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(54) **Forming cartons.**

(57) Cartons are formed from blanks (20) in a machine having a conveyor (34), a magazine (33), a pick-out mechanism (48) feeding each blank to the conveyor with end panels (21, 22) aligned therewith, adhesive-applying equipment (35) applying a coating (31) to the area of each major end panel (21) projecting laterally beyond the minor end panel (22), adhesive-conditioning equipment (36) blowing hot air on to the adhesive coatings, a transfer mechanism (49) feeding each blank onto a die (37) having a throat (38) corresponding to the bottom panel (24), a plunger (39) for pushing each blank through the die, which has guide surfaces (40) for turning the end flaps (23) and minor end panels (22) inside the major end panels (21), rollers (103) for applying pressure to the major end panels (21) to cause the adhesive (31) to form an adequate bond to the minor end panels (22) before discharge from the die (37), a motor (41), and driving mechanisms (43 to 47) connecting the motor to the conveyor (34), the pick-out and transfer mechanisms (48,49) and the plunger (39).

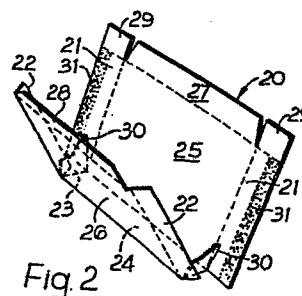


Fig. 2

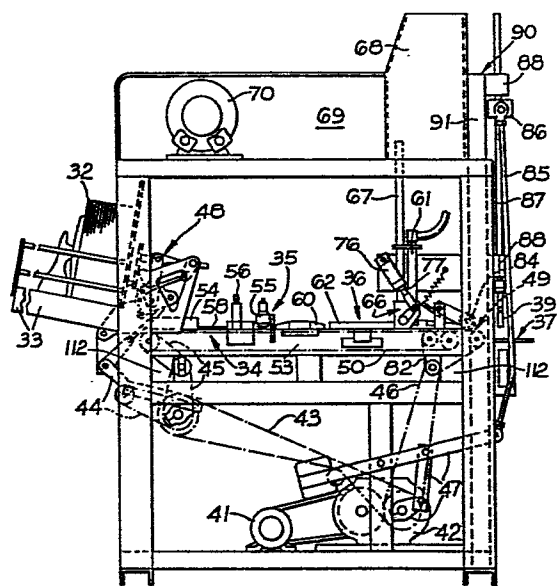


Fig. 4

FORMING CARTONS

This invention relates to the forming of cartons, more particularly of paperboard or the like by folding a blank of the type providing a bottom panel, a pair of side panels and a pair of end flaps articulated to the sides of the bottom panel, a pair of major end panels articulated to the upstanding sides of one side panel, a pair of minor end panels articulated to the upstanding sides of the other side panel, the width of the major end panels and the end flaps being substantially the same as the width of the bottom panel, top closure panels on the side panels and major end panels, and a guide tab on each end flap for guiding the end flaps by engagement with the insides of the major end panels during folding, with slits between the end panels and end flaps extending substantially to the meeting point of fold lines between the side panels and the bottom panel and the end flaps.

A carton of this type is described in GB-PS 1 424 035 as having the overlying panels bonded to each other by thermoplastic adhesive material on at least one of each pair of the surfaces to be bonded, in particular the end

flaps each having an adhesive strip across the full width of the outside thereof adjacent the bottom panel for bonding to the adjacent major end panel. The end flaps have substantially full overlap of the widths of both the major and minor end panels adjacent the juncture with the bottom panel, and the edges of the end flaps contact the fold lines of both major and minor end panels so as to obviate leakage channels. Furthermore, the fold lines are embossed on the blank, with a convexed side of the lines being on the inside of the carton to form beads when folded, the free edge of each major end panel abutting the fold bead for the corresponding minor end panel to assist in forming the side seal of the carton. Moreover, the slits between the end panels and end flaps must only extend substantially up to the outer limit of the convexed surface of the embossed lines to cause full compression of the convexed surface and whereby puckering of excess paperboard and adhesive caulks the corner formed to obviate pinhole leakage.

The particular description with reference to the drawings accompanying GB-PS 1 424 035 makes it clear that, in order to

turn the blank into a fully formed and fully sealed carton (except that is for the closing and sealing of the closure flaps) ready to receive liquid or semi-liquid products, the blank is coated on both the inside and the outside with thermoplastic adhesive material and a total of eight areas of adhesive are activated by heat applied by complex arrays of nozzle boxes disposed in opposed pairs above a forming die into and through which the blank is moved down (by a plunger or punch) to effect the folding operation. In addition to activating an adhesive strip across the full width of the outside of each end flap, the nozzle boxes also apply heat along a marginal portion of the outside of each major end panel, along the inside of each minor end panel, and across the bottom of the inside of each major end panel.

Although GB-PS 1 424 035 also describes and illustrates how blanks as hereinbefore defined can be cut from flat stock, with adjacent blanks oppositely directed, the major end panel of one being contiguous with the minor end panel of the other and the guide tab of one blank being

contiguous to the guide tab of the other blank, whereby to enhance the conservation of paperboard, the full potential of this type of carton has not been realised, probably for a number of reasons. Firstly, the need for embossed fold lines and end flap defining slits in a precise relationship as aforesaid; secondly, the provision of thermoplastic adhesive material on both the inside and the outside of the carton; thirdly, the need for complex arrays of nozzle boxes to activate the adhesive over several areas, one pair of which is disposed transversely with respect to the other areas; and fourthly, the folding of the minor end panels outside the major end panels detracting from the final appearance of the cartons, especially if pre-printed. All these have added up to the need for complex blank cutting and embossing machinery, and relatively slow heat activating and folding machinery, so that difficulty is experienced in allying such machinery to product (e.g., food) processing machinery plus a reluctance to add the cost of changing over from product loading machinery utilizing sleeve cartons open at both ends. Thus, for some ten years,

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the expensive machinery and relative slowness of operation, etc., has been considered justifiable or acceptable only with regard to leakproof cartons as described and claimed in GB-PS 1 424 035.

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One object of the present invention is to provide a method of forming a carton of the type initially defined applicable to the widest possible range of flat stock; i.e., not limited to stock coated on both sides with thermoplastic adhesive material, and even applicable to thermoplastic (e.g., polypropylene) blanks.

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Another object of the invention is to provide a method with which adhesive forming the necessary bond between each of at least two pairs of mating surfaces is brought to the best possible condition for the forming operation without impairing the speed with which cartons can be formed.

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A further object of the invention is to provide a method with which different types of adhesive can be used (to suit different types of stock material and/or coatings and/or impregnations) without impairing the speed with which cartons can be formed.

Yet another object of the invention is to provide a machine for forming cartons of the type initially defined and adaptable to the objects as aforesaid.

5 A still further object of the invention is to provide a machine for forming cartons of the type initially defined having readily interchangeable parts facilitating changes in sizes of cartons, and particularly
10 adaptable to a wide range of sizes and capable of forming narrow and deep cartons.

 According to one aspect of the present invention, a method of forming a carton of the type initially defined comprises the
15 steps of feeding the blank from a pack onto a conveyor with the side forming the interior of the carton uppermost and the end panels aligned with the direction of travel of the conveyor, passing the blank on the conveyor
20 through an adhesive applying station, applying an adhesive coating within the inside area of each major end panel projecting laterally beyond the respective minor end panel, passing the blank on the conveyor through an adhesive
25 conditioning station, applying heat to the adhesive coatings, feeding the blank from the

conveyor onto a die having a throat
corresponding substantially to the bottom
panel, pushing the blank through the die by
means of a plunger engaging the bottom panel,
5 the die having guide surfaces whereby the end
flaps and minor end panels are turned inside
the major end panels, and applying roller
pressure against the major end panels to press
them against the minor end panels to cause the
10 adhesive between them to form an adequate bond
to hold the carton together upon being
discharged from the die.

Because the steps of feeding the blank
from the pack, applying adhesive, conditioning
15 the adhesive, and pushing the blank through
the die are spaced horizontally, the speed at
which cartons can be formed is no longer
restricted by the total cycle time of these
operations, as would be the case if the known
20 method of feeding the blank from the pack onto
nozzle boxes arrayed above opposite sides of
the die were to be modified by the addition
of adhesive applying means. In other
words, because the operations requiring most
25 time (i.e., the application and conditioning
of adhesive) take place whilst the blank is

moving along the conveyor they do not slow down the rate at which the blanks are fed from the pack or the rate at which blanks are pushed through the die. Indeed, the total cycle time will be greater (which is of advantage in arranging for the condition of the adhesive to be just right when each blank is pushed through the die), but the speed of forming cartons will be the speed at which the blanks can be fed from the pack to the conveyor or the speed at which the blanks can be fed from the conveyor up to the die.

By folding the minor end panels (with the end flaps) inside the major end panels, not only does this enhance the appearance of the completed carton, it also allows advantage to be taken of the lateral protrusion of the major end panels beyond the minor end panels in the application of the adhesive whilst the blanks are travelling along the conveyor. Thus the adhesive may be a water-based adhesive (e.g. polyvinyl acetate emulsion) applied by spraying intermittently in phase with the passing of the major end panels, and then dried by hot air blown thereon as the major end panels pass through the adhesive-

conditioning station. However the minor end panels are preferably broken upwardly from the plane of the blank as it is fed onto the conveyor, so as to hold the minor end panels clear of the adhesive-applying station (and also ready for folding inside the major end panels), and the end flaps are likewise preferably broken upwardly from the plane of the blank as it is fed onto the conveyor and preferably held over closer to the blank than the minor end panels, even though in the final forming in the die the end panels may be interposed between the respective major and minor end panels. Hot air from the adhesive-conditioning station may also be blown onto the outsides of the minor end panels, to increase the speed at which the bond is formed between the respective major and minor end panels.

Suction may be applied through apertures in the vertical edges of the plunger to hold the minor end panels closely thereto, especially the minor end panels of a narrow and deep carton.

The control of adhesive condition attainable with the separate adhesive-applying

and adhesive-conditioning stations, especially using a water-based adhesive and hot air, is such that this method is applicable to virtually any paperboard capable of being transformed from flat blank to carton in a die, such as, duplex, triplex, solid white, grease resistant, single-sided polythene and double-sided polythene.

The spraying of cold adhesive shows a considerable saving over hot melt adhesive, in cost of adhesive, but the use of hot melt adhesive is not precluded.

A modification of the method is also applicable to blanks precoated with thermoplastic or thermosetting adhesive or thermoplastic blanks. Thus, according to another aspect of the present invention, a method of forming a carton of the type initially defined comprises the steps of feeding the blank from a pack onto a conveyor with the side forming the interior of the carton uppermost and the end panels aligned with the direction of travel of the conveyor, passing the blank on the conveyor through an adhesive activating station, activating adhesive at least within the inside area of

each major end panel projecting laterally beyond the respective minor end panel, feeding the blank from the conveyor onto a die having a throat corresponding substantially to the bottom panel, pushing the blank through the die by means of a plunger engaging the bottom panel, the die having guide surfaces whereby the end flaps and minor end panels are turned inside the major end panels, and applying roller pressure against the major end panels to press them against the minor end panels to cause the adhesive between them to form an adequate bond to hold the carton together upon being discharged from the die.

The minor end panels are preferably broken upwardly from the plane of the blank as it is fed onto the conveyor, so as to hold the minor end panel clear of the adhesive activating station (and also ready for folding inside the major end panels), and the end flaps are likewise preferably broken upwardly from the plane of the blank as it is fed onto the conveyor and preferably held over closer to the blank than the minor end panels, even though in the final forming in the die the end panels may be interposed between the

respective major and minor end panels;
however, the adhesive activating station may
direct heat (e.g., by means of blown air) in
two directions, one downwardly for the insides
5 of the major end panels and one laterally for
the outsides of the minor end panels, in
which case the breaking of the minor end
panels and end flaps and the holding of the
end flaps closer to the blank facilitates the
10 application of heat to the minor end panels.

Suction may be applied through
apertures in the vertical edges of the plunger
to hold the minor end panels closely thereto,
especially the minor end panels of a narrow
15 and deep carton.

According to a further aspect of the
invention, a machine for forming cartons of
the type initially defined comprises an
endless conveyor, a magazine for the blanks
20 inclined downwardly towards the leading end of
the upper run of the conveyor, a pick-out and
transfer mechanism for feeding the blanks
individually in succession from the magazine
onto the conveyor with the side forming the
25 interior of the carton uppermost and the end
panels aligned with the direction of travel of

the conveyor, adhesive-applying and conditioning or activating equipment disposed above the conveyor, a die beyond the trailing end of the upper run of the conveyor and having a throat corresponding substantially to the bottom panel, a transfer mechanism for feeding the blanks in succession from the conveyor onto the die, a plunger for pushing each blank in turn through the die by engaging the bottom panel, the die having guide surfaces whereby the end flaps and minor end panels are turned inside the major end panels, rollers for applying pressure against the major end panels to press them against the minor end panels to cause the adhesive between them to form an adequate bond to hold the carton together upon being discharged from the die, a motor, and driving mechanisms connecting the motor to the conveyor, the transfer mechanisms and the plunger.

The conveyor is preferably provided with pairs of lugs for propelling the blanks positively, and is also preferably provided with guide rails for breaking the minor end panels and end flaps upwardly from the plane of the blanks and for holding the end panels

closer to the blanks as they pass the adhesive-applying equipment and adhesive-conditioning or activating equipment, and in readiness for folding the minor end panels and the end flaps inside the major end panels, even though in the final forming in the die the end panels may be interposed between the respective major and minor end panels.

Adhesive-applying equipment may comprise sprays applying water-based adhesive intermittently and adhesive-conditioning or activating equipment may comprise hot air blowers operating continuously or intermittently in phase with the passing of blanks along the conveyor.

The vertical edges of the plunger may be provided with apertures, with passages through the plunger and flexible pipes to a source of suction, so that suction supplied at the apertures holds the minor end panels of the cartons (especially the minor end panels of narrow and deep cartons) to those edges of the plunger.

The magazine and the pick-out and transfer mechanism for feeding the blanks individually in succession from the magazine

- 15 -

onto the conveyor can be of conventional type,
but the transfer mechanism for feeding the
blanks in succession from the conveyor onto
the die preferably comprises an endless driven
5 belt having an upper run in extension of the
conveyor, and a spring-loaded nip roller
adjustable lengthwise of the upper run of the
belt, to set the position of the nip between
the roller and the belt to cease propelling
10 each blank as the latter moves into its final
position on the die.

Although the overall length of the
machine will be appreciably more than with the
known machines of the type having nozzle boxes
15 arrayed above opposite sides of the die and
onto which blanks are fed individually in
succession from a magazine, the speed of
operation can be appreciably greater.
However, the one motor and driving mechanisms
20 can operate a double (or multiple) machine
having pairs (or equivalent numbers) of
magazines, conveyors, transfer mechanisms,
dies and plungers side by side, and feeding
alternate cartons to a product packaging line,
25 which may be hand-loaded or mechanised loading
in a variety of dispositions for a wide

variety of products.

5 A further advantage of the methods and machine of the present invention is that, in addition to the saving of flat stock in making the blanks, there are great savings for the user because of savings over a preglued sleeve carton and the flat blanks are more convenient both for shrink-wrapping packs of blanks (instead of having to enclose a lesser number of sleeve blanks in a custom made carton) and
10 loading the magazine.

To facilitate adapting of the machine to different sizes of cartons, the (or each) conveyor is preferably flanked by longitudinal
15 beams carrying the respective guide rails, adhesive-applying and conditioning or activating equipment spaced longitudinally and projecting laterally appropriately to one size of carton blank, and the (or each) die and
20 plunger are preferably carried together on a common frame, the die and plunger having cross-sectional dimensions and heights appropriate to one size of carton, the longitudinal beams and the frame being readily
25 attachable and detachable, for interchange with similar beams and frames appropriately

equipped to suit other sizes of cartons.

Methods and a machine in accordance with the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a layout of blanks for cartons of the type initially defined as cut out from a single piece of board;

Figure 2 is a perspective view of one carton blank as in Figure 1 after the application of adhesive and in the process of being folded in accordance with one method aspect of the invention;

Figure 3 is a perspective view of the fully formed carton ready to receive a product;

Figure 4 is a diagrammatic side elevation of a machine in accordance with the invention, with side covers removed;

Figure 5 is a side elevation corresponding to part of Figure 4 but to a larger scale and in more detail;

Figure 6 is a plan of Figure 5;

Figures 7 to 10 are fragmentary vertical sections taken from the lines VII - VII to X - X respectively of Figure 6;

Figure 11 is a fragmentary side elevation showing a diverter valve for blown hot air appearing in Figures 4 to 6, but to a larger scale than Figures 5 and 6 and with one half of the valve body removed;

Figure 12 corresponds to Figure 11, but shows the diverter of the valve in its alternative position and a portion of nozzle box in section;

Figure 13 is a perspective view of a frame unit seen in side elevation (from the other side) at the right-hand side of Figure 4 and carrying the plunger and die;

Figure 14 is an enlarged plan of the die;

Figure 15 is a horizontal section towards the bottom of the die;

Figure 16 is a layout view of a carton blank having different dimensions from the blanks of Figure 1; and

Figure 17 is a perspective view of the fully formed carton from the blank of Figure 16 ready to receive a product.

In Figure 1 carton blanks 20 are cut out from flat stock, with adjacent blanks oppositely directed so that the major end

panel 21 of one is contiguous to the minor end
panel 22 of the other. End flaps 23 are also
contiguous but have their mating edges shaped
to provide a transition between the major and
5 minor end panels of the respective blanks.
The end flaps 23 of each blank 20 are
articulated to the ends of a bottom panel 24,
and the major and minor end panels 21, 22 are
articulated to the sides of side panels 25,
10 26 respectively, which are themselves
articulated to the sides of the bottom panel.
Top side closure panels 27, 28 are articulated
on the side panels 25, 26 respectively and top
end closure panels 29 are articulated on the
15 major end panels 21. Articulation is
determined by fold lines, which may be formed
as score lines or crease lines, and which are
indicated by broken lines in Figure 1, cutting
lines being indicated by unbroken lines.
20 Wastage is limited to the very small cutouts
formed at the ends of the top side closure
panels 27, 28 and each portion of the blank
remaining is functional, so that the blanks 20
result in conservation of the board.

25 Each end flap 23 has a guide tab 30
for guiding the end flaps by engagement with

the insides of the major end panels 21 during folding, as shown in Figure 2, and slits between the end panels 21, 22 and the end flaps 23 extend substantially to the meeting point of the fold lines between the side panels 25, 26 and the bottom panel 24 and the end flaps 23.

Figure 2 indicates, in accordance with one method of the invention of forming a carton from a paperboard blank as in Figure 1, an adhesive coating 31 applied within the inside area of each major end panel 21 projecting laterally (i.e., in the direction parallel to the length of the bottom panel 24) beyond the respective minor end panel 22, so that upon folding of the blank to bring the side panels 25, 26 parallel to each other with the minor end panels 22 and the end flaps 23 inside the major end panels 21, the adhesive coatings 31 form bonds between the insides of the major end panels 21 and the outsides of the minor end panels 22, to form the carton shown in Figure 3.

The full method will now be described with reference to Figures 4 to 15 showing a machine in accordance with another aspect of

the invention.

Each blank 20 is fed from a pack 32 in a magazine 33 onto a conveyor 34 with the side forming the interior of the carton uppermost and with the end panels 21, 22 aligned with the direction of travel of the conveyor, passing the blank on the conveyor through an adhesive applying station 35 (where the adhesive coating 31 is applied to each major end panel as aforesaid), passing the blank on the conveyor through an adhesive conditioning station 36 (where heat is applied to the adhesive coatings), feeding the blank from the conveyor onto a die 37 having a throat 38 corresponding substantially to the bottom panel 24, pushing the blank through the die by means of a plunger 39 engaging the bottom panel, the die having guide surfaces 40 whereby the end flaps 23 and minor end panels 22 are turned inside the major end panels, and applying roller pressure against the major end panels to press them against the minor end panels to cause the adhesive between them to form an adequate bond to hold the carton together upon being discharged from the die.

Figure 4 shows a motor 41 and gearbox

42 and - diagrammatically - driving mechanisms 43, 44, 45, 46, 47 to (respectively) a pick-out and transfer mechanism 48 (of well-known type) for feeding the blanks individually in succession from the magazine 33 onto the conveyor 34, to the conveyor itself, to a transfer mechanism 49 for feeding the blanks in succession from the conveyor onto the die 37, and to the plunger 39.

10 The conveyor 34 comprises two endless chains 50 (Figure 9) with pairs of lugs 51 for propelling the blanks over a deadplate 52 between the longitudinal beams 53 carrying adhesive-applying and conditioning equipment and guide rails all of which will now be
15 described in greater detail.

 The minor end panels 22 and the end flaps 23 are broken upwardly from the plane of the blank 20 as it is fed onto the conveyor 34, by means of guide rails 54 (Figures 5, 6 and 7), so as to hold them clear of the adhesive applying station 35 (and also ready for folding inside the major end panels 21).

20 The adhesive-applying station 35 has
25 adhesive-applying equipment comprising two sprays 55 applying water-based adhesive

intermittently in phase with the passing of the major end panels 21, the timing being controlled by a photocell detector 56 carried by one of a pair of guide rails 57, which are spaced from the breaker guide rails 54 by spacer guide rails 58 (which initially receive the major end panels 21). The sprays 55 are adjustable towards and away from each other by means of handwheels or knobs 59 (see also Figure 8).

The adhesive-conditioning station 36 is spaced from the adhesive-applying station 35 by guide rails 60 (see also Figure 9) and has adhesive-conditioning equipment comprising two hot air blowers 61 with nozzle boxes 62 having lower apertures 63 for directing hot air onto the adhesive coatings 31 applied to the major end panels 21, and side apertures 64 for directing hot air against the outsides of the minor end panels 22 (see also Figures 10 to 12), while the end flaps 23 are held clear by bar guides 65. The hot air blowers 61 may operate continuously, but if there is an interruption in the succession of blanks 20 sensed by the detector 56, whereupon the hot air is diverted, by diverter valves 66, into

upstanding exhaust pipes 67 and ducts 68
(Figure 4 only) exhausting above an attic 69,
which houses a separately powered air unit 70
providing air for the blowers 61 and suction
5 for the pick-out and transfer mechanism 48.
Each diverter valve 66 comprises a two-part
valve body 71 with alternative passages 72, 73
for the blown air from the blower 61 to
respectively the nozzle box 62 and the exhaust
10 pipe 67, under the control of a diverter 74
which is swung between its two positions
(Figures 11 and 12) by an arm 75 oscillated by
a pneumatic cylinder 76 and piston 77.

Beyond the adhesive-conditioning
15 station 36 the blanks 20 are carried by the
conveyor between guides 78 until they are fed
by the transfer mechanism 49 onto the die 37.
A pair of hold-down guides 79 prevent the
blanks from lifting from the conveyor at this
20 crucial stage, and similar pairs of hold-down
guides 80, 81 respectively are provided at the
adhesive-applying station 35 and between there
and the adhesive-conditioning station 36.

The transfer mechanism 49 comprises an
25 endless belt 82, driven by the drive mechanism
46, with an upper forwarding run extending

from a slot 83 in the end of the deadplate 52 of the conveyor, and with a spring-loaded nip roller 84 adjustable lengthwise of the upper run of the belt to set the position of the nip
5 between the roller 84 and the belt 82 to cease propelling each blank 20 as the latter moves into its final position on the die 37.

As can be seen particularly in Figure 13 (but also to some extent in Figure 4), the
10 drive mechanism 47 for the plunger 39 includes link rods 85 to a crosshead 86 to which is gimballled the upper end of a shaft 87 to the lower end of which is secured to the plunger 39. The shaft 87 has a non-circular cross-
15 section (e.g., it may be splined) and slides in corresponding bearings 88 on two out of three cross-beams 89 of a frame 90, so that the plunger 39 cannot rotate about the shaft axis (i.e., the plunger will be maintained in
20 correct alignment with the throat 38 of the die 37). The frame 90 also consists of two columns 91 (between which the cross-beams 89 are secured) and upper and lower pairs of brackets 92, 93 for securing the frame to the
25 end of the machine.

The die 37 (see also Figures 14 and

15) comprises an open-sided box 94 secured by brackets 95 to the columns 91, and a table 96 bolted on the top of the box 94. The table has a slot 97 into which curve two plates 98 adjustable towards or away from each other to set the width of the throat 38 closely to the width of the bottom panels 24 of the blanks 20, which are positioned on the table by pairs of guide rails 99, 100 and an end stop 101. The box 94 houses rollers 102 for guiding the folded blanks through the die as the blanks are pushed downwards by the plunger 39, and also houses rollers 103 (Figure 15 only) for applying pressure against the major end panels 21 to press them against the minor end panels 22 to cause the adhesive 31 between them to form an adequate bond to hold the carton together upon being discharged from the die 37.

Figure 13 also shows apertures 104, which are provided in both edges 105 of the plunger 39, suction being applied to the apertures via passages (not shown) in the plunger, rigid pipes 106 between the plunger and the crosshead 86, and flexible pipes 107 to the air unit 70, under the control of a

valve (not shown) actuated by a switch 108 engaged by the crosshead 86 when the plunger has entered the die, for the suction at the apertures 104 to hold the minor end panels 22
5 firmly to the edges 105 of the plunger, as is particularly advantageous when forming blanks of the type 20A shown in Figure 16 into cartons which, as shown by Figure 17, are much deeper and narrower than cartons of the
10 type shown in Figure 3.

To facilitate adapting of the machine to different sizes of cartons, the longitudinal beams 53 carrying the respective guide rails 54, 58, 57, 60, 78 and 80, 81, 82,
15 the adhesive-applying equipment 35 and the adhesive-conditioning equipment 36 are provided with brackets 109 (Figures 5 to 7) with holes 110 locating on pegs 111 upstanding from beams 112 (Figures 4 and 7), which have
20 quick-action clamps 113 for the brackets, thus enabling the beams 53 to be detached for interchange with similar beams appropriately equipped with guide rails etc. to suit other sizes of cartons. The detector 56, adhesive
25 sprays 55, the diverter valves 66 and the transfer mechanism 49 are conveniently readily

transferable from one set of beams 53 to another, to save duplication of too many parts not requiring different dimensions.

5 Likewise, the frame 90 with its plunger 39 and die 37 are readily detachable from the machine as a unit for interchange with a similar frame appropriately equipped with plungers and dies to suit other sizes of cartons.

10 For operation of the machine for forming similar cartons from blanks precoated with thermoplastic or thermosetting adhesive or from blanks made of thermoplastic, in accordance with another method aspect of the
15 present invention, the adhesive-applying station 35 can be removed, or its sprays 55 rendered inoperative, the adhesive-conditioning station 36 then becoming an adhesive-activating station, with the hot air
20 blown by the blowers 61 activating the thermoplastic or thermosetting adhesive at least within the inside area of each major end panel 21 projecting laterally beyond the respective minor end panel 22 (i.e., the area
25 corresponding to that of the sprayed adhesive coating 31 in Figure 2), or with the hot air

softening the surface of a thermoplastic blank within that same area of each major end panel to an extent that enables it to form an adequate bond with the respective minor end panel. The same nozzle boxes 62 may be used, with hot air from the apertures 64 heating the uncoated outside of the minor end panel, or activating thermoplastic or thermosetting adhesive thereon, or softening the surface of a thermoplastic blank additionally on the outside of the minor end panel, to form an extremely good bond with the inside of the major end panel.

The methods and machine in accordance with the invention will be seen to be applicable to the widest possible range of flat stock, including thermoplastic blanks, as well as virtually any paperboard capable of bonding by water-based adhesive conditioned by hot air and also any paperboard carrying or coated - on one or both sides - with thermoplastic or thermosetting adhesive. Because the various steps or stations are spaced horizontally, the speed at which cartons can be formed is not restricted to the total cycle time of the operations performed

at these steps or stations. The operations requiring most time (i.e., the application and conditioning or the activation of the adhesive - or thermoplastic) merely take up more
5 length along the conveyor and so do not slow down the rate at which blanks are fed from the pack or the rate at which blanks are pushed through the die. The total cycle time will be greater, but the speed of forming cartons
10 will only be limited by the maximum speed at which blanks can be moved by the conveyor and kept under full control by the various guides. A speed of seventy-five cartons per minute is perfectly feasible with one conveyor, but the
15 comparatively simple nature of the equipment and drive mechanisms associated therewith makes it also very feasible to incorporate two or more similarly equipped conveyors in one machine (with one motor and gearbox, and one
20 air unit) to obtain machine speeds of one hundred and fifty cartons per minute or in excess of two hundred cartons per minute, as may be required for a product packaging line.

CLAIMS

1. A method of forming a carton of the type initially defined comprising the steps of feeding the blank (20) from a pack (32) onto a conveyor (34) with the side forming the interior of the carton uppermost and the end panels (21, 22) aligned with the direction of travel of the conveyor, passing the blank on the conveyor through an adhesive applying station (35), applying an adhesive coating (31) within the inside area of each major end panel (21) projecting laterally beyond the respective minor end panel (22), passing the blank on the conveyor through an adhesive conditioning station (36), applying heat to the adhesive coatings, feeding the blank from the conveyor onto a die (37) having a throat (38) corresponding substantially to the bottom panel (24), pushing the blank through the die by means of a plunger (39) engaging the bottom panel, the die (37) having guide surfaces (40) whereby the end flaps (23) and minor end panels (22) are turned inside the major end panels (21), and applying roller pressure against the major end panels to press them against the minor end panels to

cause the adhesive between them to form an adequate bond to hold the carton together upon being discharged from the die.

2. A method as in Claim 1, wherein the adhesive is a water-based adhesive applied by spraying intermittently in phase with the passing of the major end panels (21), and then
5 dried by hot air blown thereon as the major end panels pass through the adhesive-conditioning station (36).

3. A method as in Claim 1 or Claim 2, wherein the minor end panels (22) are broken upwardly from the plane of the blank (20) as it is fed onto the conveyor (34) and the end
5 flaps (23) are likewise broken upwardly from the plane of the blank as it is fed onto the conveyor.

4. A method as in Claim 2 and Claim 3, wherein hot air from the adhesive-conditioning station (36) is blown onto the outsides of the minor end panels (22).

5. A method as in any one of Claims 1 to 4, wherein suction is applied through apertures (104) in the vertical edges (105) of the plunger (39) to hold the minor end panels
5 (22) closely thereto.

6. A method of forming a carton of the type initially defined from blanks (20) precoated with thermoplastic or thermosetting adhesive or formed of thermoplastic material comprising the steps of feeding the blank (20) from a pack (32) onto a conveyor (34) with the side forming the interior of the carton uppermost and the end panels (21, 22) aligned with the direction of travel of the conveyor, passing the blank on the conveyor through an adhesive activating station (36), activating adhesive at least within the inside area (31) of each major end panel (21) projecting laterally beyond the respective minor end panel (22), feeding the blank from the conveyor onto a die (37) having a throat (38) corresponding substantially to the bottom panel (24), pushing the blank through the die by means of a plunger (39) engaging the bottom panel, the die (37) having guide surfaces (40) whereby the end flaps (23) and minor end panels (22) are turned inside the major end panels (21), and applying roller pressure against the major end panels to press them against the minor end panels to cause the adhesive between them to form an adequate bond

to hold the carton together upon being discharged from the die.

7. A method as in Claim 6, wherein the minor end panels (22) are broken upwardly from the plane of the blank (20) as it is fed onto the conveyor (34), and the end
5 flaps (23) are likewise broken upwardly from the plane of the blank as it is fed onto the conveyor.

8. A method as in Claim 7, wherein the adhesive activating station (36) directs heat in two directions, one downwardly for the insides of the major end panels (21) and
5 one laterally for the outsides of the minor end panels (22).

9. A method as in any one of Claims 6 to 8, wherein suction is applied through apertures (104) in the vertical edges (105) of the plunger (39) to hold the minor end panels
5 (22) closely thereto.

10. A machine for forming cartons of the type initially defined comprising an endless conveyor (34), a magazine (37) for the blanks (20) inclined downwardly towards the
5 leading end of the upper run of the conveyor, a pick-out and transfer mechanism (48) for

feeding the blanks individually in succession from the magazine onto the conveyor with the side forming the interior of the carton uppermost and the end panels (21, 22) aligned with the direction of travel of the conveyor, adhesive-applying equipment (35) and adhesive-conditioning or activating equipment (36) disposed above the conveyor, a die (37) beyond the trailing end of the upper run of the conveyor and having a throat (38) corresponding substantially to the bottom panel (24), a transfer mechanism (49) for feeding the blanks in succession from the conveyor onto the die, a plunger (39) for pushing each blank in turn through the die by engaging the bottom panel, the die (37) having guide surfaces (40) whereby the end flaps (23) and minor end panels (22) are turned inside the major end panels (21), rollers (103) for applying pressure against the major end panels (21) to press them against the minor end panels (22) to cause the adhesive (31) between them to form an adequate bond to hold the carton together upon being discharged from the die, a motor (41), and driving mechanisms (43 to 47) connecting the motor to the conveyor

(34), the transfer mechanisms (48, 49) and the plunger (39).

11. A machine as in Claim 10, wherein the conveyor (34) is provided with pairs of lugs (51) for propelling the blanks (20) positively, and is also provided with guide rails (54) for breaking the minor end panels (22) and end flaps (23) upwardly from the plane of the blanks.

12. A machine as in Claim 10 or Claim 11, wherein adhesive-applying equipment (35) comprises sprays (55) applying water-based adhesive intermittently.

13. A machine as in Claims 10 and 11 or Claim 12, wherein adhesive-conditioning or activating equipment (36) comprises hot air blowers (61) operating continuously or intermittently in phase with the passing of blanks (20) along the conveyor (34).

14. A machine as in any one of Claims 10 to 13, wherein the vertical edges (105) of the plunger (39) are provided with apertures (104), with passages through the plunger and flexible pipes (107) to a source of suction (70).

15. A machine as in any one of Claims

10 to 14, wherein the transfer mechanism (49)
for feeding the blanks (20) in succession from
the conveyor (34) onto the die (37) comprises
5 an endless driven belt (82) having an upper
run in extension of the conveyor, and a
spring-loaded nip roller (84) adjustable
lengthwise of the upper run of the belt.

16. A machine as in any one of Claims
10 to 15, wherein the conveyor (34) is flanked
by longitudinal beams (53) carrying the
respective guide rails (54, 58, 57, 60, 78 to
5 819, adhesive-applying equipment (35) and
conditioning or activating equipment (36)
spaced longitudinally and projecting laterally
appropriately to one size of carton blank and
the die (37) and plunger (39) are carried
10 together on a common frame (90), the die and
plunger having cross-sectional dimensions and
heights appropriate to one size of carton,
the longitudinal beams (53) and frame (90)
being readily attachable and detachable, for
15 interchange with similar beams and frames
appropriately equipped to suit other sizes of
cartons.

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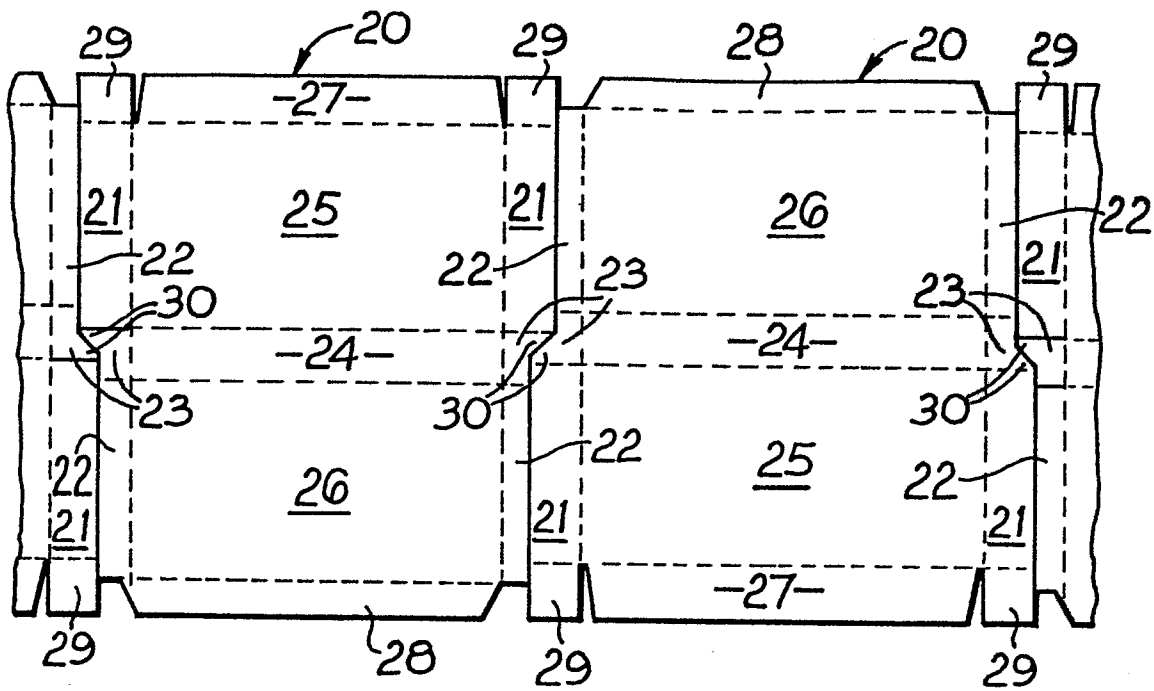


Fig. 1

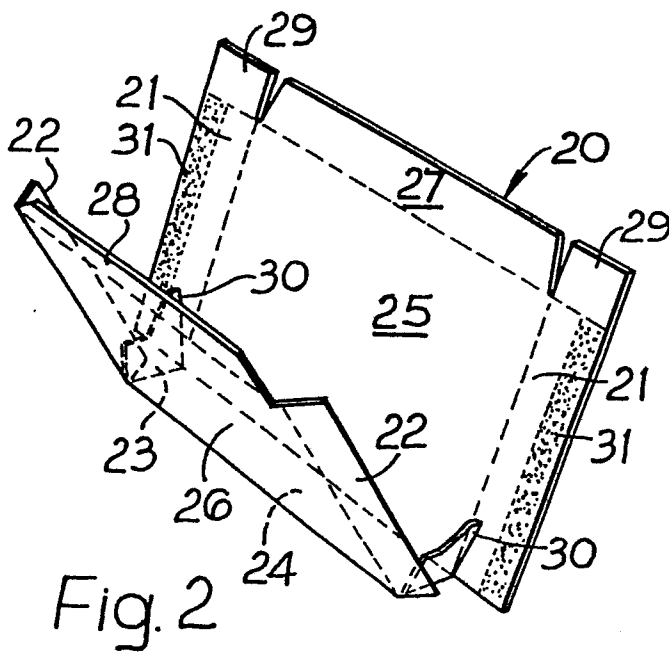


Fig. 2

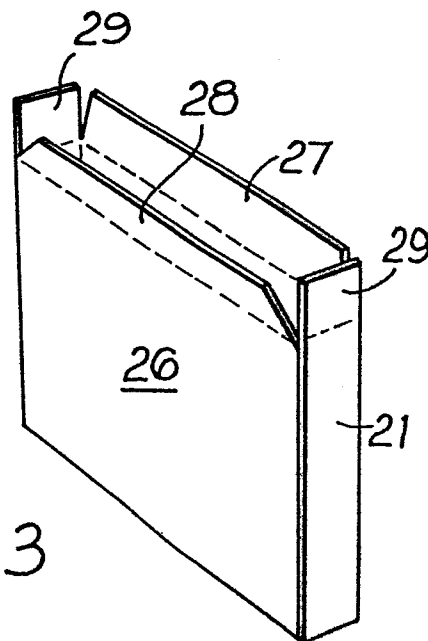


Fig. 3

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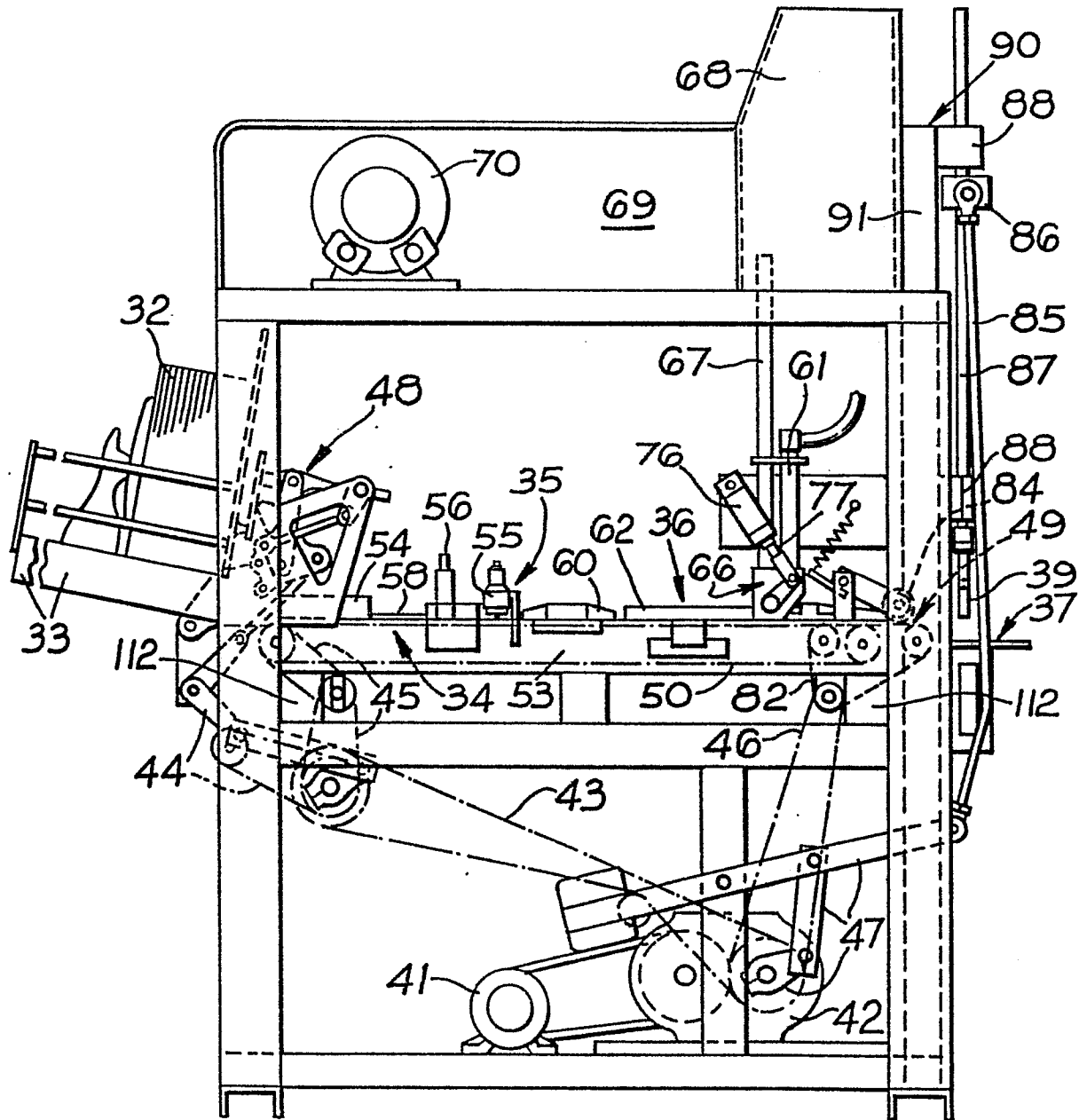
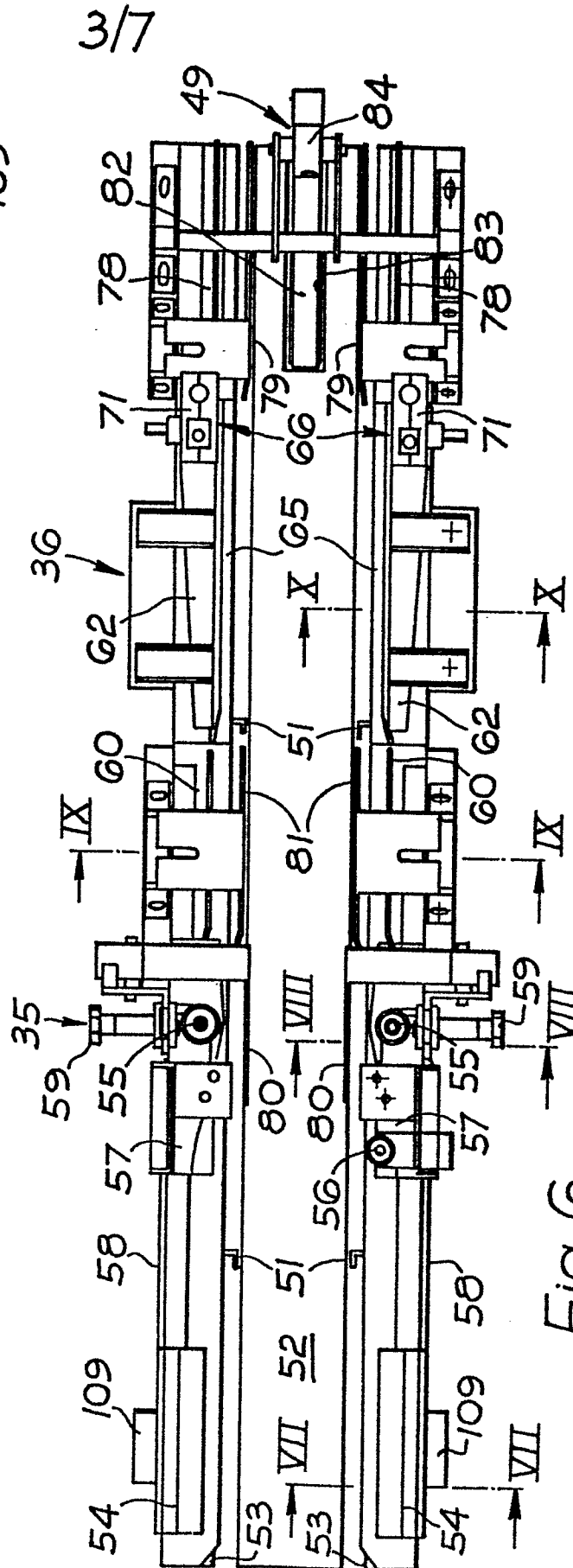
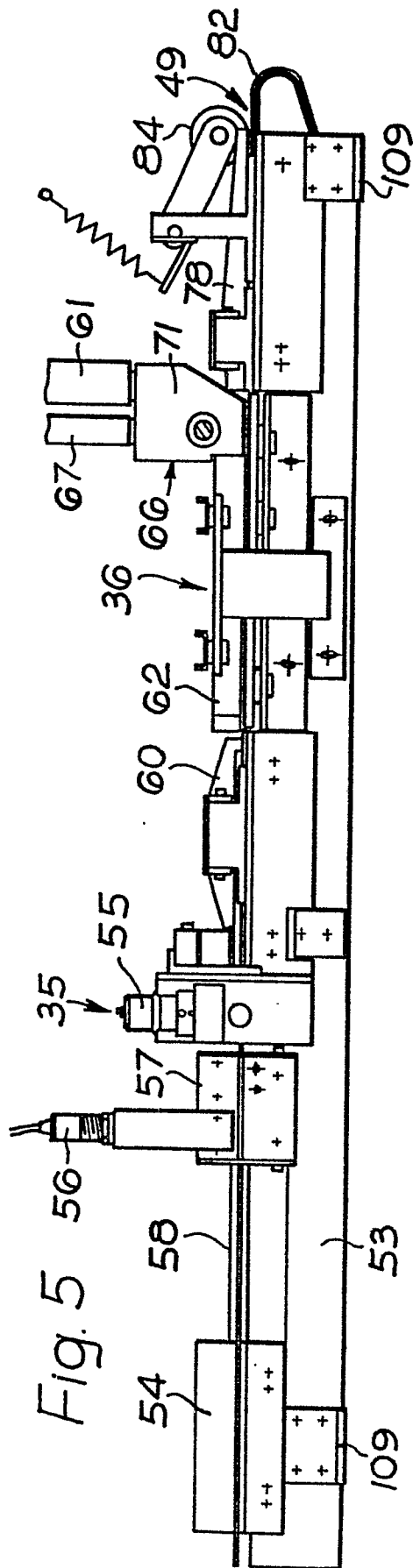


Fig. 4



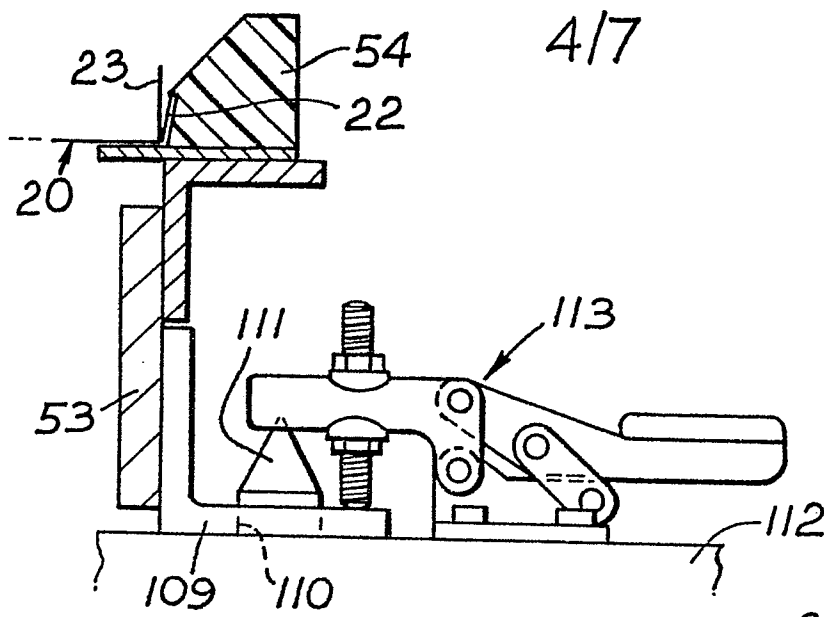


Fig. 7

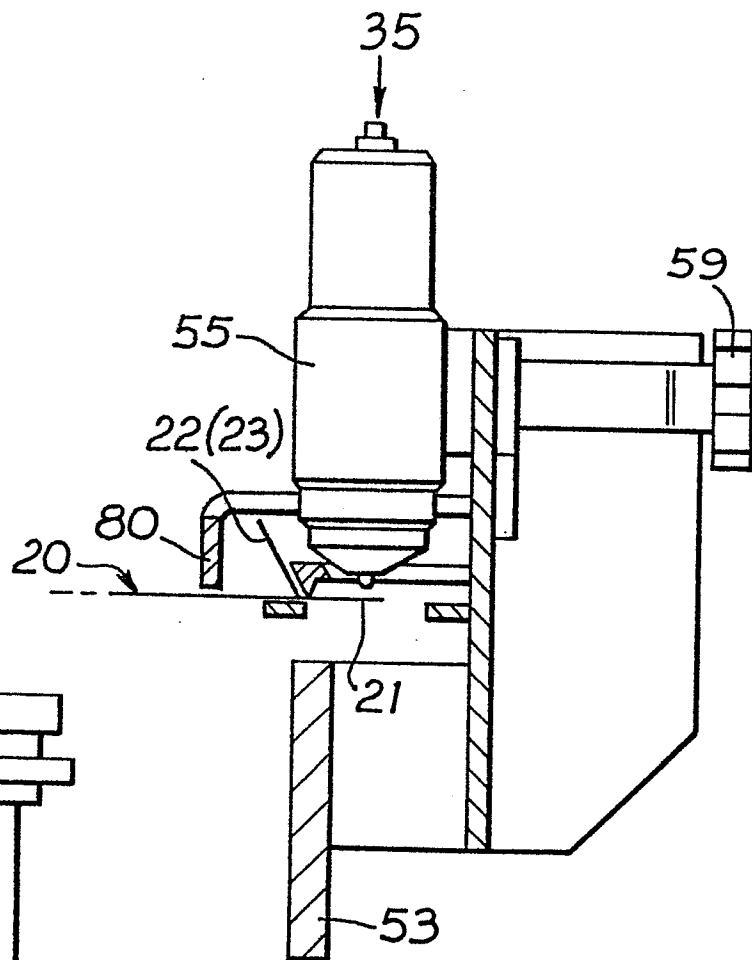


Fig. 8

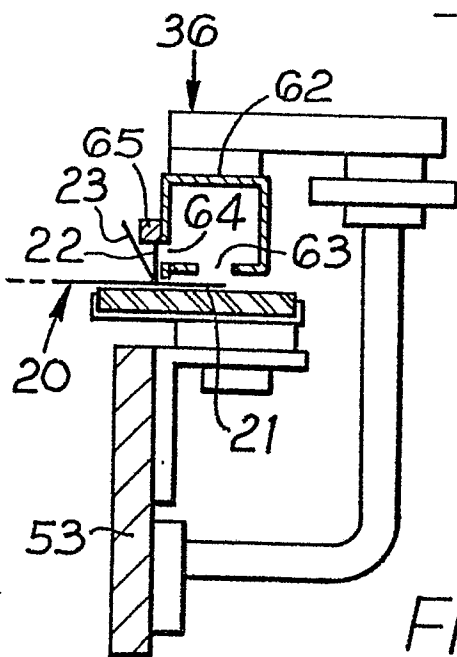


Fig. 10

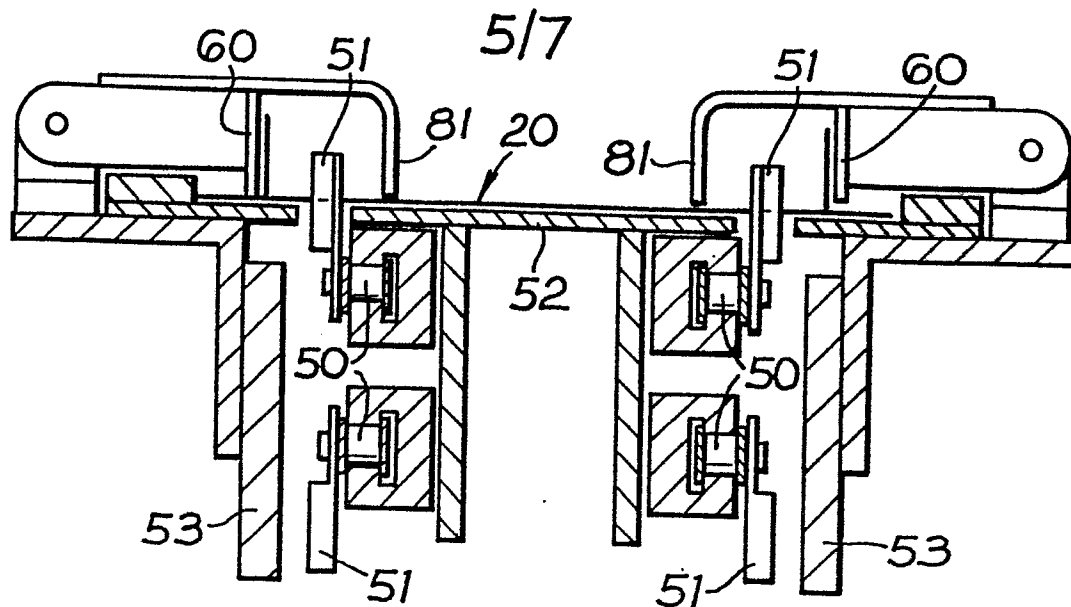


Fig. 9

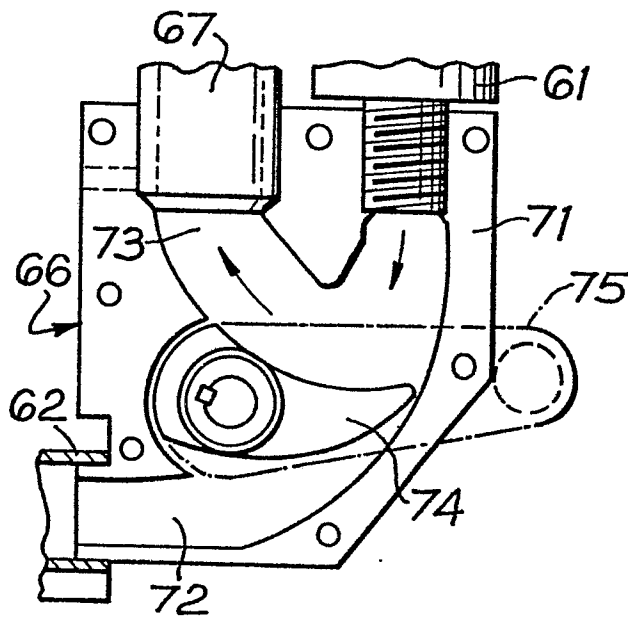


Fig. 11

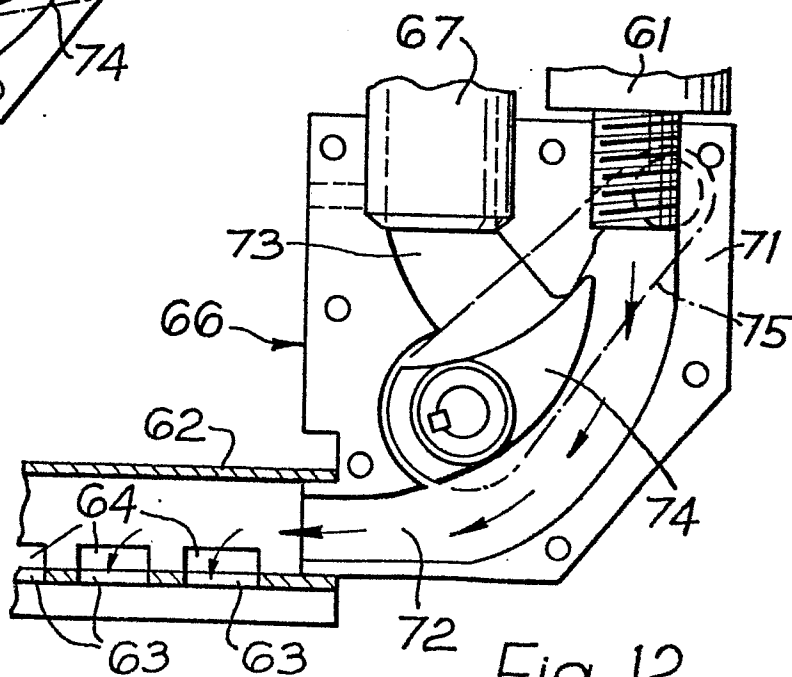


Fig. 12

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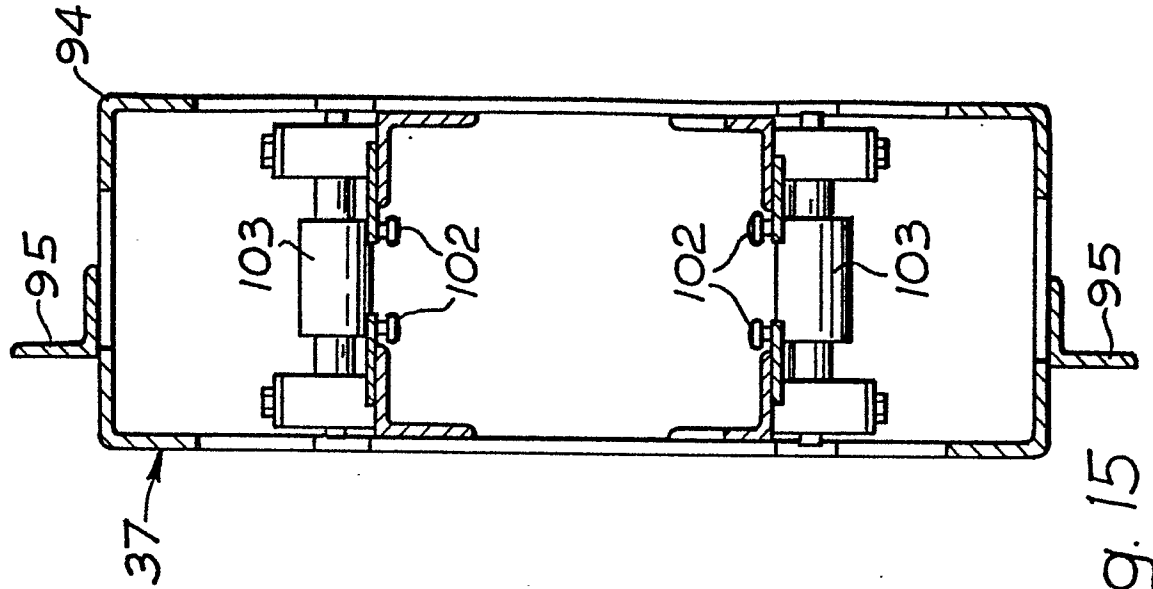


Fig. 15

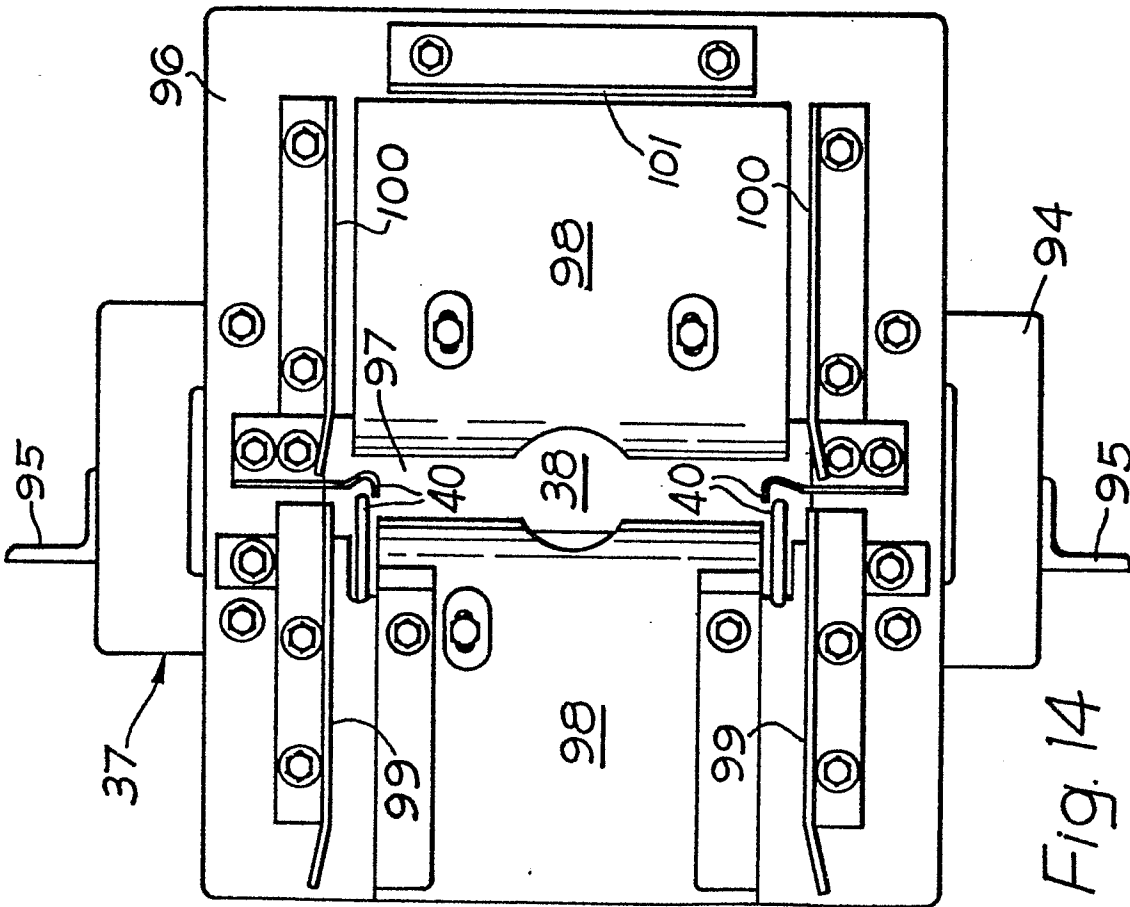
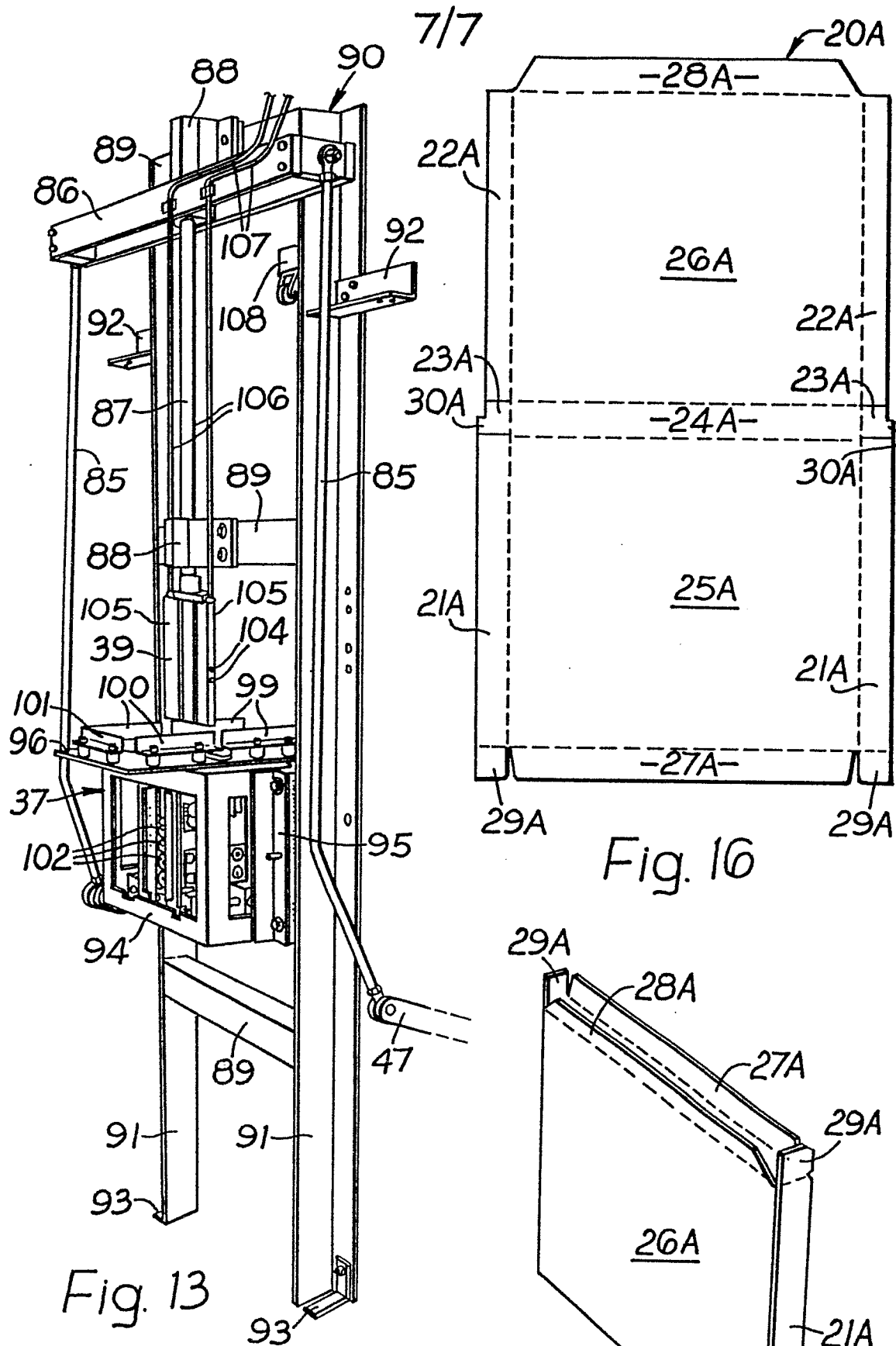


Fig. 14





European Patent
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EUROPEAN SEARCH REPORT

0105559

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 83201378.3
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
X	GB - A - 2 093 762 (METAL BOX LIM.) * Page 1, lines 1-93; page 2, line 112 - page 3, line 44; fig. 1 *	1,2,4,6	B 31 B 1/46
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A	US - A - 4 345 905 (L.E. MOEN) * Abstract; fig. 1 *	10,11,16	
	--		
A	GB - A - 1 187 258 (META BOX COMP. LIM.) * Totality *	10	
	--		
D,A	GB - A - 1 424 035 (KLIKLOK CORP.) * Page 1, line 74 - page 3, line 56; fig. 1,3 *	1,4	

			TECHNICAL FIELDS SEARCHED (Int. Cl. 7)
			B 31 B 1/00
			B 31 B 3/00
			B 31 B 5/00
			B 65 D 5/00
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 16-12-1983	Examiner HABART
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone		T : theory or principle underlying the invention	
Y : particularly relevant if combined with another document of the same category		E : earlier patent document, but published on, or after the filing date	
A : technological background		D : document cited in the application	
O : non-written disclosure		L : document cited for other reasons	
P : intermediate document		& : member of the same patent family, corresponding document	