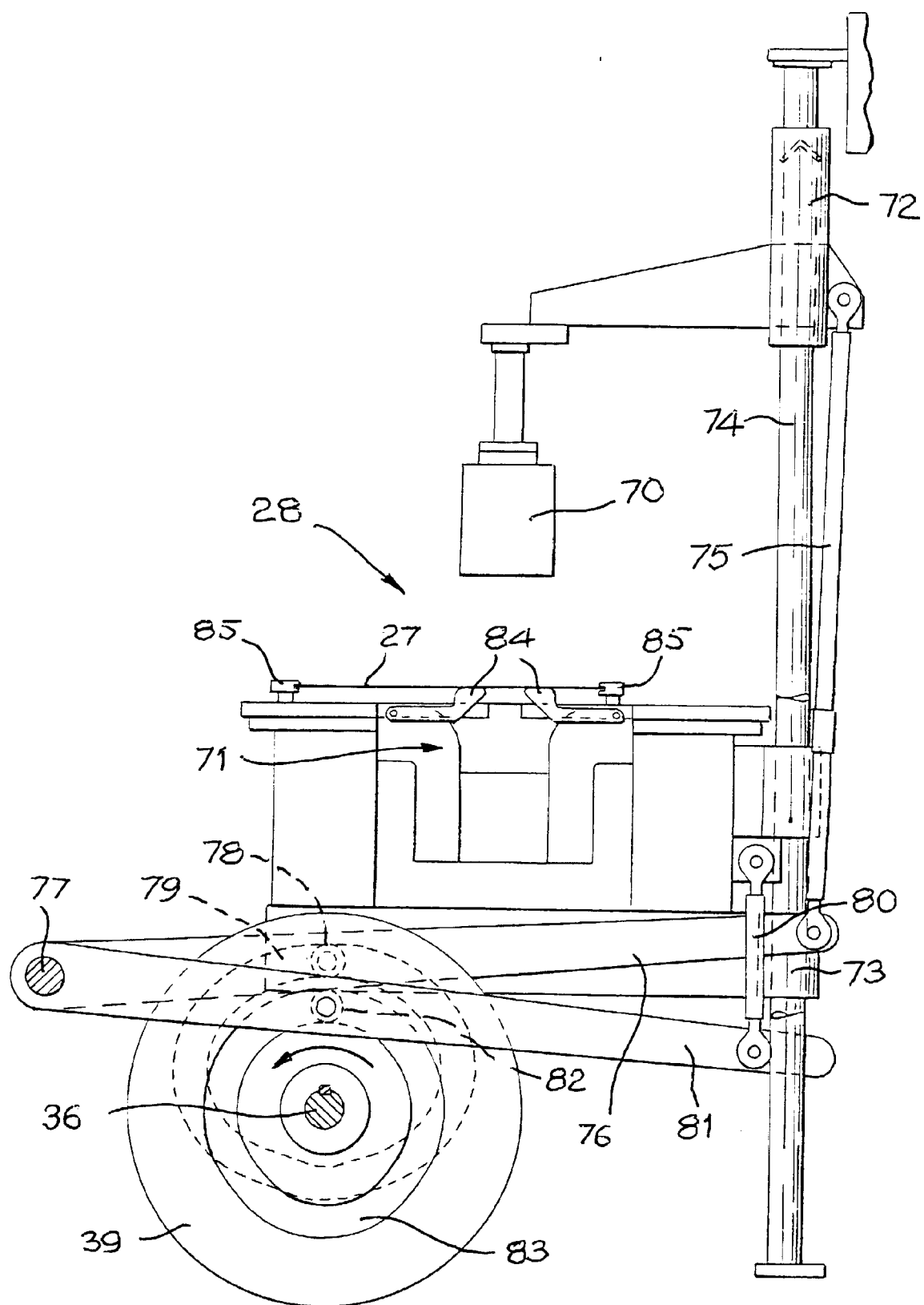
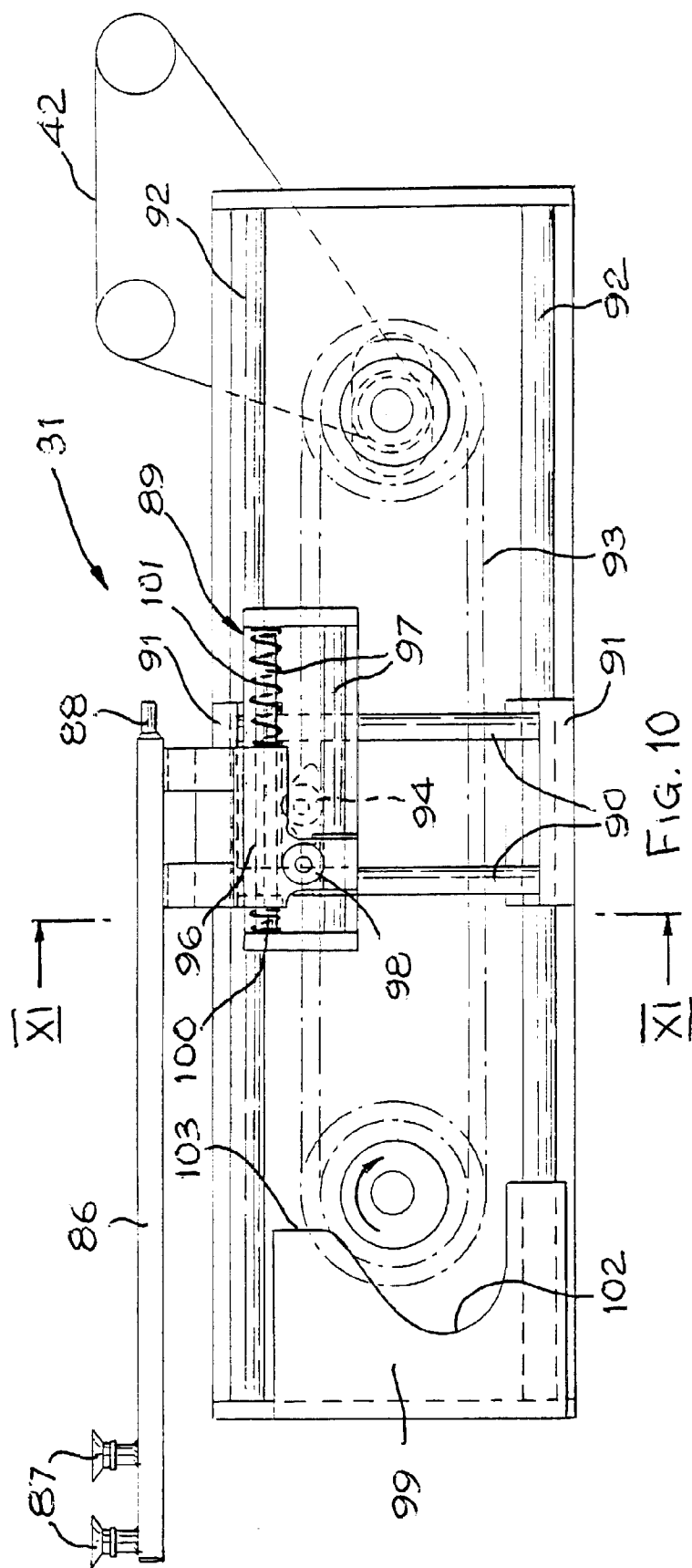


FIG. 9





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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 6344

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	GB 2 237 787 A (CESTIND) 15 May 1991 * page 10-13; figures 1,2 * ---	1-3,5	B65B5/02
A	WO 95 28321 A (THORSTED MASKINER) 26 October 1995 * claim 1; figure 4 * ---	1	
A	US 4 738 083 A (KAWAI ET AL.) 19 April 1988 * abstract; figures 1,2,7 * ---	1	
A	EP 0 642 976 A (4P EMBALLAGES FRANCE) 15 March 1995 * abstract; figures 1,2 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B65B B31B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20 November 1997	Examiner Grentzius, W
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