

[54] **METHOD OF, AND MEANS FOR FOLDING
A CONTAINER BLANK INTO A TUBULAR
BODY**

[75] Inventor: **Jan F. Palsson**, Lund, Sweden

[73] Assignee: **Tetra Pak Development S.A.**,
Lausanne, Switzerland

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Primary Examiner—Roy Lake

Assistant Examiner—James F. Coan

Attorney, Agent, or Firm—Pierce, Scheffler & Parker

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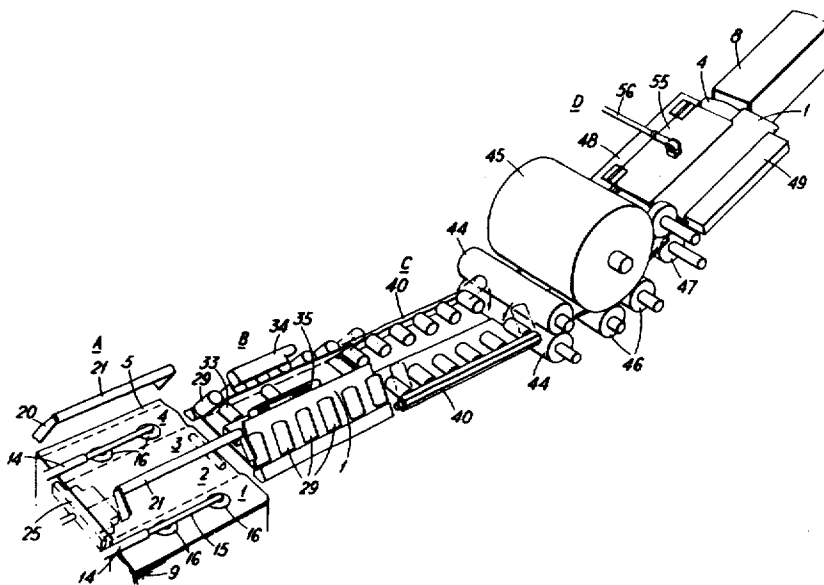
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[57] **ABSTRACT**

An arrangement for forming a container blank into a tubular body, the blank having fold lines defining four side wall panels foldable into a tubular container of rectangular cross-section, wherein opposite heat-sealable free edge-zones of the blank are subjected to heating, the blank is folded to bring the heated edge zones into overlapping contact thereby to seal them together and the flattened tubular body thus formed is then "squared" for subsequent filling.

25 Claims, 11 Drawing Figures



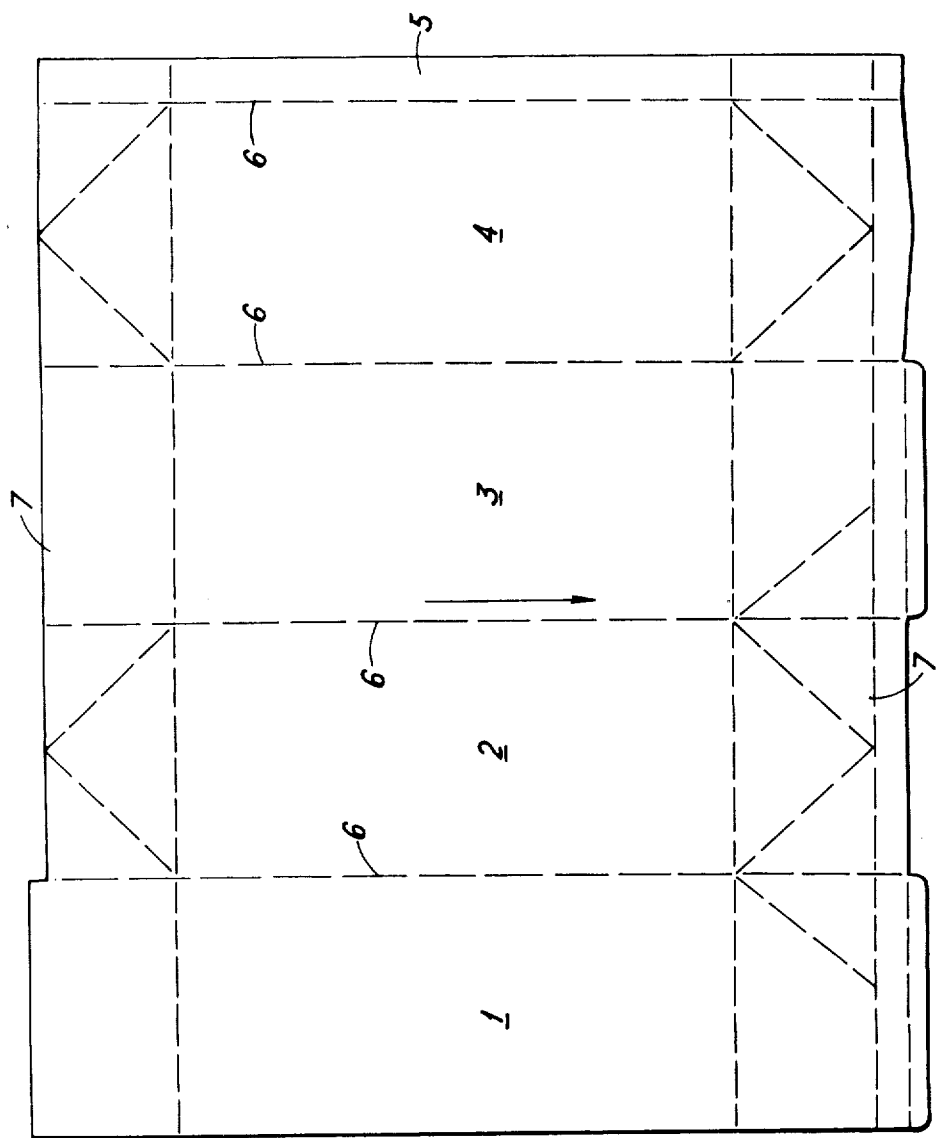
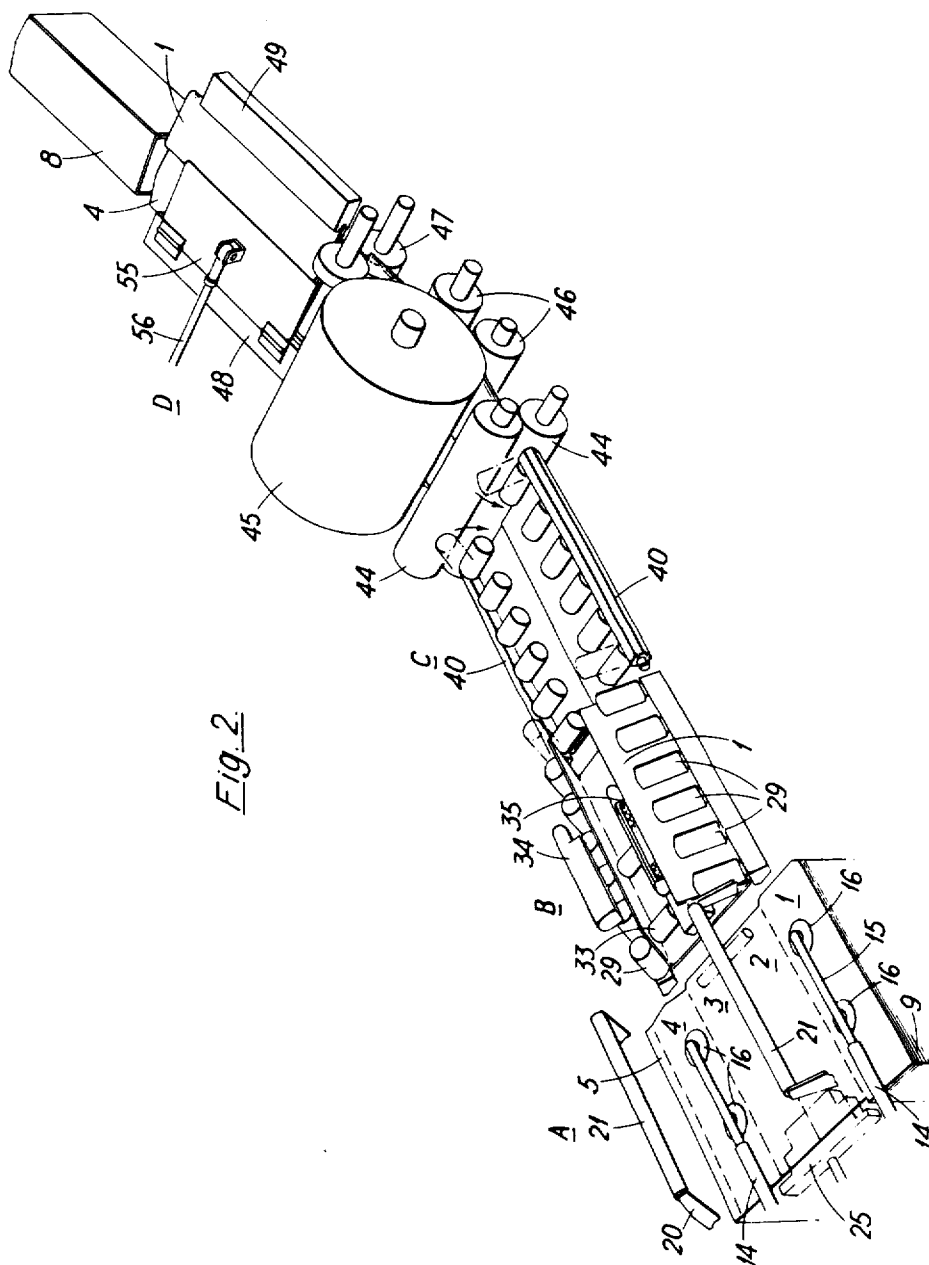
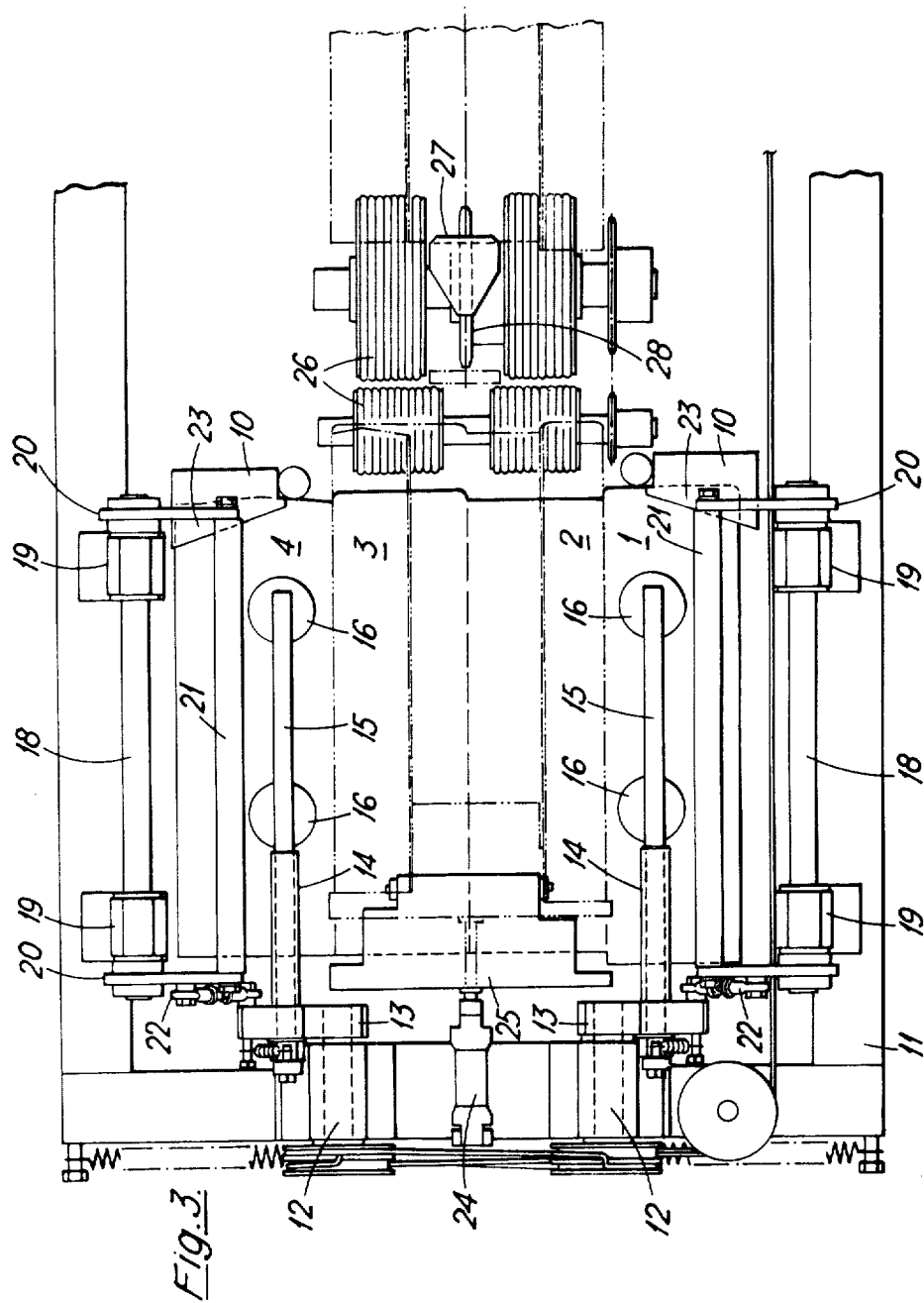
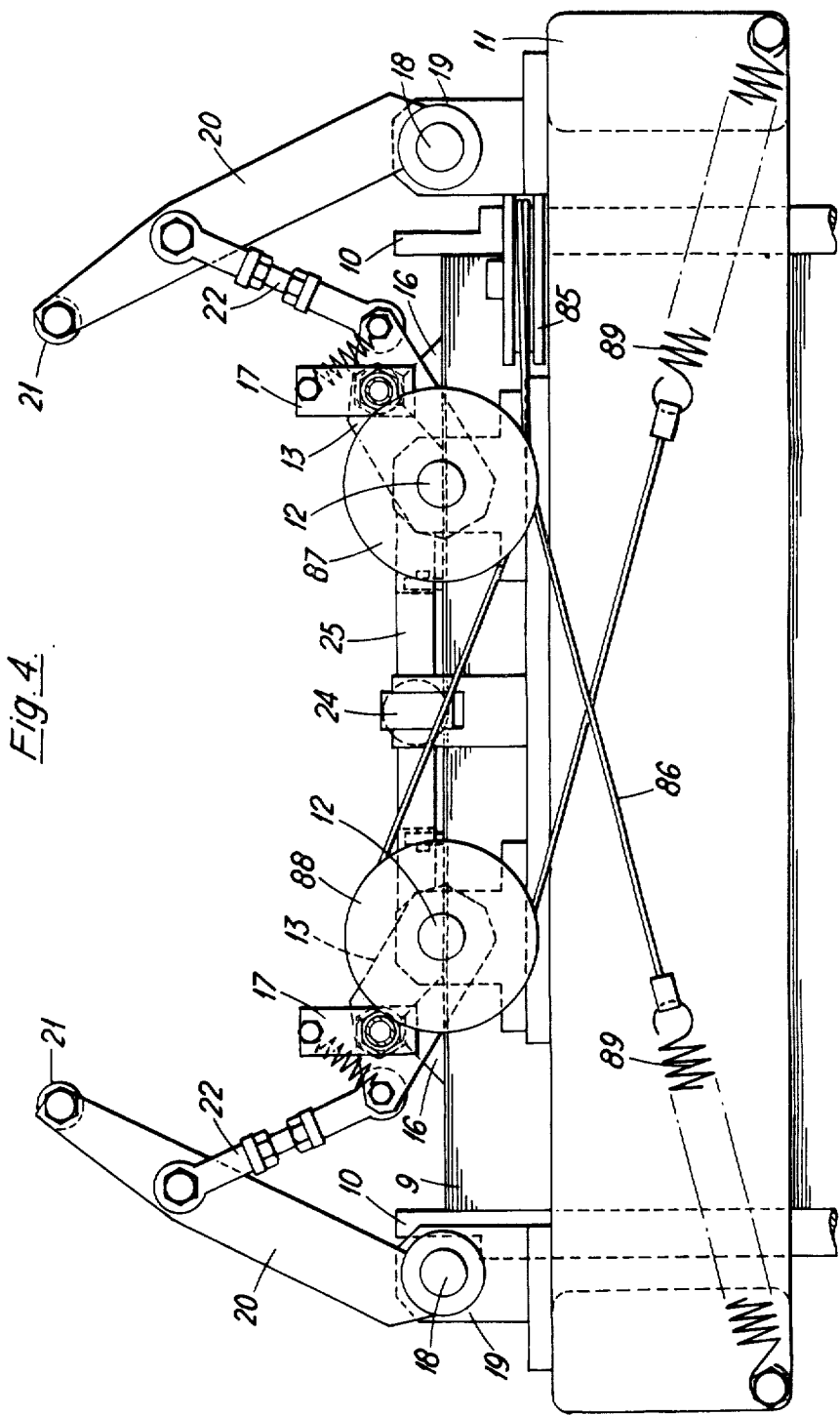
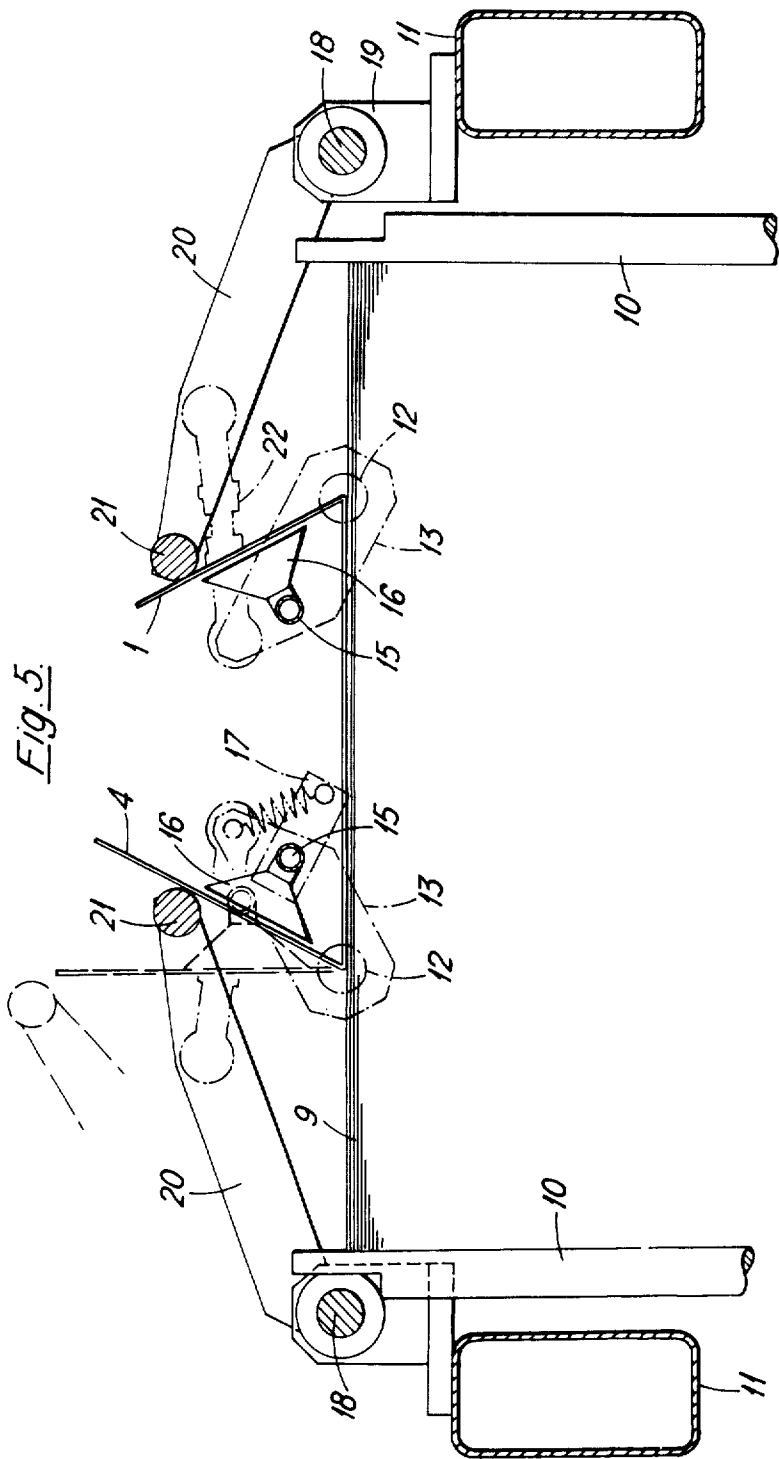


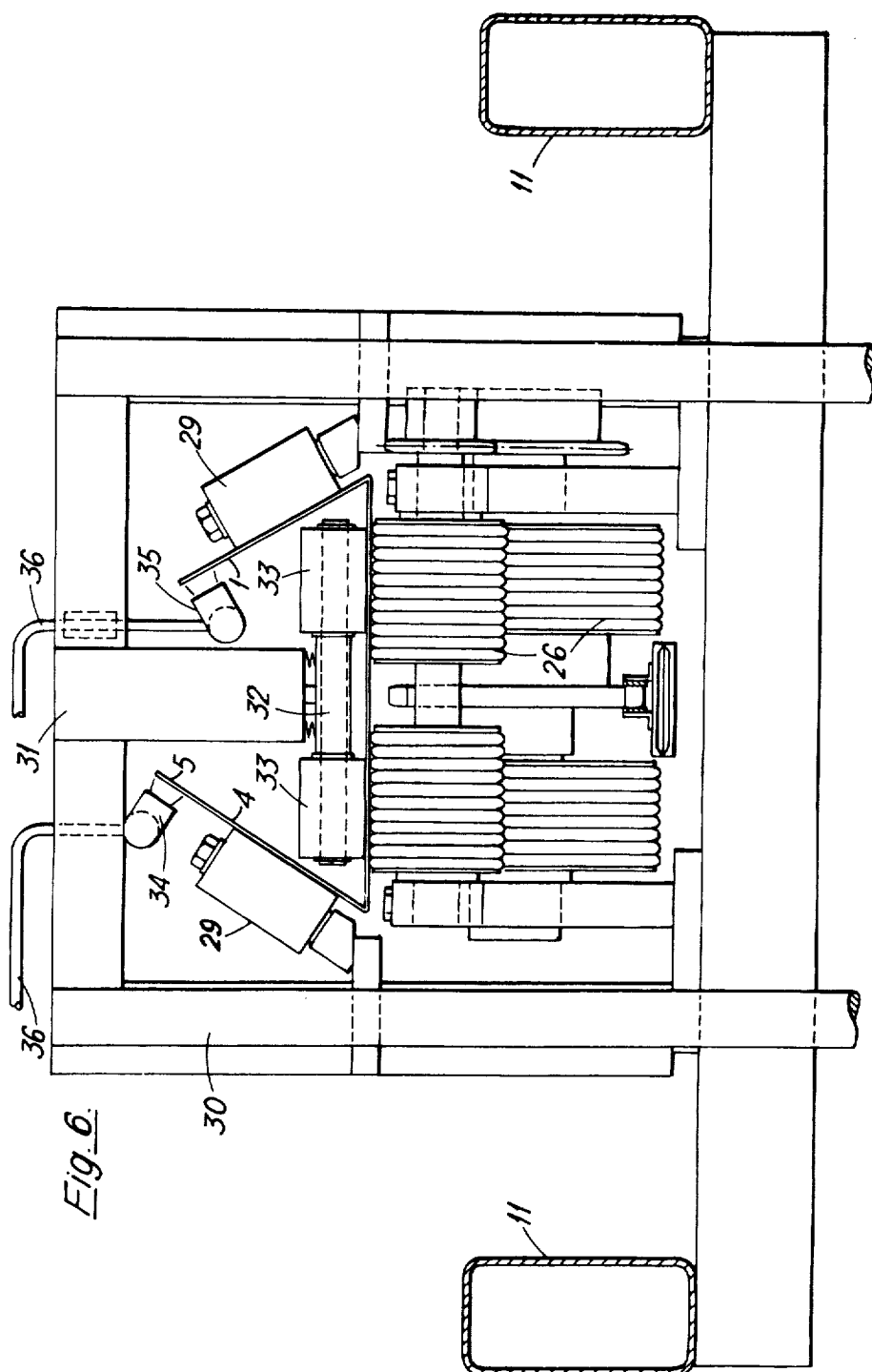
Fig. 1.











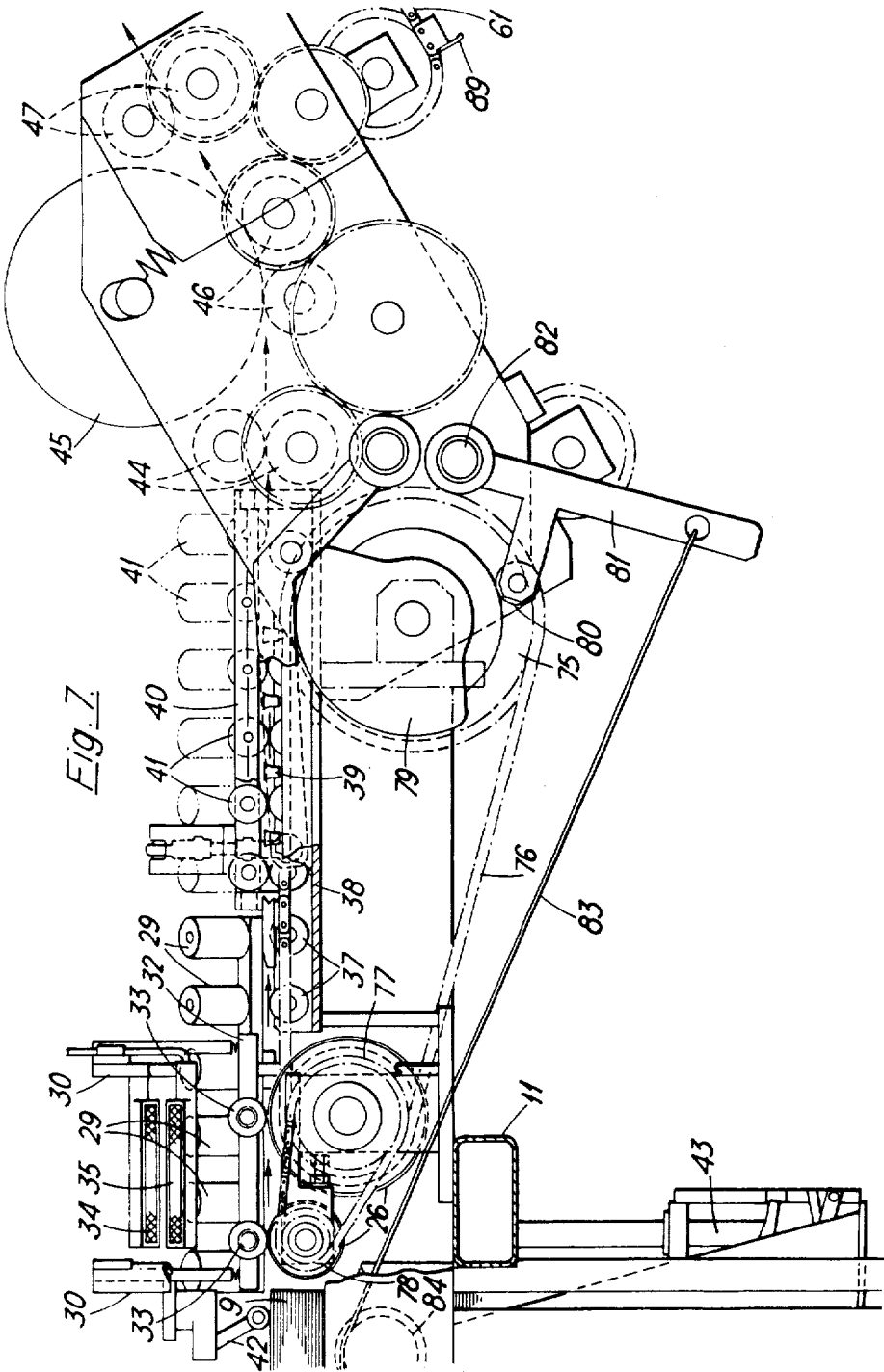
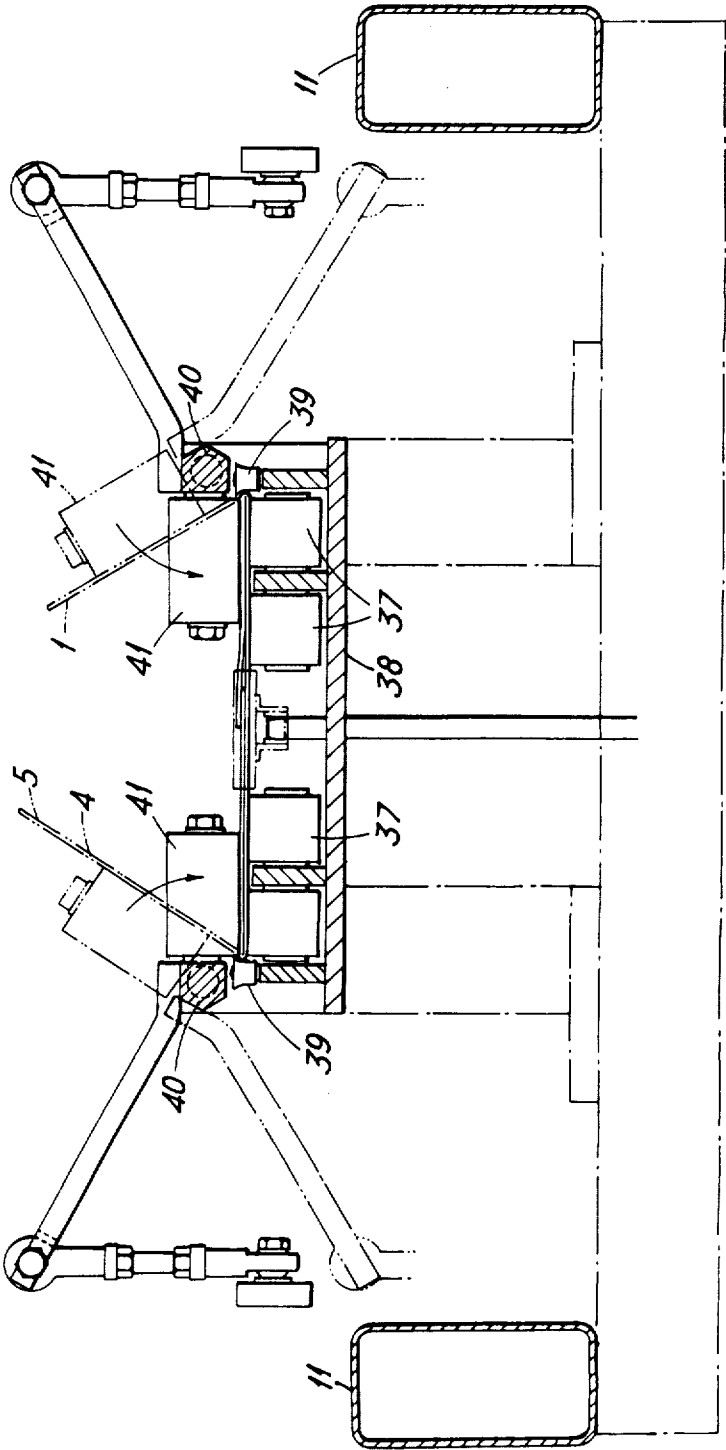
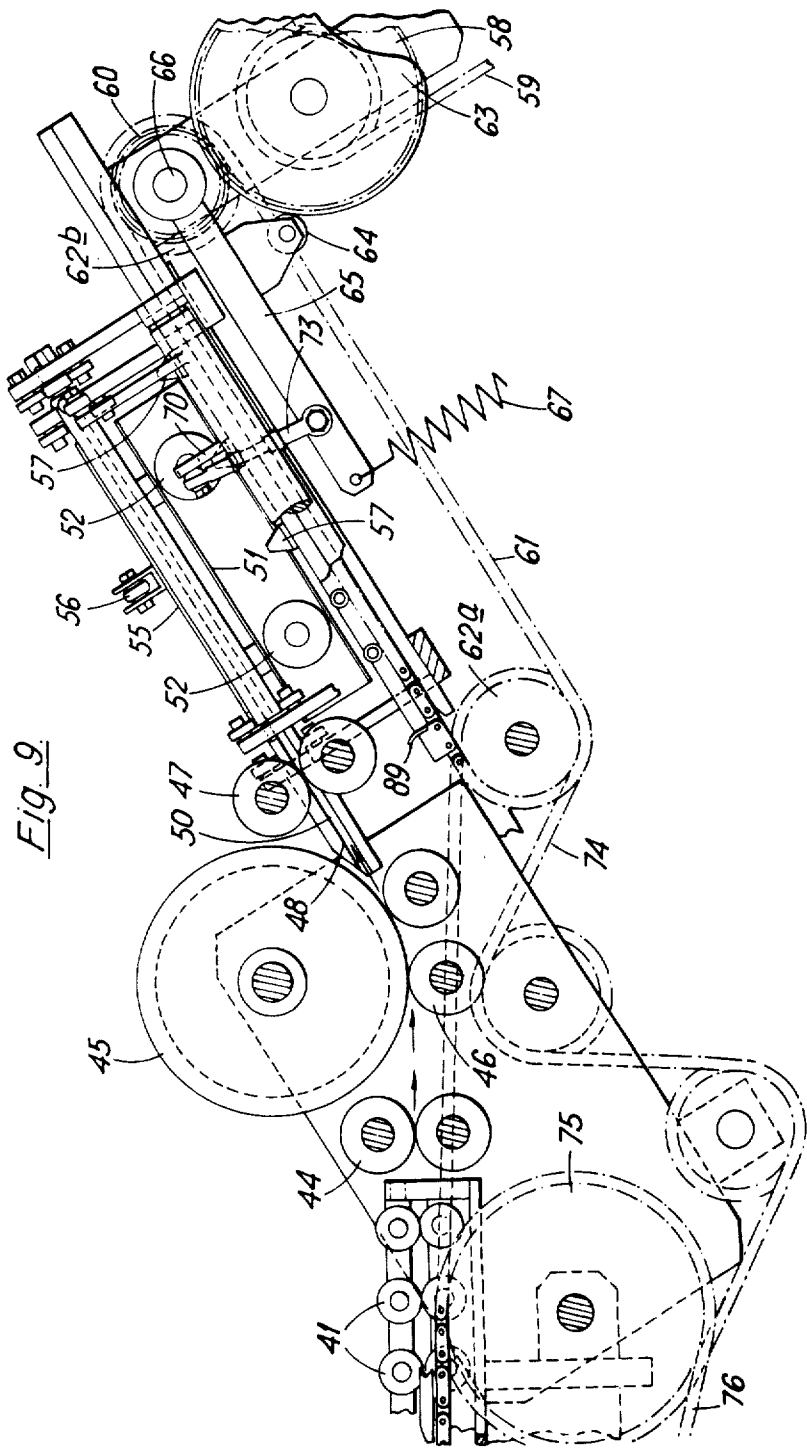


Fig. 8





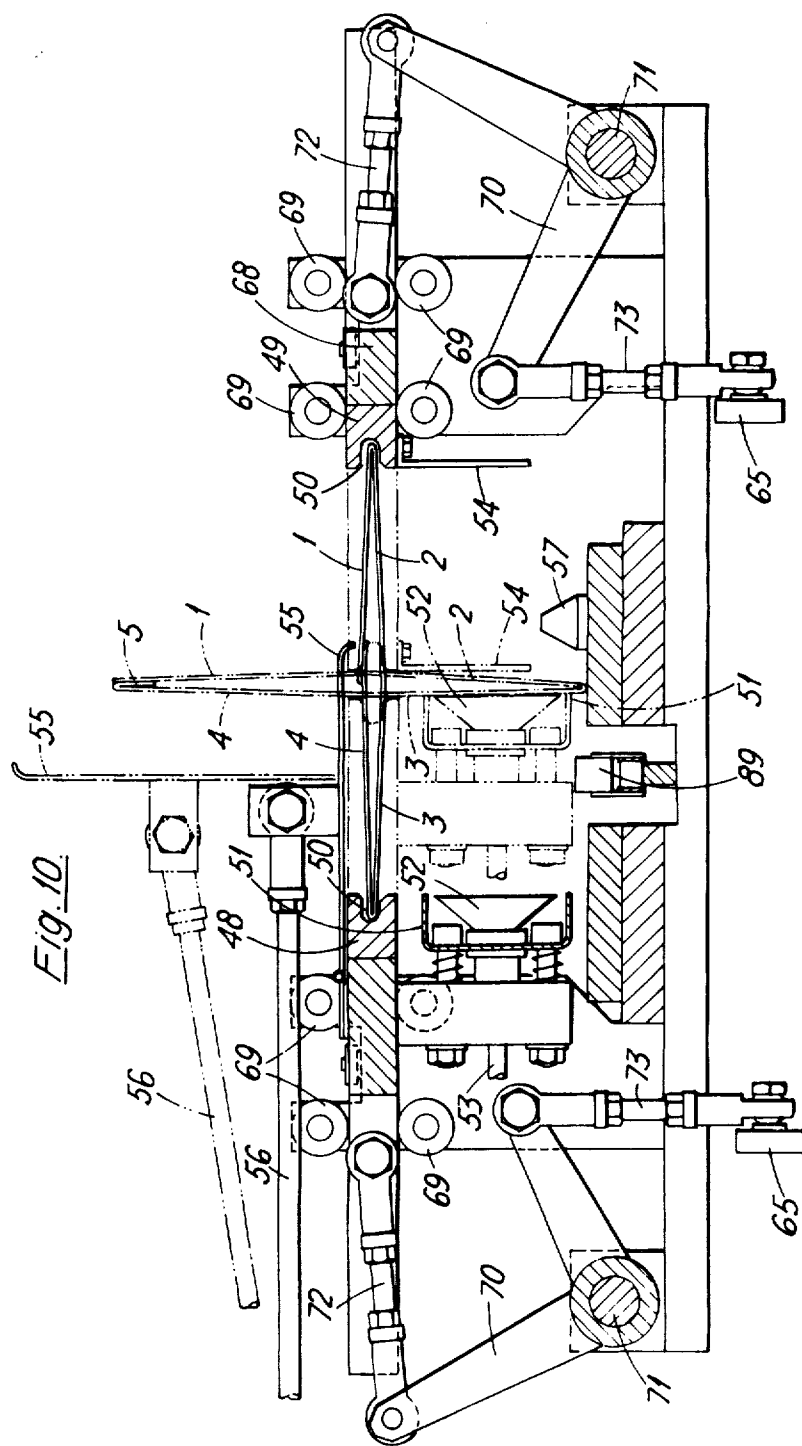
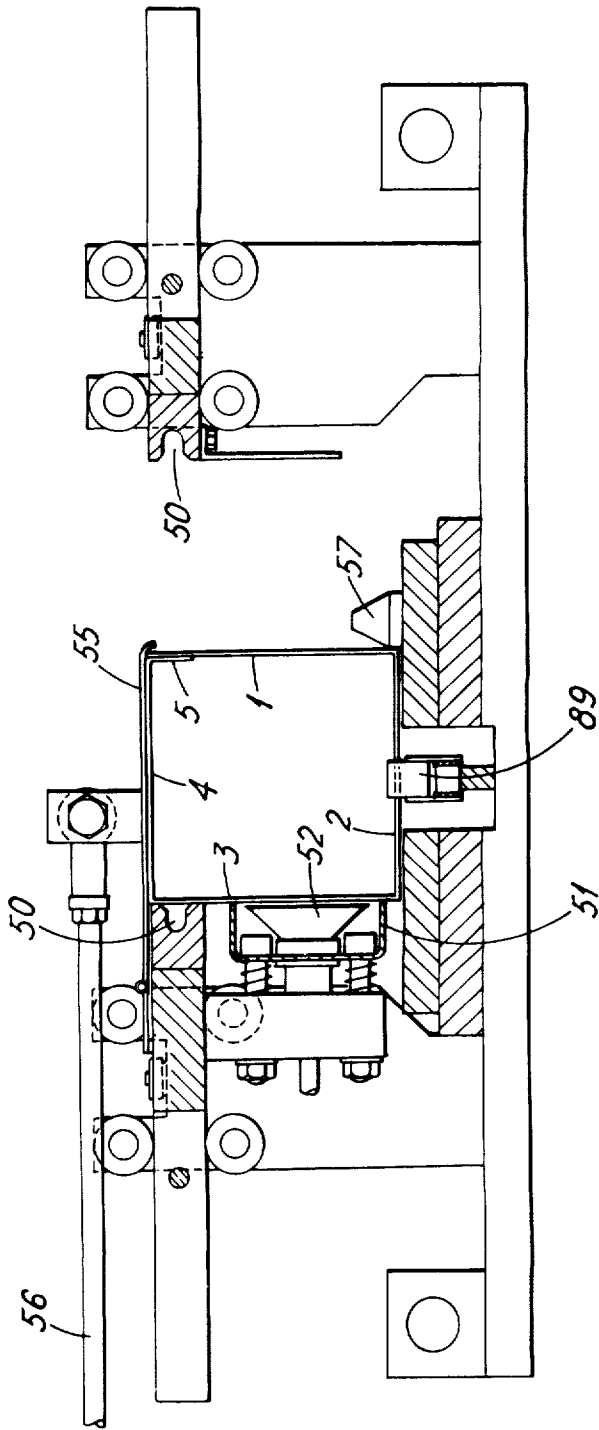


Fig. 11.



METHOD OF, AND MEANS FOR FOLDING A CONTAINER BLANK INTO A TUBULAR BODY

This invention relates to the forming of container blanks into tubular bodies, and more especially to the initial stage of erecting a blank, for example of cardboard with plastics coating, previously cut to shape, and having fold lines therein to define four side wall panels foldable into a tubular container body of rectangular cross-section, and secured together along contacting free edges.

The invention consists in a method of forming a container blank into a tubular body, wherein opposite heat-sealable free edge-zones of the blank are subjected to heating, the blank is folded flat to bring said heated zones to overlapping contact, whereupon they are sealed together, and the flattened tubular body thus formed is "squared" for subsequent filling.

Side panels of the blank may be folded to move the edge-zones a convenient position for heating. The blank may be advanced by suitable means to positions when the various steps, viz, heating edge-zones, sealing the edge-zones, and squaring the body, are performed.

Apparatus in accordance with the invention for carrying out the aforesaid method comprises means for heating sealable edge-zones of a blank means for bringing and sealing together the heated edge-zones, and means for squaring the body formed by such edge-zone sealing.

A blank for forming into a body as aforesaid may comprise panels (constituting side walls of the set-up container) hinged together along fold-lines indented in the blank, and conveyor means may be provided in the apparatus for advancing a blank, in a direction parallel to said fold lines, through the apparatus. At successive stages the apparatus may comprise means for lifting, and holding up, the outer panels of the blank: means for heating sealable edge-zones of the held-up panels: means for folding together said two outer panels, and sealing together these overlapping edge-zones: and means for relative flexing of the side panels of the tubular body formed by said edge-zone sealing in order to square the body for a subsequent operation.

The invention further consists in a container body whenever formed by the method, or by use of the apparatus referred to above.

The invention will be clearly understood from the following description of one form (given, however, merely by way of example) which it may assume, and this description will be more readily followed by reference to the accompanying drawings wherein

FIG. 1 represents in plan a container blank suitable for use in carrying the invention into effect,

FIG. 2 represents in perspective a somewhat simplified or diagrammatic view of apparatus in accordance with the invention for forming a blank such as shown in FIG. 1 into a tubular body,

FIG. 3 represents in plan the rear or in-feed end section of the machine shown in FIG. 2,

FIGS. 4 and 5 represent end-elevational views of the section of the machine shown in FIG. 3, in different operative positions,

FIG. 6 represents in transverse sectional elevation a second, heating, section of the apparatus shown in FIG. 2, looking in the direction of advance of a blank under treatment.

FIG. 7 represents a side elevational view of the section of the apparatus shown in FIG. 6, and a succeeding, sealing, section of the apparatus,

FIG. 8 represents a transverse sectional elevation of the sealing section of the apparatus included in FIG. 7, looking in the direction of advance of a blank,

FIG. 9 represents in side elevation a further section of the apparatus shown in FIG. 2 for squaring a container body after edge-sealing, and

FIGS. 10 and 11 represent transverse sectional elevations of the squaring section shown in FIG. 9, in different operative positions.

In carrying the invention into effect in one convenient manner, as shown in the aforesaid drawings, apparatus is provided for forming into a tubular body a container blank (made, for example, of plastics-coated cardboard) such as shown in FIG. 1, comprising four panels 1, 2, 3 and 4 with a sealing flap 5, in side-by-side relationship, articulated together along fold-lines 6, and having at opposite ends flap portions 7 defined by fold-lines, which close the ends of the container resulting from final erection of the blank.

The first stage of erection of a blank such as shown in FIG. 1 is to secure the sealing flap 5 to the free edge of the opposite panel 1, in order to form a tubular body with the flap portions 7 projecting from opposite ends, and the present invention is concerned with the execution of this stage of erection.

One form of apparatus in accordance with the invention for the aforesaid operation is illustrated, in simplified form, in FIG. 2 of the drawings and comprises four sections adapted to operate in sequence upon a blank advanced through the apparatus, (in the direction of the arrow shown in FIG. 1) by suitable conveyor means.

In section A of the apparatus the side panels of the uppermost blank of a pile are folded up about their fold lines, and held up by retainer bars while the blank is advanced to section B.

While passing through section B the side panels are held up by rollers while the plastics-coated edge-zones of the blank are heated in readiness for sealing.

The blank proceeds to section C where another set of rollers folds down the side panels so that their heated edge-zones overlap, and the blank, thus folded, passes between pressure rollers which ensure the sealing together of the edge-zones.

From section C the folded and sealed blank, in flat condition, passes to section D incorporating means for flexing the side panels 1, 2, 3 and 4 in relation to one another about their fold lines 6, and shaping the blank into a rectangular tubular body 8, which is delivered for a subsequent operation, for example to a container filling and sealing machine.

Mechanical details of the folding section A of the apparatus are illustrated in FIGS. 3, 4 and 5 of the drawings. A pile 9 of blanks such as shown in FIG. 1 is supported in four angle columns 10 forming a frame, located inside the main frame 11 of the apparatus. Shafts 12 in suitable bearings mounted on the rear cross-member of the main frame 11 support rocker plates 13 secured thereon. Extending forwards from each rocker plate 13, offset from the axis of shaft 12, is a rotatable tube 14, in which is mounted another tube 15 fitted with suction cups 16 above the uppermost blank of the pile 9. The rear end of the tube 14 is attached to a spring-loaded plate 17 to allow some rotation and self-

centering of the suction-cup assembly. The tube 15 communicates with evacuating means (not shown) so that, upon suitable actuation, the cups 16 can grip the uppermost blank of the pile 9. As shown the cups are located over the outer panels 1 and 4 of the blank.

Shafts 18 mounted in bracket bearings 19 on the side members of the frame 11, each supports at each end an arm 20, and between the outer ends of these arms is mounted, in each case, a retainer roller bar 21, extending substantially the full length of the blanks. The rear arm 20 of each of these retainer assemblies is adjacent to a rocker plate 13 of the corresponding suction cup assembly, and is connected thereto by an adjustable link 22.

The commencement of a cycle of operations is illustrated in FIG. 4, where the suction cups 16 rest against the outer panels 1, 4 of the uppermost blank of the pile 9. Suction is applied to the cups 16 to grip the blank, and the shafts 12 are rotated to rock the plates 13 and thus fold up the blank panels 1, 4 about their foldlines to an erected position such as shown in FIG. 5. At the same time, by action of the links 22 the arms 20 are swung downwards to locate the retainer bars 21 against the outer faces of the upstanding panels 1 and 4. When suction of the cups 16 is released, the panels 1 and 4 spring back from the cups but are held up by the bars 21 (FIG. 5).

The forward blank-pile supports 10 have each a substantially triangular plate 23 (FIG. 3) overlapping the forward corners of the uppermost blank. When the cups lift the panels 1 and 4 of the top blank, the corner of each panel flexes to slip past its plate 23 which catches the next lower blank and prevents two from being lifted together.

A hydraulic device 24 mounted at the mid-point of the rear cross-member of the frame 11 reciprocates a pusher 25 by which the uppermost blank is advanced when the side panels 1 and 4 are lifted, as shown in FIG. 5. Following a small advance by the pusher 25 a blank is taken up by driven rollers 26 which continue the advance of the blank to a point where the rear edge of the blank is picked up by a finger 27 on an endless chain 28 by which subsequent travel of the blank is effected. The driven rollers 26 have corrugated surfaces formed by rings of plastics, rubber or the like mounted upon a cylindrical body.

A sensing device 42 (FIG. 7) bearing on the top surface of the pile 9 initiates a signal upon removal of blanks, to actuate a pneumatic jack 43 by which the platform supporting the pile 9 is raised to keep the top of the pile in line with the pusher 25.

When the panels 1 and 4 of a blank have been erected, as described above, and the blank advanced by the pusher 25 it moves from section A to section B of the machine, which latter is illustrated in FIGS. 6 and 7.

A series of rollers 29 on stationary spindles, inclined to the vertical by substantially the same angle as that at which the erected panels 1 and 4 are held by the retainer bars 21, is located on each side of the machine frame, and the upstanding panels 1 and 4, upon running off the retainer bars 21, are taken up by these rollers and held thereby at substantially the same angles during their further forward travel.

Two spaced bridge members 30 extend across the path of travel of a blank, each having at its mid-point a downwardly projecting leg 31 supporting at its lower

end a spring-loaded platform 32 with side-rollers 33 to hold down the middle panels 2 and 3 of a passing blank against the under rollers 26.

Mounted on brackets secured to the bridges 30 are heaters for softening the plastics coating at the edges of a passing blank. These are directed to the surfaces which are to be sealed together, and thus, for example, one heater 34 is directed to the outer face of the sealing strip 5, and the other heater 35 is directed to the inner face of the edge-zone of panel 1 which is to fold down on to the strip 5. One convenient form of heater comprises gas burners fed with gas by pipes 36, providing gas jets by which the blank is heated. The burners are adjustably mounted.

As a blank passes through section B the edge-zones of the panels 1 and 4 are heated by the heaters 34, 35 to such an extent that the plastics coated becomes softened or molten, and in a state suitable for sealing together the heated areas. In this condition the blank passes to section C of the apparatus (FIGS. 7 and 8), running over rollers 37 supported on rails of an underplate 38 of the frame, and held, during its passage, against lateral displacement by side rollers 39.

Over each side of the underplate 38 extending in the direction of movement of the blank is a shaft 40 rotatable about its own axis, and supporting spaced rollers 41 substantially identical in form with rollers 29. By rotation of the shaft 40 the rollers 41 are moved between raised and lowered positions. In the raised positions, shown in dotted lines in FIG. 8, the rollers are inclined, and in alignment with the rollers 29. In the lowered positions the rollers 41 are substantially horizontal (full lines, FIG. 8), and in moving from raised to lowered positions the rollers 41 fold down the panels 4 and 1 in edge-overlapping relationship, when the edge-zone of panel 1 abuts on the outer surface of the sealing flap 5. It will be noted that in passing from section B to section C of the machine a blank is taken up from the rollers 26, by the chain fingers 27 which ensure subsequent progress of the blank.

In this folded condition the blank passes between pressure rollers 44 to effect firm bonding of the softened plastics at the edges of panels 1 and 4, and round a cooling drum 45 to which it is held by rollers 46. The drum 45 may be cooled by internal water circulation (not shown), and causes the plastics seal to harden.

The blank then passes by way of rollers 47 to section D of the machine, (FIGS. 9, 10 and 11). The purpose of section D is to relieve the stiffness of folding of the panels 1, 2, 3 and 4 of the blank (now sealed together), and to "square" the blank in order that it can pass on (e.g., to a packaging machine), as an open tubular container body. To achieve this result section D is adapted to press together the opposite folded edges of the flat-folded blank, delivered to section D substantially in a horizontal plane, (as seen in full line in FIG. 10), so that the blank becomes flat-folded in a substantially vertical plane (as seen in dotted lines in FIG. 10), and thereafter to open the articulated panels to square tubular form (FIG. 11). The frame of section D comprises opposite side bars 48, 49 extending in the direction of travel of the blank, and slidable towards and away from one another. The inner surfaces of these side bars 48, 49 are slotted, as at 50, and as seen in FIG. 10, the folded edges of the blank slide into slots 50 when advancing from section C of the apparatus.

Beneath the side bar 48 is suspended a spring-loaded pressure foot 51, within which is a suction cup 52 connected by a tube 53 to evacuating means. Likewise beneath the side bar 49 is mounted pressure bracket means 54. After the flat-folded, and sealed, blank is delivered into the slots 50 the side bars 48 are moved towards one another, with the result that the upper, horizontal panels 1, 4 swing upwards and fold together, while the lower panels 2 and 3 swing downwards and fold together in like manner. The change-over is represented in FIG. 10 as from the position shown in full line to that in dotted line, and in the latter position the lower panels 2 and 3 are pressed together between the pressure foot 51 and bracket means 54.

In this position the suction means 52 are actuated and the bars 48, 49 moved apart. As a result the panel 3, in upright attitude is drawn sideways (to the left as seen in FIG. 10) to the outer rest position of the suction means 52.

Pivotally mounted on the side bar assembly 48, is a plate 55 loosely connected to a link 56. When the bar 48 is moved towards bar 49, the link 56 causes the plate 55 to rise about its hinges from the "closed" position (shown in full line in FIGS. 10 and 11) to an erect position (shown in dotted line in FIG. 10). When the bar 48 is retracted, and draws back the blank-panel 3 by the suction means 52, the plate 55 is automatically caused to fold down again about its hinges by the link 56, and in so doing it embraces and folds down the panel 4 to a square position, for example at right angles to panel 3 (FIG. 11). In consequence of this squaring of panels 3 and 4, the opposite panels become equally squared, and the blank assumes the shape of a tubular body of rectangular cross-section, as shown in FIG. 11. It may be noted that to facilitate these folding movements the slots 50 are of substantial width and have rounded corners to accommodate the folded edges of the blank. The sealed and squared blank is ejected from the apparatus, as shown in FIG. 2, to pass to a subsequent stage, for example into a packaging machine, being guided in ejection by the pressure member 51 on one side, and by a series of frusto-conical guide rollers 57 on the other.

The various parts of the apparatus described above are actuated from a common drive by way of a gear 58 driven by a chain 59 from an external source of power, meshing with gear 60 driving a chain or belt 61 running over gears or pulleys 62a, 62b beneath section D of the apparatus (FIG. 9). Driven with the gear 58 is a cam-wheel 63 on which rides a follower 64 mounted on a lever 65 mounted on a shaft 66 which is held by spring means 67 to keep the follower against the camwheel.

The side bars 48, 49 are each mounted on a slide 68 reciprocable between rollers 69 under control of a crank lever 70 pivoted to the machine frame at 71. Each slide 68 is connected to one limb of its crank lever by an adjustable link 72 (FIG. 10) while the other limb of each crank lever is connected by an adjustable link 73 to the corresponding lever 65 mounted on shaft 66 and controlled by camwheel 58 as described above. During each rotation of the camwheel 63, an edge depression allows the levers 65 to be rocked by the spring means 67 to reciprocate the side bars 48, 49 on slides 68, as previously described.

On the shaft of pulley 62a is mounted another gear or pulley over which runs an endless chain 74 (FIGS. 9 and 7) driving shafts adapted through suitable gear-

ing the pressure roller 46 and a large gear 75. A chain 76 (FIG. 7) driven by the gear 75, drives a gear 77 which in turn is connected by chain to drive a small gear 78. The gears 77, 78 drive the rollers 26, and the chain 76 drives the fingers 27, by which the blanks are advanced through the machine. On the shaft of gear 75 is a cam 79 against which rides a follower 80 mounted on a lever 81 pivoted at 82. The free end of the lever 81 is attached by a cable 83, running over pulley 84, to a pulley 85 for reciprocable partial rotation of the latter. A cable 86 wound round pulley 85 runs over pulleys 87, 88 (one in a sense reverse to the other), and is connected by its ends to tension springs 89 attached to the frame 11. The pulleys 87, 88 are mounted on the shafts 12, and when the lever 81 is rocked by the cam 79 during each rotation withdrawal of the cable 83 turns the pulley 85, and thereby the pulleys 87, 88 (in opposite senses) to rock the plates 13 with the suction cups 16, and retainer bars 21, as previously described. Final ejection of the squared tubular container body is effected by fingers 89 on shaft 61. The various gear ratios, and the forms and settings of the cams are selected to ensure correct synchronisation of the successive operations on a blank, thus allowing continuous flow of a line of blanks through the apparatus.

From the above description it will be seen that the invention provides apparatus enabling a series of flat container blanks to be partially erected in order to form properly sealed and squared tubular container bodies ready to be fed to a packaging machine for filling and sealing, but it should be understood that the invention is not limited solely to the details of the form described above, which may be modified in various ways, in order to meet conditions and requirements encountered without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A method of forming a tubular container body from a flat blank of package-forming material having a heat-sealable surface, said blank having four side-by-side panels, one of said outer panels including an outer sealing flap therealong, said panels and flap being separated by parallel fold lines therebetween comprising the steps of simultaneously folding up the two outer panels about their fold lines to positions upstanding from the plane of the inner panels, heating the outer edge zones of the upstanding panels, folding the upstanding panels down toward the inner panels so that the heated edge zones overlap, applying pressure to the overlapping edge zones to seal said edge zones together, flexing said folded and sealed blank to break the fold lines and squaring said flexed blank to form the tubular container body.

2. A method as claimed in claim 1 wherein said steps are carried out at successive stations and further comprising passing the blank from one station to the next for carrying out the successive steps.

3. A method as claimed in claim 1 wherein the step of flexing the folded and sealed blank to break the fold lines comprises flattening the sealed blank in a diagonal plane opposite to that plane in which it is flattened during sealing.

4. A method as claimed in claim 1 wherein the blank is squared to provide a substantially rectangular cross section.

5. Apparatus for forming a tubular container body from a flat blank of package-forming material having a

heat-sealable surface, said blank having four side-by-side panels, one of said outer panels including an outer sealing flap therealong said panels and flap being separated by parallel fold lines therebetween, said apparatus comprising in succession, means for simultaneously 5 folding up the two outer panels about their fold lines to positions upstanding from the plane of the inner panels, means for heating the outer edge zones of the upstanding panels, means for folding down the upstanding panels toward the inner panels so that the heated edge 10 zones overlap, means for applying pressure to the overlapping edge zones to seal said edge zones together, means for flexing said folded and sealed blank to break the fold lines and means for squaring said flexed blank to form the tubular container body.

6. Apparatus as claimed in claim 5 and further comprising conveyor means for advancing the blank from one means to the next means.

7. Apparatus as claimed in claim 6 wherein said flexing means, upon receiving the sealed blank flattened in one diagonal plane of the tubular body flattens the blank in the other diagonal plane of the body. 20

8. Apparatus as claimed in claim 5 and further comprising means for squaring the flexed flattened blank to form a tubular body having a substantially rectangular cross section. 25

9. Apparatus as claimed in claim 5 wherein the means for folding up the outer panels includes rotatable suction means for folding said outer panels and retainer means for holding the folded panels in their upward direction after said suction means is released. 30

10. Apparatus as claimed in claim 9 wherein said retainer means comprises bars movable to positions behind the panels after they have been folded up to support said panels. 35

11. Apparatus as claimed in claim 9 and further comprising means for moving said suction means and said retainer means synchronously.

12. Apparatus as claimed in claim 10 wherein said bars are spaced from said outer panels so that said panels spring back to engage said bars when said suction means is released. 40

13. Apparatus as claimed in claim 5 wherein said heating means comprises one means for heating the edge zone of one panel and a second means for heating the edge zone of the other panel. 45

14. Apparatus as claimed in claim 13, wherein said heating means comprises burners for providing gas jets for heating the edge zones of said panels.

15. Apparatus as claimed in claim 6 and further comprising means for holding the upstanding panels at substantially the same angle with respect to the inner panels when advanced from the means for folding up the outer panels to the heating means.

16. Apparatus as claimed in claim 15 wherein said holding means comprises a plurality of rollers in series.

17. Apparatus as claimed in claim 5 wherein the means for folding down the upstanding panels includes means for receiving the panels at substantially the same angle with respect to the inner panels as when passing the heating means.

18. Apparatus as claimed in claim 17 wherein said receiving means comprises a series of rollers.

19. Apparatus as claimed in claim 17 wherein said receiving means are rockable for folding down the upstanding panels toward the inner coplanar panels of the blank.

20. Apparatus as claimed in claim 18 wherein the axes of said rollers are disposed at right angles to the axis of a rotatable shaft extending parallel to the passage of the blank to the means for folding down said upstanding panels.

21. Apparatus as claimed in claim 5 wherein said means for applying pressure to seal said heated edge zones together comprises pressure roller means.

22. Apparatus as claimed in claim 21 wherein said pressure roller means includes a cooled roller means for cooling the sealed edge zones.

23. Apparatus as claimed in claim 5 wherein said flexing means comprises a pair of elements reciprocable toward and away from each other and adapted to receive the flattened blank from the pressure sealing means when spaced apart from each other and to flex the flattened blank when said elements move toward each other to flatten the blank in the opposite plane of the body. 50

24. Apparatus as claimed in claim 23 wherein said flexing means further includes suction means for holding a panel of said flexed blank when said reciprocable elements are withdrawn after flexing said folded blank.

25. Apparatus as claimed in claim 24 and wherein said squaring means includes a plate means for engaging the panel adjacent the panel held by said suction means for positioning said adjacent panel at right angles to the panel held by the suction means and thus square the flexed blank to form a substantially rectangular tubular container body. 55

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