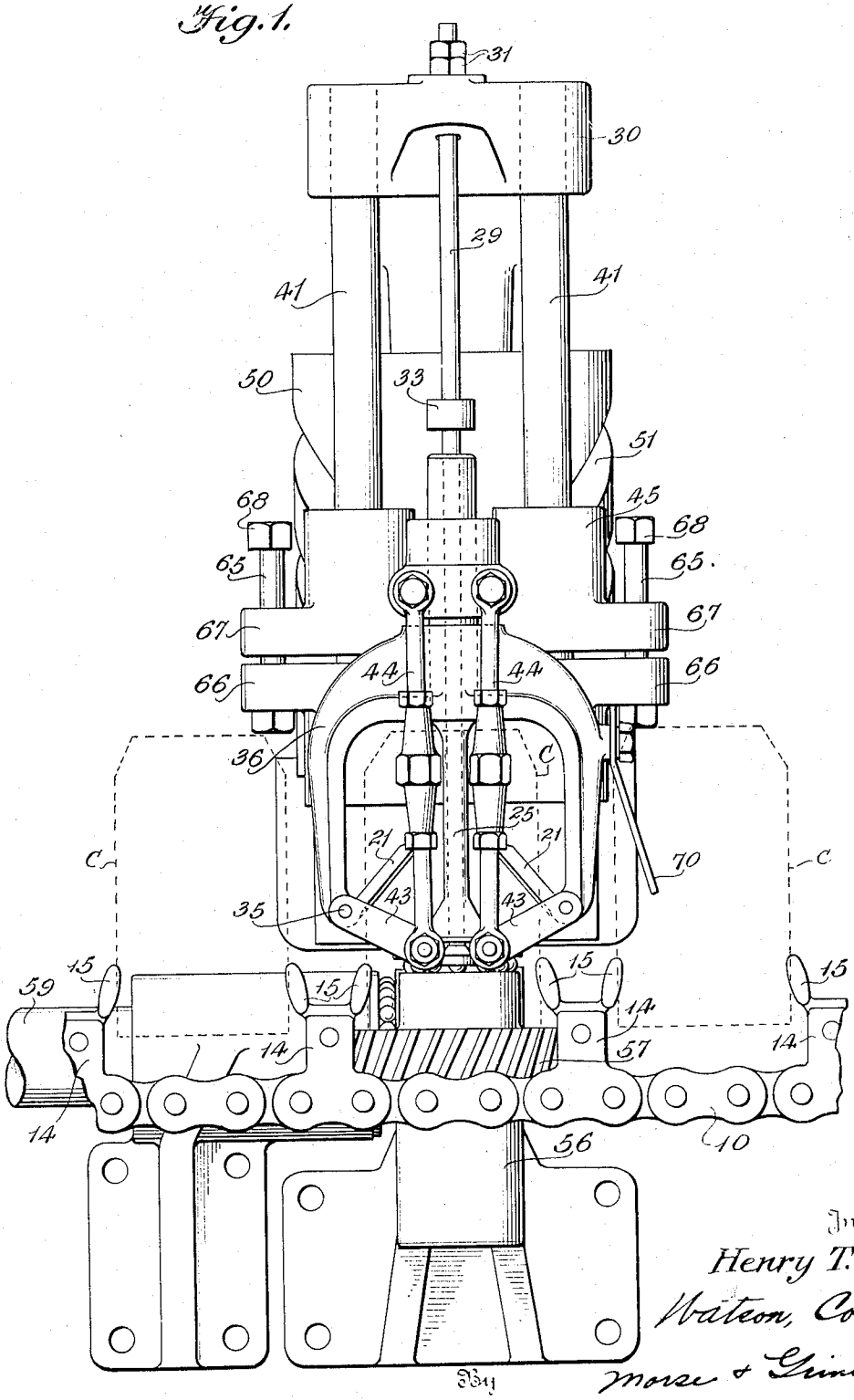
Oct. 6, 1936. H. T. SCOTT 2,056,330

MECHANISM FOR PARTIALLY FOLDING CONTAINER CLOSURES

Filed Oct. 16, 1934 4 Sheets-Sheet 1

Fig. 1.



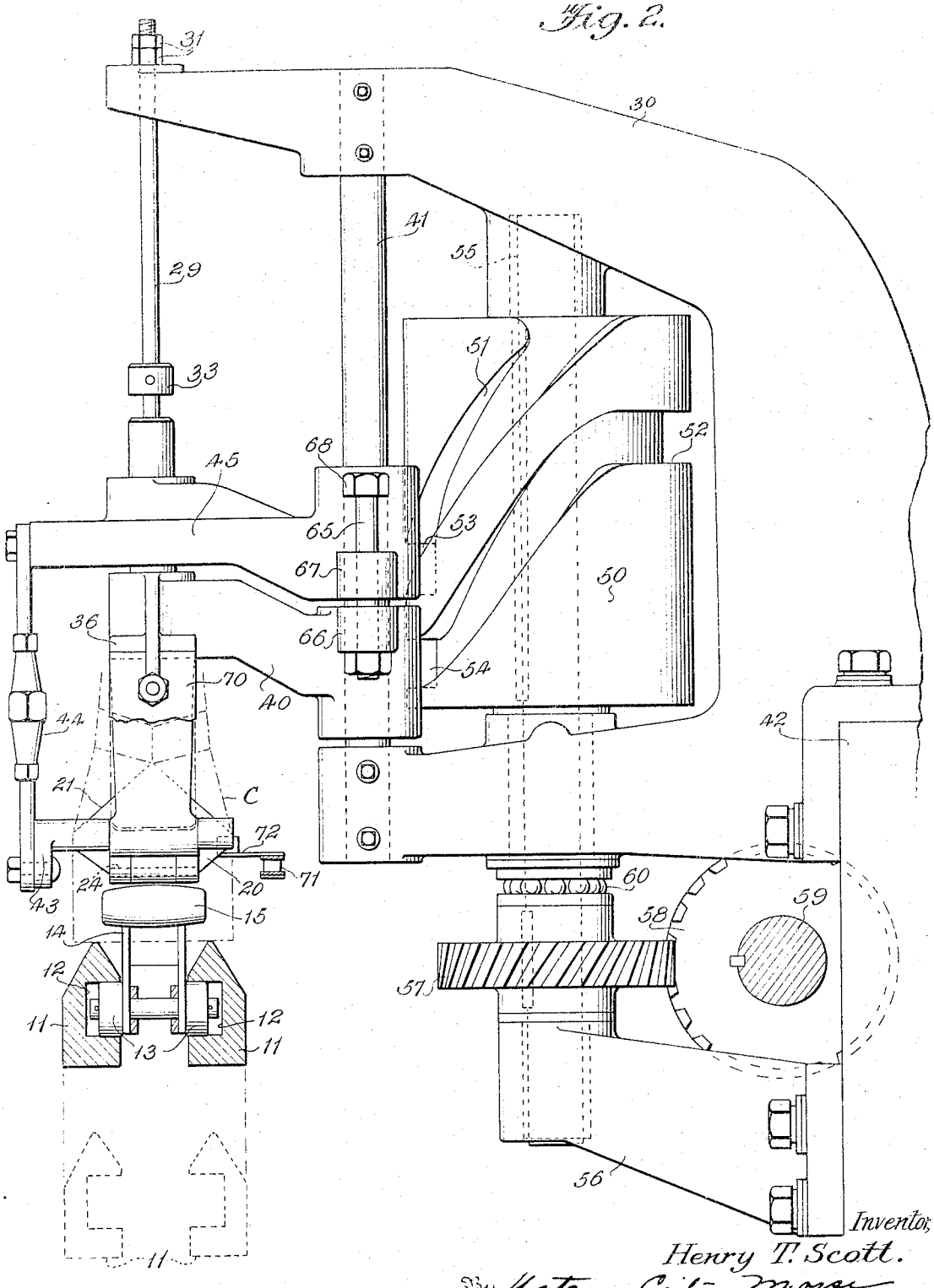
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MECHANISM FOR PARTIALLY FOLDING CONTAINER CLOSURES

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Fig. 2.



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MECHANISM FOR PARTIALLY FOLDING CONTAINER CLOSURES

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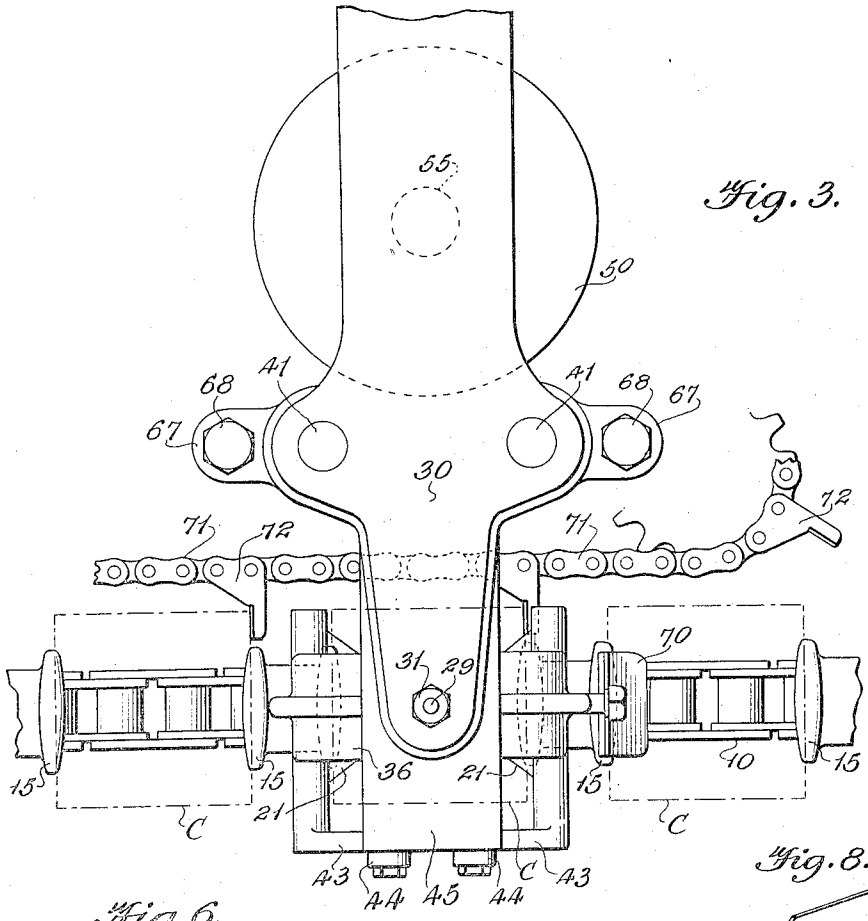


Fig. 3.

Fig. 6.

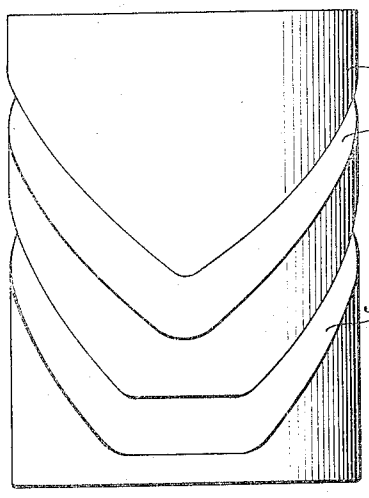


Fig. 7.

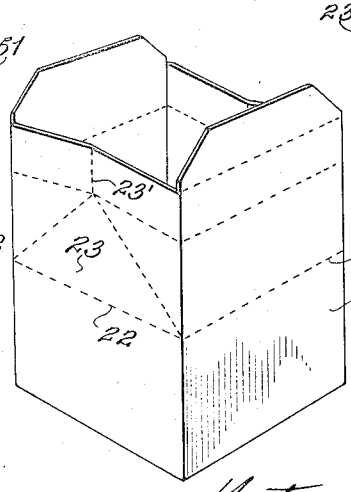
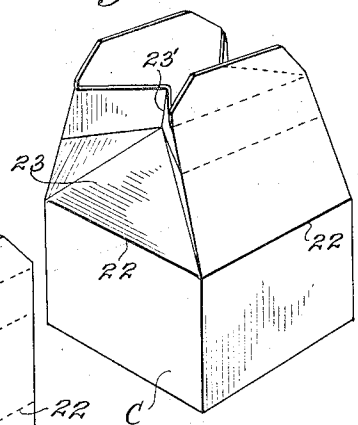


Fig. 8.



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MECHANISM FOR PARTIALLY FOLDING CONTAINER CLOSURES

Filed Oct. 16, 1934 4 Sheets-Sheet 4

Fig. 4.

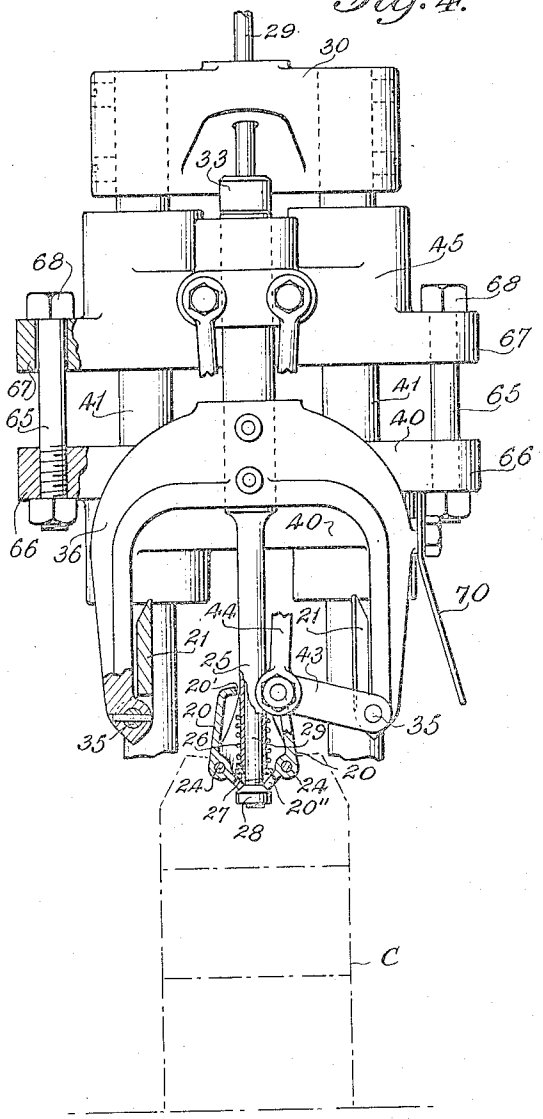


Fig. 5.

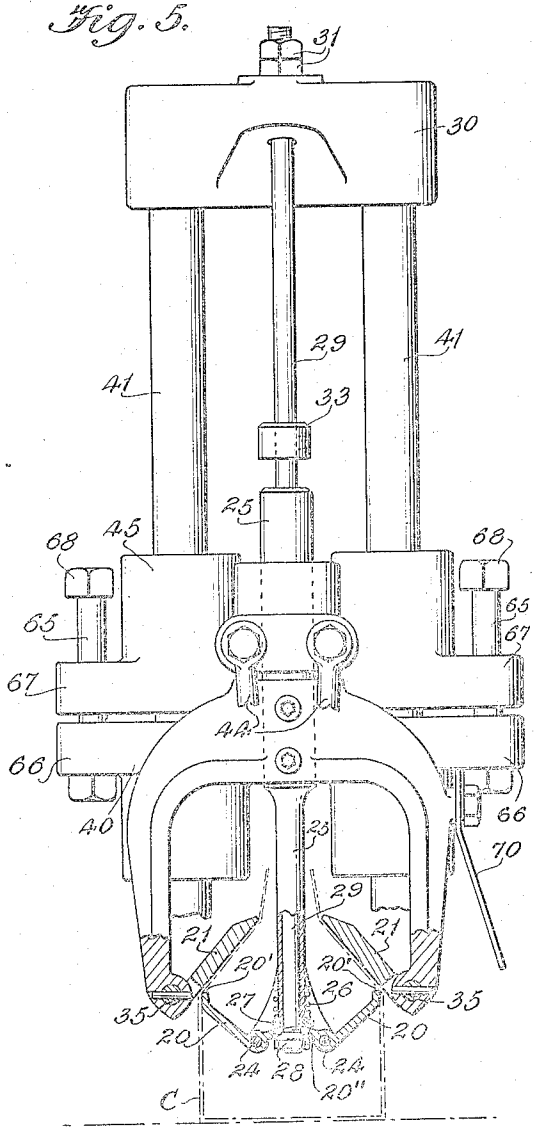


Fig. 9.

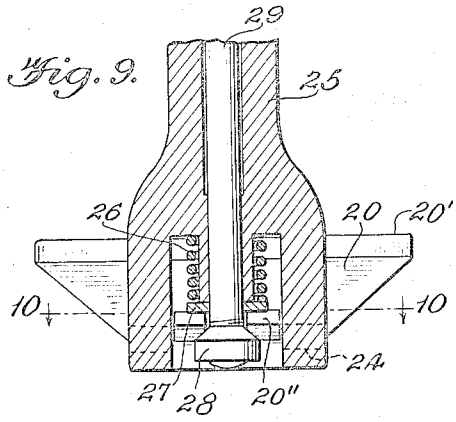
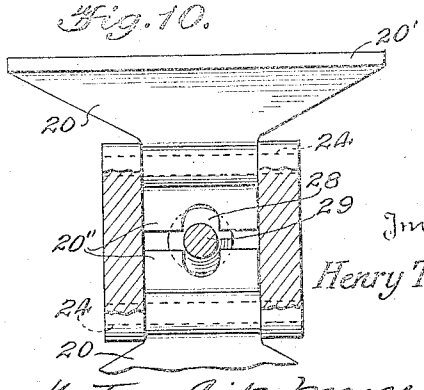


Fig. 10.



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Patented Oct. 6, 1936 2,056,330

UNITED STATES PATENT OFFICE

2,056,330

MECHANISM FOR PARTIALLY FOLDING CONTAINER CLOSURES

Henry T. Scott, Toledo, Ohio, assignor to The American Paper Bottle Company, Toledo, Ohio, a corporation of Ohio

Application October 16, 1934, Serial No. 748,561

9 Claims. (Cl. 93—49)

The present invention relates to mechanism for the folding, or partial folding, of the end closures of paper containers and particularly to mechanism for partially folding the scored foldable end extensions of paper containers of the type disclosed in my copending application Serial No. 686,300, filed August 22, 1933.

In the application just referred to, there is disclosed a paper container which is fabricated from a flat blank, the blank being formed of relatively stiff paper so that the completed container is self-supporting even when charged with a liquid. The blank from which the container is to be formed is divided by score lines into a plurality of panel sections, these panel sections being relatively foldable along the score lines in the fabrication of the completed article. Thus the blank is divided by rectilinear score lines into side wall panels, bottom panels and top panels. In forming the container the side wall panels are first folded relatively to each other so as to form a tubular member, the bottom panels being next folded relatively to each other and to the side wall panels to form the bottom closure, the several bottom panels, and the meeting edges of the side wall panels being secured together by a suitable adhesive substance. At this stage, the container comprises an open tube with closed bottom having an extension at its open end comprising a plurality of relatively foldable panels. Next, the container as thus far completed is coated with paraffin or some other analogous substance designed and intended to make it completely waterproof or leakproof. After this, there remain to be performed the operations of charging and folding and sealing the open end to make a completely sealed container well adapted to contain liquids without the possibility of leakage. As the paper originally used in the fabrication of the blank is necessarily comparatively stiff in order that the completed container may be entirely self-supporting despite the internal pressure of the liquid and as, furthermore, the paraffin or other coating substance, after it has become congealed or hardened, imparts increased stiffness to the paper, the folding of the closure portion requires the application of forces of considerable magnitude in order to properly position the panels by folding them relatively to each other along the score lines. Application of the necessary forces to the relatively foldable panels of the closure portion of the container cannot be effectively made unless certain of the container side walls are interiorly supported while these forming operations are being carried out and hence it has been found necessary to provide means which enter the container and to supportingly engage the side walls thereof just below the foldable end closure, while the folding operations are being carried out. The necessity for the use of such internal supporting means makes it desirable to effect the folding operation in two stages, a partial breaking down or folding of the collapsible end portion of the container being first carried out, the container then being charged with its liquid contents and the final folding and sealing being thereafter completed. By following out this sequence of operations the container wall supporting mechanism does not make contact with the liquid with which it is to be charged, which would be highly undesirable while at the same time the foldable end of the container is rendered, by this preliminary or partial folding operation, in such condition that charging may be subsequently effected in an easy manner and complete closure and sealing effected without danger of contamination of the liquid charge.

In accordance with the present invention, means is provided for quickly and automatically effecting the partial folding of the foldable container end closure portion, the relatively foldable panels of this portion being moved midway from their original positions to their final positions. The folding operations are carried out accurately by flexing the blank along the rectilinear score lines, the operation in effect redefining the score lines which have previously been coated with paraffin and hence rendered considerably stiffer.

The mechanism which comprises the subject matter of the present invention is designed particularly so as to form a part or unit of a complete automatic machine into which blanks are successively fed, the blanks being first folded into the form of open-ended containers such as previously described, then automatically carried to a liquid coating mechanism and then, after the coating applied has fully congealed, being transferred to the score line redefining mechanism just above briefly described, thence to a liquid charging unit, and thence to mechanism for effecting the final closure and sealing of the charged container. The unit is, of course, adapted to be used quite apart from the other units of the completed machine and may be so used if desired. It is primarily intended to be used for the partial folding of paper containers which are rectangular in horizontal cross section but is by no means limited in this respect, being well adapted to act upon the foldable end portions of containers of other shapes, such as coni-

cal containers or containers which are circular in cross section.

The unit comprises, in combination, a container holding means for supporting the container in a predetermined position, a container entering means for interiorly supporting the container walls, this last mentioned means being collapsible so that it may be easily withdrawn through the partially folded container end, means for acting upon the foldable end closure portion while the container walls are thus interiorly supported to effect the partial folding of the relatively movable panels, and mechanism for operating the several means in the desired order.

In the accompanying drawings and in the following description, an eminently satisfactory mechanism is disclosed for accomplishing the desired objects, but it will be appreciated that this mechanism is set forth by way of example only and that adapting the invention to various types of machines, and for performing folding operations upon containers of different shapes, the design and arrangement of its component elements may be considerably modified.

In the drawings:

Figure 1 is a front elevation of the improved mechanism;

Figure 2 is a side elevation of the same;

Figure 3 is a top plan view of the mechanism;

Figures 4 and 5 are views generally similar to Figure 1, parts of the mechanism having been broken away, however, and certain of the operating elements being shown in different positions;

Figure 6 is an elevation of a cam member which comprises a portion of the mechanism;

Figure 7 is a perspective view of one of the partially completed containers upon which the mechanism is intended to operate;

Figure 8 is a perspective view of the same container but showing the foldable end closure in a partially collapsed condition resulting from the operation of the mechanism, and

Figures 9 and 10 are two views, partially in section and partially in elevation, of the container entering mechanism.

In order that the operation of partially folding or collapsing the scored foldable extension of a paper container such as illustrated in Figure 7 may be accomplished by the present mechanism, it is first necessary to bring the container into predetermined relationship to the machine. Various devices may be employed for accomplishing this purpose, but I preferably utilize an intermittently operating conveyor, which conveyor is provided with means for supporting a series of containers, and is so actuated as to bring these containers successively into position to be folded and to successively remove them from this position. In the present instance the conveyor utilized is of the endless chain type, a portion of the upper reach of the chain being indicated at 10, this upper reach being positioned between parallel supporting rails 11, disposed horizontally, which rails are provided with mutually facing parallel trackways or slots 12 which house and guide rollers 13 rotatably mounted upon the ends of certain of the pins which are employed to fasten the chain links together. Every fourth link is provided with an upstanding portion 14 and to the tops of these upstanding portions 14 are secured respectively two transversely extending container engaging elements 15. The distance between each element 15 and the nearest similar element mounted upon the next adjacent support 14 is slightly less than the width of the container, as indicated in Figure 1, so each container positioned on the conveyor is pinched between the two elements 15, its opposite side walls being slightly deflected inwardly. Inasmuch as the elements 15 bear centrally against the side walls and some distance above the bottoms of the containers, the pressure which they exert upon the containers merely results in the flexure of the side walls and effects no damage or permanent distortion such as might result if pressure were applied at the corners or at or near the plane of the bottom. This pinching of a container in the position shown in Figure 1 prevents it from being lifted upwardly by the operation of the folding mechanism, which is important for reasons hereinafter to be made more clear. The bottoms of the containers rest upon the tops of supporting rails 11 and the containers slide along these rails as they are moved along the conveyor. By the means just described a container may be positioned as indicated in chain lines in Figure 2, in which position it is rigidly supported against downward movement by means of rails 11, is laterally confined by elements 15, and is also held against upward movement by the pinching action of these elements.

In this position, the folding mechanism is automatically brought into operation. This folding mechanism comprises essentially a container entering means or mandrel of collapsible type, including two rocking or swinging container wall engaging elements or fingers 20, and an exteriorly positioned folding mechanism, including two opposed rocking or swinging folding fingers 21. The supporting fingers 20 and the folding fingers 21 cooperate in effecting the folding operation, the supporting fingers 20 being first positioned in such manner that the upper horizontal edges 20' of these fingers engage opposite side walls of the container C just below the score line 22 of the container, which score line extends continuously around the container and marks the division between the container body and the foldable end or closure portion. The folding fingers 21 are substantially triangular in shape, with apex uppermost, and these fingers are adapted to bear against, respectively, the two triangular panels upon opposite sides of the container and one of which is indicated at 23 in Figure 7, being joined to the adjacent side wall of the container along score line 22.

When simultaneously rocked inwardly from their inactive vertical positions to the positions in which they are shown in Figure 5 of the drawings, these folding fingers 21 bear upon triangular panels 23 of the container substantially over the entire areas of these panels and carry the panels before them to a position such as indicated in Figure 5. As the triangular panels 23 are moved inwardly in this manner the entire foldable end portion of the container may be partially collapsed, as indicated in Figure 8, or the permanent effect of the operation may be less pronounced. In any event the score lines between panels 23 and adjacent panels are "redefined" and also the vertical score lines 23' just above panels 23. In this collapsing operation the integrity of all of the panels is maintained and no flexure of the paper, except at the score lines, is brought about. After the operation has been completed and the supporting fingers 20 and folding fingers 21 are removed from contact with the container, its foldable closure portion may appear as shown in Figure 8 of the drawings, that

is, will be in partially collapsed position, many if not all of the score lines between the various panels having been flexed or "redefined" and the container top having been so conditioned that final closing thereof may be effected without difficulty. As shown in Figure 8, the foldable extension of the container is only partially closed, and when the container has been removed from the score line redefining mechanism it may be immediately transferred to a charging unit, by means of which a liquid or solid may be readily introduced.

The supporting fingers **20** are at their lower edges rockably mounted upon parallel horizontally disposed pins **24** which are in turn rigidly mounted upon the enlarged lower end of a vertically extending tubular member **25**. A coiled compression spring **26**, the upper end of which rests against a downwardly facing annular shoulder formed upon tubular member **25**, has its lower end bearing upon an annular presser plate or washer **27** and this washer in turn rests upon the ends of the inwardly extending arms **20''**, integral with supporting fingers **20**, so that arms **20''** are normally pressed downwardly by the spring **26**. Folding fingers **20** are therefore normally in the folded or collapsed positions in which they are shown in Figure 4 and it is only when the pressure of spring **26** is overcome that these fingers may move to their container supporting positions, as shown in Figure 5. The means for overcoming the action of spring **26** comprises an annular nut **28** secured upon the lower end of a rod **29** which is slidably housed within tube **25**, extending out of the upper end of this tube and through a cylindrical aperture formed in a frame member **30**, the portion of the rod **29** which projects above the upper surface of frame member **30** being provided with nuts **31** which limit the downward movement of the rod by contacting with the upper surface of the frame member and it is the contact of nuts **31** with frame member **30**, while the tube **25** is still moving downwardly into a container C, which causes the supporting fingers **20** to swing outwardly from collapsed position to open position, the nut **28** on the lower end of rod **29** preventing further downward movement of the folding fingers **21** at a time when the pivots **24** are still moving downwardly with sleeve **25**. The pressure of spring **26** is thus overcome and the fingers swing outwardly, the exact angles through which these fingers swing being variable by adjusting the position of nuts **31** upon rod **29**. When the sleeve **25** is drawn upwardly the mandrel is collapsed, rod **29** not at first moving by reason of the fact that spring **26**, acting through washer **28** and arms **20'**, exerts a downward pressure on nut **28**. The upward movement of tube **25** and supporting fingers **20**, relative to rod **29**, will in fact continue until the upper end of tube **25** strikes the adjustable stop **33** fixed on rod **29**, whereupon the rod and sleeve move upwardly together with the supporting fingers in collapsed position as shown in Figure 4.

The folding fingers **21** are respectively rotatably mounted upon parallel horizontally extending pins **35** fixed in the lower ends of the downwardly extending arms of a yoke member **36**. The tube **25** extends through an aperture in the central portion of yoke member **36** and is secured to this member so that the tube and yoke move vertically as a single unit. The yoke **36**, and hence tube **25**, are mounted upon the outer end of a slide **40** hereinafter designated the lower slide, slide **40** having parallel vertically disposed cylindrical apertures extending therethrough which slidingly engage the parallel vertically extending guide rods **41**. The upper and lower ends of the guide rods **41** are securely anchored to the upper and lower members of frame member **30** which is a generally U-shaped member suitably mounted upon a base, a portion of which is indicated at **42** and which base may conveniently be one of the side frame members of an automatic machine such as previously briefly described.

Each of the folding fingers **21** has either connected thereto or formed integral therewith, an angularly arranged lever arm **43** and the free ends of these lever arms are, respectively, connected by means of pivoted and adjustable links **44** to the outer end of a horizontally disposed arm **45**, hereinafter designated the upper slide, since it is located just above lower slide **40** and is likewise slidably mounted upon and guided by the guide rods **41** so as to be constrained to move vertically. As the folding fingers **21** are pivotally supported upon means rigidly connected to the lower slide and the lever arms **43** of these folding fingers are connected by links **44** to the upper slide, it is apparent that, to effect simultaneous inward or rocking movements of the folding fingers, it is only necessary to produce relative vertical movements of the lower and upper slides **40** and **45**, the folding fingers being rocked inwardly as these two slides are caused to approach each other and being rocked outwardly as these two slides are separated.

The means for effecting this relative movement of the slides and rocking movement of the folding fingers comprises a cam member **50** to which both slides are connected, cam **50** having upper and lower cam slots **51** and **52** formed therein, the upper slide carrying a roller **53** which projects within the upper cam slot **51** and the lower slide carrying a roller **54** which projects within the lower cam slot **52**. Cam **50** is keyed to a vertical shaft **55**, the lower end of which is rotatably supported in a bracket **56**, and the upper end, as well as an intermediate portion thereof just below the cam, is rotatably supported in bearings formed in the frame member **30**. Also keyed on this shaft is a spiral gear **57**, the teeth of which mesh with those of a companion spiral gear **58** fixed upon a drive shaft **59** mounted in suitable bearings fixed to the frame member **42**. Rotation of the shaft **59** therefore effects rotation of shaft **55** through the intermediate gearing and a thrust bearing **60** is positioned intermediate the lower arm of frame **30** and spiral gear **57** to minimize frictional retardation due to the axial thrust exerted by gear **57**.

From an inspection of Figures 2 and 6, it will be seen that the cam slots **51** and **52** are generally similar and parallel, but that the upper cam slot **51** in its lowermost portion is rather sharply pointed, whereas the lower cam slot **52** includes a horizontal section of considerable length just under the lowermost point of the upper cam slot. As a result, the rollers **53** and **54** of the upper and lower slides respectively will travel downwardly at substantially the same rate in their respective cam slots as the cam **50** rotates until the roller **54** of the lower slide reaches the horizontal section of cam slot **52** whereupon the downward motion of the lower slide **40** is halted, while the downward motion of the upper slide **45** is not halted, but continues for some further distance. This causes the upper slide **45** to approach the

lower slide at this period in the travel of the cam with the result that the pivoted links 44 are caused to depress arms 43 to which they are connected and thus to inwardly rock the folding fingers 21, downward movement of the pivotal axes of these folding fingers having ceased with the downward movement of lower slide 40. Immediately after the inward swinging movements of the folding fingers 21 the upper slide 45 commences to rise while the lower slide is yet stationary, and this relative movement of separation of the two slides is continued until both rollers 53 and 54 have entered the parallel upwardly inclined portions of the cam slots, the folding fingers 21 having been retracted through the action of levers 43 and links 44 to the positions in which they are shown in Figure 4 during this relative movement. Further rotation of cam 50 simply causes simultaneous upward movement of slides 40 and 45 and elevation of the supporting fingers 20 and folding fingers 21 until these elements have been lifted to such position that the container just acted upon has been completely disengaged and may be removed and a fresh container placed in position by the conveying mechanism. The conveying mechanism is synchronized with the container closure collapsing mechanism so as to operate while this last mentioned mechanism is inactive, the rollers 53 and 54 at this time travelling through horizontal portions of the cam slots 51 and 53. As will be seen from Figure 2, cam slot 51 at its upper ends is open and the top surface of cam 50 functions as the bottom of the cam slot.

To ensure roller 53 entering the cam slot 51 at the proper time to commence the lowering of slide 45 simultaneously with slide 40, the two slides are connected together by bolts 65, each bolt 65 being rigidly fixed within an ear 66 integral with slide 40 and slidably extending through a similar ear 67 integral with slide 45. The heads 68 of bolts 65 come into contact with the upper surfaces of ears 67 and simultaneous downward movement of the slides is thereby ensured.

For the purpose of accurately positioning a container vertically in the conveyor mechanism, just prior to its emplacement beneath the score line redefining unit, a tongue 70 is provided, rigidly secured to the yoke member 36 and which therefore moves upwardly and downwardly with this member. This tongue is so positioned that it will enter the open end of the container C which is positioned next to the one to be acted upon by the folding and supporting fingers as the yoke 36 descends and to properly align this container in a vertical direction in the event that it requires such alignment. The inter-engagement of the tongue and container is indicated in Figure 1. Likewise a horizontally disposed endless chain 71 is so disposed as to operate intermittently and in synchronism with the conveyor chain 10, chain 71 having fixed thereon outstanding members 72 adapted to engage the cartons and to assist in properly aligning these cartons vertically in the event that, for any reason, they are retained within the retaining elements 15 of the conveyor in not quite the correct positions.

It is desirable that the container end collapsing unit just described shall be able to act to partially close the foldable extensions of paper containers which vary in height and for this purpose the supporting trackways 11 and the conveyor chain 10 are so mounted as to be vertically adjustable. The container illustrated in Figures 7 and 8 of the drawings is for instance a half pint container. A pint container is exactly the same except in that its side walls are longer. Hence to alter the machine so as to be able to handle pints, the conveyor and trackways are dropped from the positions in which they are shown in Figure 2 in full lines to the positions in which these elements are shown in this same figure in dotted lines. With this simple change the machine is adapted to a container of different capacity. Quart containers may be as easily handled by further dropping the conveyor to bring the foldable upper end closure to the same position in which the foldable upper end closure of the half pint container is shown in the drawings.

Should the foldable end closure of the container be so far collapsed by the operation of the described mechanism that the container entering mandrel comes in contact with the inner surface of the collapsed end of the container, as the collapsed mandrel is withdrawn from the container, no displacement of the container can result. This is by reason of the fact that the container is firmly gripped adjacent its lower end by the gripping elements 15.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. Mechanism for inwardly folding opposed foldable panels of the end extension of a tubular paper container about score or hinge lines defining the edges of said panels, comprising two folding fingers adapted to contact with the outer surfaces of said panels respectively and to deflect the same bodily inwardly about said score lines as axes, and supporting fingers adapted to contact with and support portions, located next adjacent said hinge lines, of the inner surfaces of the container during the deflection of said panels, whereby said portions are supported against distortion during the deflection of said panels, said supporting fingers being mounted for movement toward and away from the axis of a container being acted upon so that they may be withdrawn from the container through the partially folded end extension.

2. Mechanism for inwardly folding opposed foldable panels of the end extension of a tubular paper container about score or hinge lines defining the edges of said panels, comprising two folding fingers adapted to contact with the outer surfaces of said panels respectively and to deflect the same bodily inwardly about said score lines as axes, and supporting fingers adapted to contact with and support portions, located next adjacent said hinge lines, of the inner surfaces of the container during the deflection of said panels, whereby said portions are supported against distortion during the deflection of said panels, said supporting fingers being supported for pivotal movements about closely adjacent parallel axes which lie, when said fingers are in operative positions, within the container and beyond the end extension thereof.

3. Mechanism for inwardly folding opposed foldable panels of the end extension of a tubular paper container about score or hinge lines defining the edges of said panels, comprising two folding fingers adapted to contact with the outer surfaces of said panels respectively and to deflect the same bodily inwardly about said score lines as axes, and supporting fingers adapted to contact with and support portions, located next adjacent said hinge lines, of the inner surfaces of the container during the deflection of said panels, whereby said portions are supported

against distortion during the deflection of said panels, said means comprising two supporting fingers, a central rod to which said fingers are pivotally connected, a second rod, movable with respect to the first rod and adapted to act upon said fingers to simultaneously swing them about their pivotal axes, and a resilient device normally tending to swing said fingers in directions opposite to those in which they move under the influence of said second rod.

4. Means for interiorly supporting opposed inner wall surfaces of a tubular paper container during a folding operation comprising a rod insertable axially into the open end of such a container, supporting fingers mounted on said rod for swinging movement about parallel axes, a second rod parallel to the first rod and movable axially relatively thereof, said second rod having operative engagement with said fingers adjacent the axes thereof respectively, and mechanism for producing equal and simultaneous axial movements of said rods for inserting said fingers into a container and withdrawing them therefrom, and for producing relative axial movements of said rods to effect movements of said supporting fingers.

5. Means for interiorly supporting opposed inner wall surfaces of a tubular paper container during a folding operation comprising a rod insertable axially into the open end of such a container, supporting fingers mounted on said rod for rocking movement about parallel axes, a second rod parallel to the first rod and movable axially relatively thereto, said second rod having operative engagement with said fingers adjacent the axes thereof respectively, and mechanism for producing equal and simultaneous axial movements of said rods for inserting said fingers into a container and withdrawing them therefrom, and for producing relative axial movements of said rods to effect movements of said supporting fingers, said mechanism including two relatively movable members to which said rods are connected, respectively, and cam devices for moving said members in timed relationship.

6. Mechanism for folding the foldable end extension of an open ended tubular container comprising, means for acting upon the container end to fold portions thereof inwardly, collapsible means for supporting the inner wall of the container during the operation of said folding means, said collapsible means being insertable into and removable from the same end of the container, and means for gripping the container adjacent the base thereof to support the same during the folding operations, the container folding and supporting means and the container gripping means being relatively adjustable to permit the folding of the end extensions of containers of different heights.

7. Mechanism for inwardly folding a foldable panel of the end extension of a tubular paper container about a score or hinge line defining one edge of said panel, comprising a folding finger adapted to contact with the outer surface of said panel and to deflect the same bodily inwardly about said score line as an axis, and a supporting finger adapted to contact with and support an otherwise unsupported portion, located next adjacent said hinge line, of the inner surface of the next adjacent panel during the deflection of said first mentioned panel, whereby said adjacent panel is supported against distortion during the deflection of said first mentioned panel, said supporting finger being mounted for movement laterally of the container so that it may be withdrawn from the container through the partially folded end extension.

8. Mechanism for inwardly folding opposed foldable panels of the end extension of a tubular paper container about transverse score or hinge lines intermediate said panels and the container body, comprising two folding fingers adapted to contact with the outer surfaces of said panels respectively, and to deflect the same bodily inwardly about said score lines as axes, and means adapted to be inserted into the container to engage opposed inner surfaces of the container body walls next adjacent said intermediate score lines and to comprise the sole support for said walls during the deflection of said panels, said means being collapsible to permit its withdrawal from the container through the partially folded end closure after the folding operation has been completed.

9. Mechanism for inwardly folding opposed foldable panels of the end extension of a tubular paper container about transverse score or hinge lines intermediate said panels and the container body, comprising two folding fingers adapted to contact with the outer surfaces of said panels respectively, and to deflect the same bodily inwardly about said score lines as axes, and means adapted to be inserted into the container to engage opposed inner surfaces of the container body walls next adjacent said intermediate score lines and to comprise the sole support for said walls during the deflection of said panels, said means comprising two supporting fingers, a single member upon which both of said fingers are pivotally mounted, and mechanism for simultaneously swinging said fingers about their pivotal axes.

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