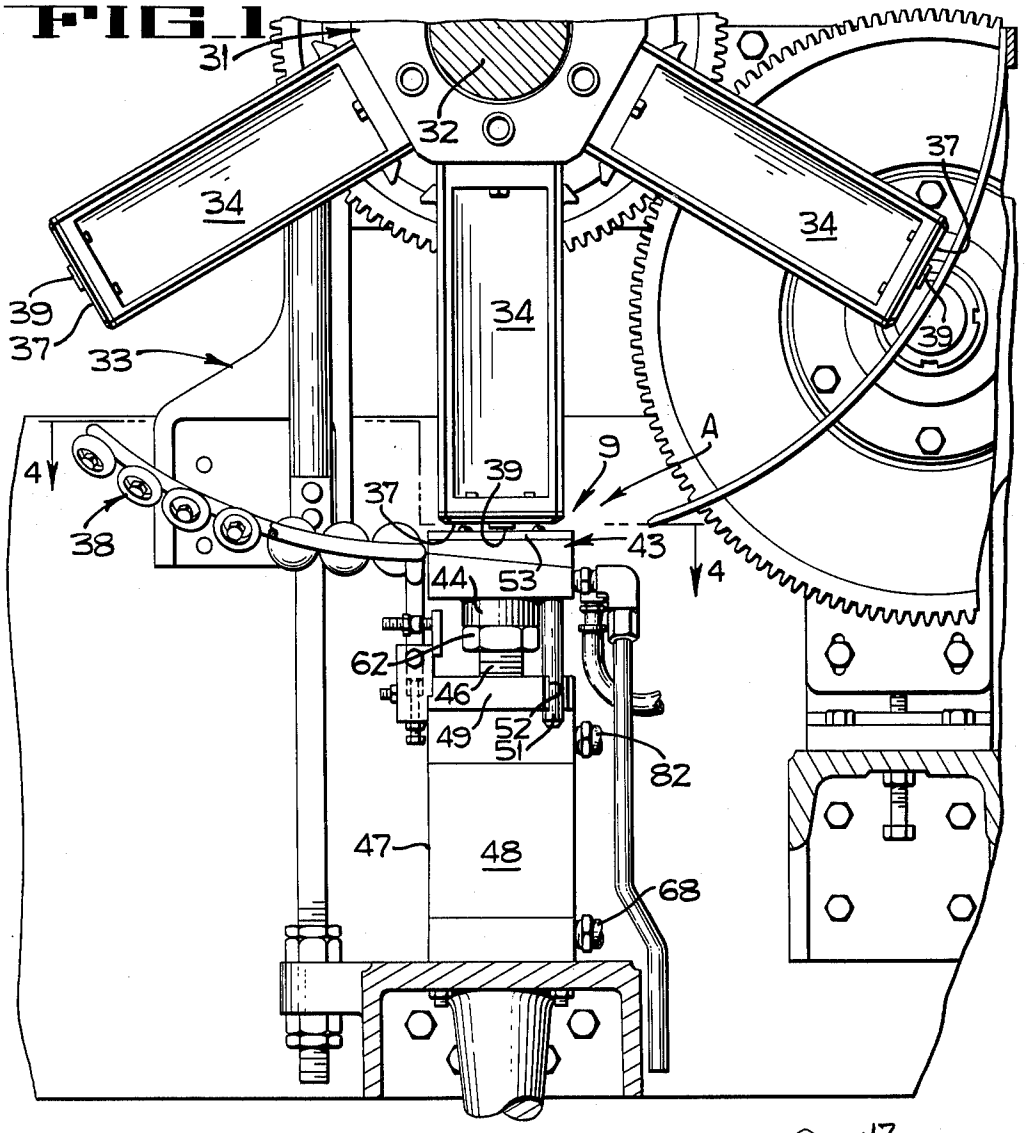
May 24, 1966 J. L. REIMERS 3,252,386

APPARATUS FOR SEALING END CLOSURES OF CARTONS

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FIG_1



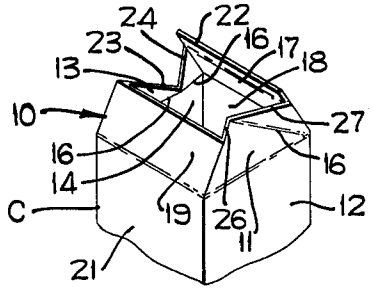


FIG_2

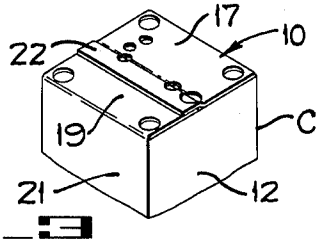


FIG_3

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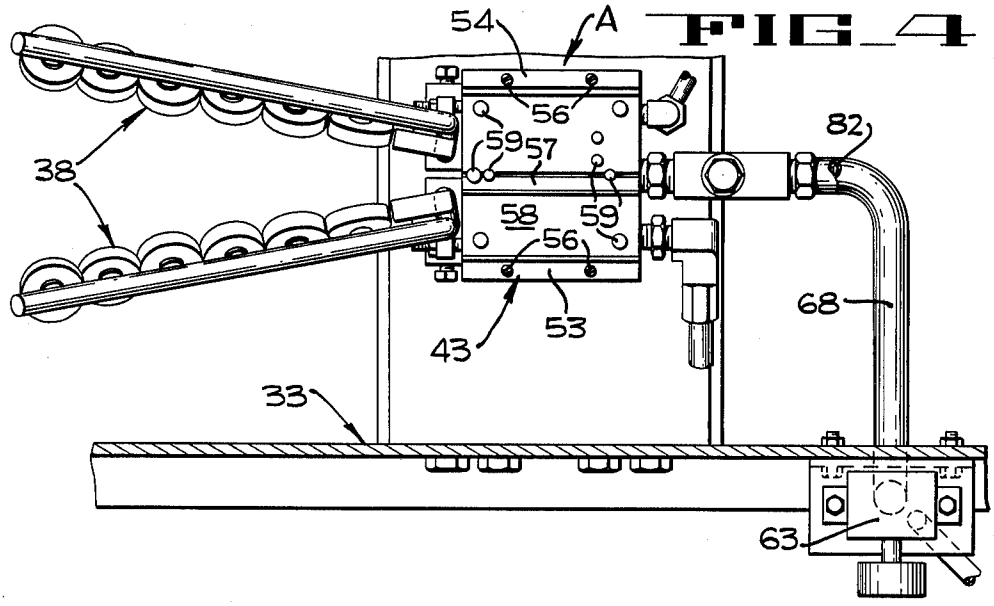
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May 24, 1966 J. L. REIMERS 3,252,386

APPARATUS FOR SEALING END CLOSURES OF CARTONS

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FIG_4



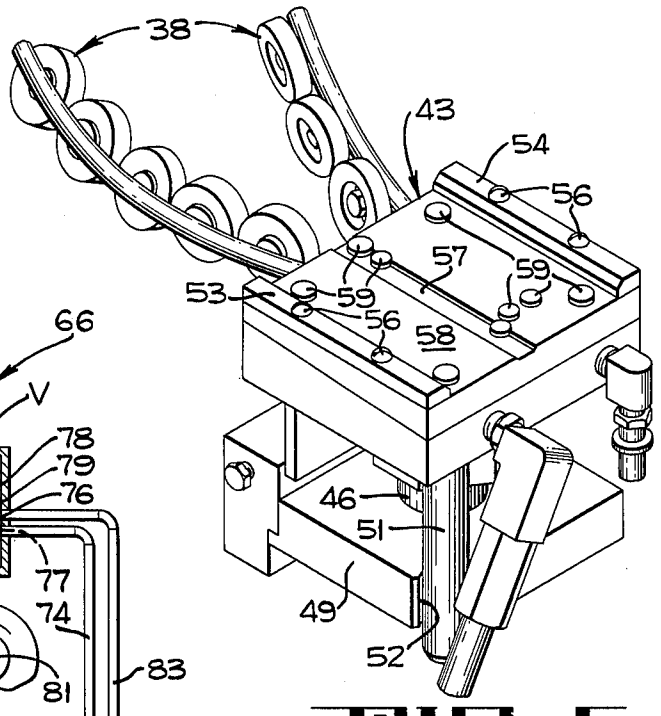


FIG_5

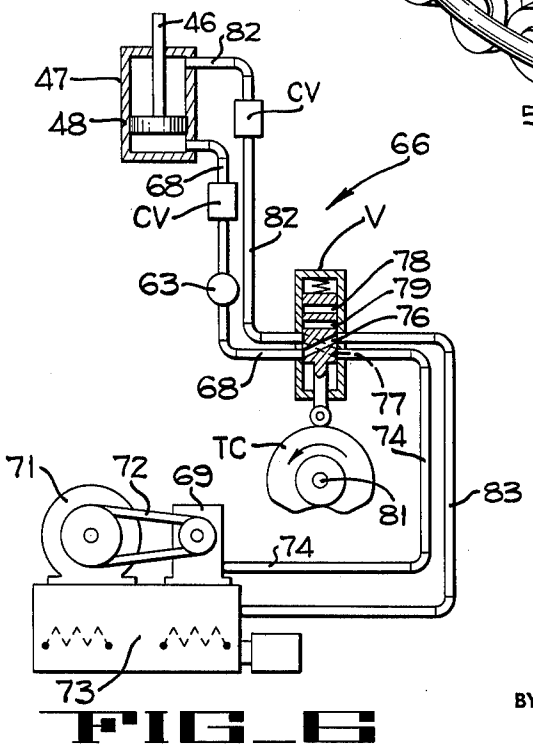


FIG_6

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United States Patent Office

3,252,386

Patented May 24, 1966

3,252,386
APPARATUS FOR SEALING END CLOSURES OF CARTONS

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Filed Sept. 26, 1963, Ser. No. 311,697
3 Claims. (Cl. 93—44.1)

The present invention pertains to packaging equipment and more particularly relates to apparatus for applying sealing pressure to heated and folded thermoplastic flaps which provide fluid tight closures for cartons.

In carton forming and filling machines of the type disclosed in the applications for patent of Heffelfinger et al., Ser. No. 216,248, filed August 10, 1962, and of Reimers, Ser. No. 290,795, filed June 26, 1963, both applications being assigned to the assignee of the present invention, cartons are formed for use in packaging milk or similar products. The cartons have a wall structure which includes a cardboard inner base layer laminated with a polyethylene coating on both the outside and the inside of the base layer.

Although the laminated material from which the carton walls and closure parts which are extensions of the walls are made is intended to be of a predetermined thickness, in actual practice it has been found that the thickness of the carton walls varies to such an extent that it is impractical to use positive mechanical stops for limiting the stroke of the pressure applying means relative to the pressure resisting back-up means against which the closure parts are squeezed. When using positive mechanical stops, it has been found that the closure flaps of the cartons having walls which are thicker than the predetermined desired thickness are squeezed to such an extent that the closure flaps are crushed providing a defective closure. When the closure flaps are thinner than normal, the mechanical stops prevent the proper squeezing force to be applied to the flaps which likewise results in a defective closure.

It is, therefore, one object of the present invention to provide apparatus for applying a predetermined sealing force to carton flaps.

Another object is to provide apparatus for applying a predetermined sealing force to carton flaps when the flaps vary in thickness from a predetermined standard.

Another object is to provide pressure controlling means in apparatus for squeezing the closure flaps of a carton together in fluid-tight relationship.

These and other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings, in which:

FIG. 1 is a vertical elevation of a portion of a carton forming and filling machine showing the end sealing apparatus of the present invention associated therewith, certain parts of a flap folding apparatus being broken away.

FIG. 2 is a perspective of the end closure of a carton, showing the several flaps thereof in positions they assume after certain breaking and forming operations have been performed preliminary to the sealing operation.

FIG. 3 is a perspective of a completely formed and sealed end closure of a carton.

FIG. 4 is an enlarged horizontal section taken along lines 4—4 of FIG. 1 showing an end sealing head.

FIG. 5 is a perspective of the pressure applying end sealing head of the apparatus of FIG. 1.

FIG. 6 is a hydraulic diagram illustrating the structure for actuating the end sealing head.

The end sealing apparatus 9 (FIG. 1) of the present invention is adapted to provide a fluid-tight seal on the end closure 10 (FIGS. 2 and 3) of a carton C. Although

the specific details of the carton form no part of the present invention, a description of the end closure 10 of a carton of the type, that is closed by the apparatus of the present invention, is presented as an aid in the understanding of the function of the end sealing apparatus.

The end closure of each carton C comprises a front flap 11 projecting from a wall 12 of the carton, and a rear flap 13 projecting from the opposite wall 14. Each flap is provided with a pair of score lines 16 to facilitate the inward bending of the flaps. The closure also includes a flap 17 that projects from a wall 18 and is slightly longer than an opposed flap 19 which projects from the opposite wall 21. The outer end of the long flap 17 provides a lip 22 which is adapted to overlap and be sealed to the shorter flap 19. The lines of bend between the flaps and their adjacent walls are prescored to facilitate bending of flaps relative to the walls. The edges of adjacent flaps are connected, and the lines of bend which connect the edges of the flaps together are likewise prescored to facilitate bending of these edges. When the flaps are bent into sealed position shown in FIGURE 3, free edges 23 and 24 of the flap 13, and free edges 26 and 27 of the flap 11, are brought into abutting engagement.

The end sealing apparatus 9 (FIG. 1) of the present invention is suitable for use with a carton forming and filling machine of the type disclosed in the previously referred to Heffelfinger et al. application. With the exception of the sealing apparatus 9, the mechanism of FIG. 1 is identical to that disclosed in said Heffelfinger et al. application, and reference may be had to said application for a complete description of any mechanism not described in detail herein. This machine includes a turret 31 which is keyed to a horizontal shaft 32 that is journalled in the frame 33 of the machine. The turret 31 includes a plurality of evenly spaced mandrels 34 which project radially outward from the shaft 32. Each mandrel is of generally rectangular form, and receives a carton black which is shaped in the form of a rectangular tube. Both ends of each blank are open, and the end closure 10 (FIGS. 2 and 3) is the bottom closure of the carton C, which bottom closure projects outwardly from the outer free end or head 37 of the associated mandrel 34. The turret 31 is intermittently indexed in a counterclockwise direction (FIG. 1) into operating stations (not shown) where the flaps of the bottom closures are first bent about the preformed score lines 16, and thereafter are heated so that the surface materials which are subsequently sealed together are raised to the bonding temperature.

After the flap surfaces which are to be sealed together have been heated to the bonding temperature, the flaps are moved over a flap folding apparatus 38 and are accurately folded into sealing position. Continued movement of the turret 31 advances the flaps past the folding apparatus 38 and into a sealing station A where pressure is applied to the flaps to seal them together in fluidtight relationship. The cartons, with their end closures 10 sealed, are thereafter discharged from the associated mandrels 34.

More particularly, the end sealing apparatus 9 comprises the head 37 of the mandrel 34 which head is stationary during the sealing operation and includes an outwardly projecting V-shaped die 39 which compensates for the absence of two thicknesses of the carton material near the center of the carton due to the manner of folding the carton. Thus, the mandrel head 37 acts as means for resisting the pressure applied to the end closure 10 by an end sealing die 43 which includes a hub 44 screwed on the piston rod 46 of a hydraulic power unit 47. The cylinder 48 of the power unit 47 is bolted to

the frame 33 and to a support block 49 secured to its upper end. The flap folding apparatus 38 is bolted to the block 49 and serves to plow the flaps of the end closure 10 into sealing position as fully disclosed in the previously referred-to Reimers application.

The end sealing die 43 (FIG. 5) is held from rotation above the axis of the piston rod 46 by a pin 51 secured to the die and projecting downwardly therefrom through a slot 52 in the support block 49. Chamfered side guide strips 53 and 54 are secured to the upper face of the die 43 by screws 56, and aid in holding the parts of the bottom closure in proper position during the sealing operation. A shallow, longitudinally extending groove 57 is formed in the sealing face 58 of the die 43 for receiving the extra thickness afforded by the lip 22 of the end closure when the bottom flaps are being pressed into sealing engagement.

In order to provide a leak proof closure, raised buttons 59 are provided on the sealing face 58 and are positioned to engage the several seam lines existing in the heated flaps of the end closure 10 to apply localized forces to the end closure. These forces slightly deform the carton material to thereby block the potential flow passages which occur at these seam lines and to firmly bond the heated material of the mating parts together.

In accordance with the present invention, the end sealing die 43 is screwed down on the piston rod 46 until a clearance of approximately thirty to thirty-five thousandths of an inch occurs between the mandrel head 37 and the face of the die 43 when the piston rod 46 has reached the uppermost limit of its stroke. The die 43 is then locked in this position on the piston rod 46 by a lock nut 62. This amount of clearance is sufficient to permit proper sealing pressure to be applied to the bottom closures having walls which are far thinner than would be present on any acceptable cartons of the type being sealed with the end sealing apparatus 9. This clearance also permits the die 43 to be moved to the upper limit of its stroke without contacting the mandrel head 37 when a carton is not positioned on the mandrel.

An important feature of the present invention is the discovery that by applying the same pressure to the closure of each carton and by relying on the thickness of the material from which the end closures are formed for stopping the upward movement of the die 43, the cartons passing through the machine are consistently provided with fluidtight end closures regardless of the variations and thicknesses of the carton walls.

This application of pressure to the end closure 10 is controlled so that fluidtight seals will be provided on thick walled cartons as well as on thin walled cartons. In this regard, a hydraulic control system 66 (FIG. 6) is provided and includes a pressure reducing valve 63 in a conduit 68 leading to the lowermost end of the power unit 47. It has been found that a pressure of approximately 350 p.s.i.g. will effectively seal the end closures of certain types of milk cartons. However, it should be understood that the valve 63 may be adjusted to adapt the pressure for different types of carton material. The hydraulic control system 66 comprises a hydraulic pump 69 which is driven by a motor 71 through a belt drive 72. The pump draws hydraulic fluid from a sump 73 and directs it through a high-pressure conduit 74 at approximately 450 p.s.i.g. to a valve V having cross-passages 76 and 77 therein and parallel passages 78 and 79 therein. A timing cam TC, which is secured to a continuously driven cam shaft 81, holds the valve V in the cross-passage position while the turret 31 is being rotated to move one of the mandrels 34 to the sealing station A. The cam TC shifts the valve V to the straight passage position after a mandrel has been indexed at station A.

At the beginning of a cycle of operation and before the carton to be sealed reaches station A, the cam TC shifts valve V to the cross-passage position. High-pressure fluid is directed from the pump 69, through the conduit 74, through the passage 77, through a conduit 82, through a speed control valve CV and into the upper end of the power unit 47 thereby moving the piston rod 46 downwardly to a retracted position in the cylinder 48. Fluid in the lower end of the power unit 47 is discharged through the conduit 68, through a speed control valve CV and the pressure reducing valve 63 in the conduit 68, through the cross-passage 76 in the valve V, and through a low pressure conduit 83 for return to the sump 73.

The speed control valves CV are of the type which prevents free entry of fluid into the cylinder 48 and restricts the flow of fluid leaving the cylinder to thereby control the operating speed of the piston rod. Therefore, the speed control valve CV in conduit 68 controls the speed of the downward movement of piston rod 46 when the valve V is in the cross-passage position. If a more specific description of the speed control valves CV and timing cam TC is desired, reference may be had to the aforementioned Heffelfinger et al. application.

After a carton has been indexed into the sealing station A, the timing cam TC shifts the valve to the parallel passage position wherein high pressure fluid flows into the lower end of the power unit 47 through the conduit 74, passage 79, conduit 68, speed control valve CV, and pressure reducing valve 63 which reduces the pressure to approximately 350 p.s.i.g. The fluid in the upper portion of the power unit 47 is discharged through the conduit 82 and speed control valve CV therein, and flows through the parallel passage 78 in the valve V to return to the sump 73 through the low pressure conduit 83. With the valve V in this position, the piston rod 46 moves the die 43 upwardly until the several thicknesses of carton material disposed between the mandrel head 37 and die 43 terminates the upward movement of the die and holds the die in this position under a pressure of approximately 350 p.s.i.g. until the end closure is sealed. The cam TC then shifts the valve V to the cross passage position to prepare the sealing apparatus for another cycle of operation.

From the foregoing description it will be apparent that the end sealing apparatus of the present invention includes a pressure reducing valve in the hydraulic system which eliminates the need for mechanical stops to stop the die at a specific position, wherein only those cartons having walls of a predetermined thickness will be properly sealed. By controlling the hydraulic pressure and discarding the positive mechanical stop, cartons having thicker or thinner walls than said predetermined thickness are consistently provided with fluid tight bottom closures.

While one embodiment of the present invention has been shown and described, it will be understood that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

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

1. A carton end sealing apparatus comprising means for supporting a thermoplastic carton with the flaps that define an end closure heated to a bonding temperature and folded into a sealing position and with one face of said folded flaps abutting said supporting means, means movable into engagement with said flaps for applying and holding a sealing pressure against the opposite face of said heated closure flaps against the resistance of said supporting means to bond said closure flaps together in fluid tight relation, and means for controlling the sealing pressure so that the flaps of the closure determine the length of travel of the pressure applying means and provide the sole pressure resisting means between the pressure applying means and the carton supporting means during the carton sealing operation.

2. A carton end sealing apparatus comprising means for supporting a thermoplastic carton with the flaps that

define an end closure heated to a bonding temperature and folded into sealing position and with one face of said flaps abutting said supporting means, an end sealing die, a power unit connected to said die and arranged to move said die toward and away from said supporting means to engage the opposite face of said flaps, and means for controlling said power unit for causing said power unit to apply a sealing force to said closure so that the flaps of the closure will determine the length of travel of the sealing die and will provide the sole pressure resisting means between the die and the carton supporting means during the carton sealing operation.

3. A carton end sealing apparatus comprising means for supporting a thermoplastic carton with the flaps that define an end closure heated to a bonding temperature and folded into a sealing position and with one face of said flaps abutting said supporting means, an end sealing die, a plurality of buttons projecting from the sealing faces

of said die in position to engage seam lines formed on the opposite face of said flaps, a hydraulic power unit connected to said die and arranged to move said die toward and away from said supporting means, and a pressure reducing valve for controlling the hydraulic pressure of said power unit for causing said power unit to apply a sealing force to the closure, whereby the flaps of the closure will determine the length of travel of the sealing die during the application of said force and will provide the sole pressure resisting means between the die and the carton supporting means during the carton sealing operation, said buttons being arranged to deform the carton material at the seam lines so as to block natural flow passages in the end closure and to provide a superior seal at the deformed areas.

No references cited.

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