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Farfaglia

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[45] **July 23, 1974**

[54] **HOT AIR HEATER FOR CARTON SEALING MACHINE**

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[73] Assignee: **Phillips Petroleum Company,** Bartlesville, Okla.

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[21] Appl. No.: **395,033**

[52] **U.S. Cl.** ..... **34/104,** 34/105, 93/44.1 R, 432/230

[51] **Int. Cl.** **F26b 25/00**

[58] **Field of Search** ..... 432/230; 34/104, 105; 93/44.1 R

[56] **References Cited**

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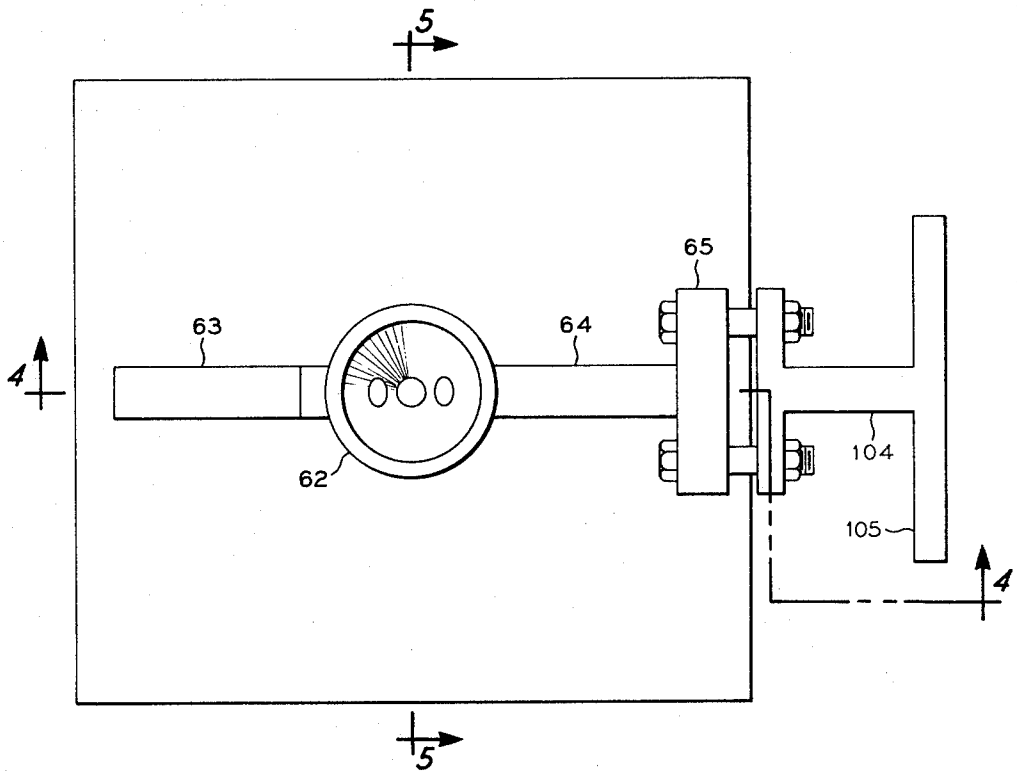
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Primary Examiner—John J. Camby

[57] **ABSTRACT**

In a machine for filling and sealing cartons such as the thermoplastic coated paperboard milk cartons, the heater head for heating the upper portion of the carton prior to sealing comprises a first hot air plenum chamber which enters the open end of the carton and has a continuous outer perforated wall facing the inner surface of the carton and a second hot air plenum chamber which surrounds the outside of the upper end of the carton and has a continuous inner perforated wall facing the outside surface of the carton. The outer wall of the first plenum chamber and the inner wall of the second plenum chamber form a continuous annular space for receiving the top marginal portion of a carton, with the perforations in both walls being spaced to provide heating of both the inner surface and the outer surface of the full extent of the top marginal portion of the carton. The outer wall of the first plenum chamber extends downwardly and inwardly toward the central vertical axis of the carton while the inner wall of the second plenum chamber extends downwardly and outwardly with respect to the central vertical axis of the carton.

10 Claims, 6 Drawing Figures



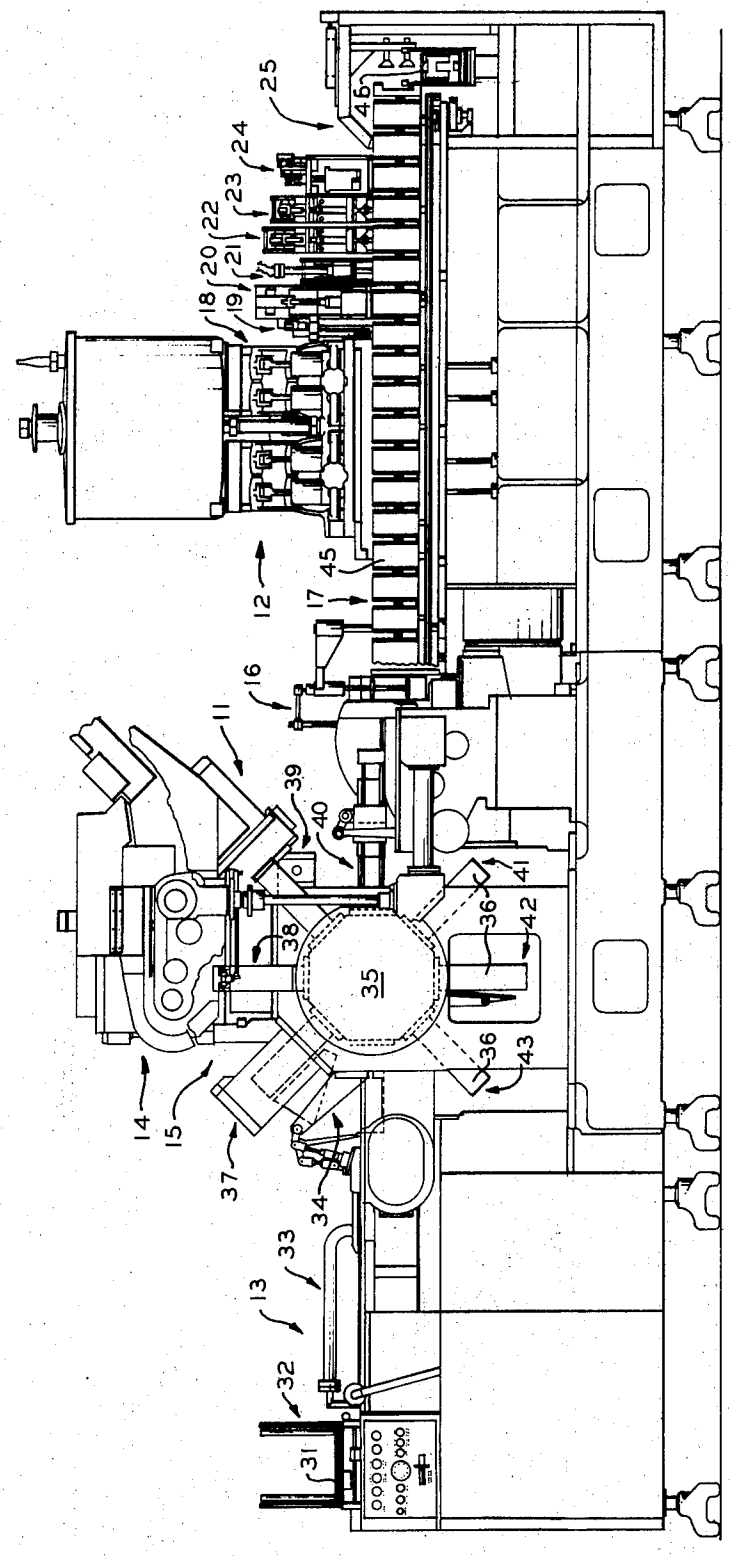

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FIG. 1

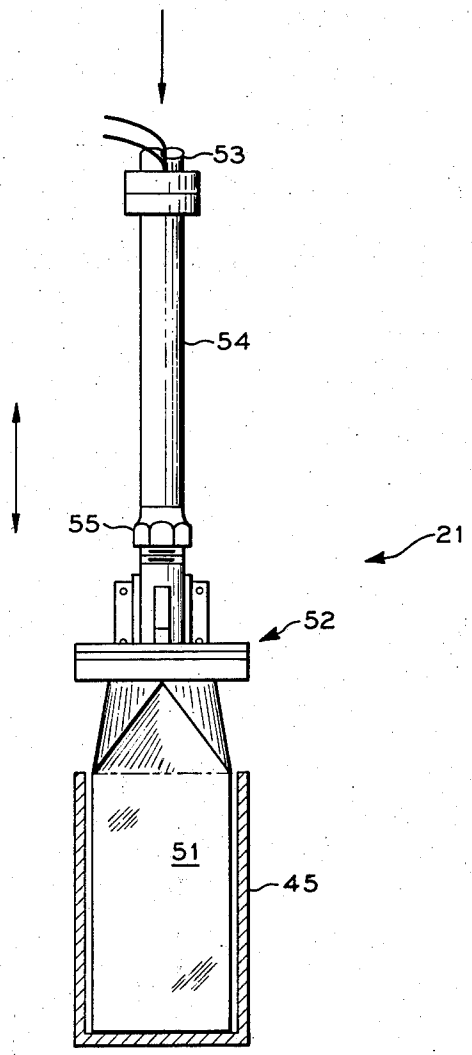


FIG. 2

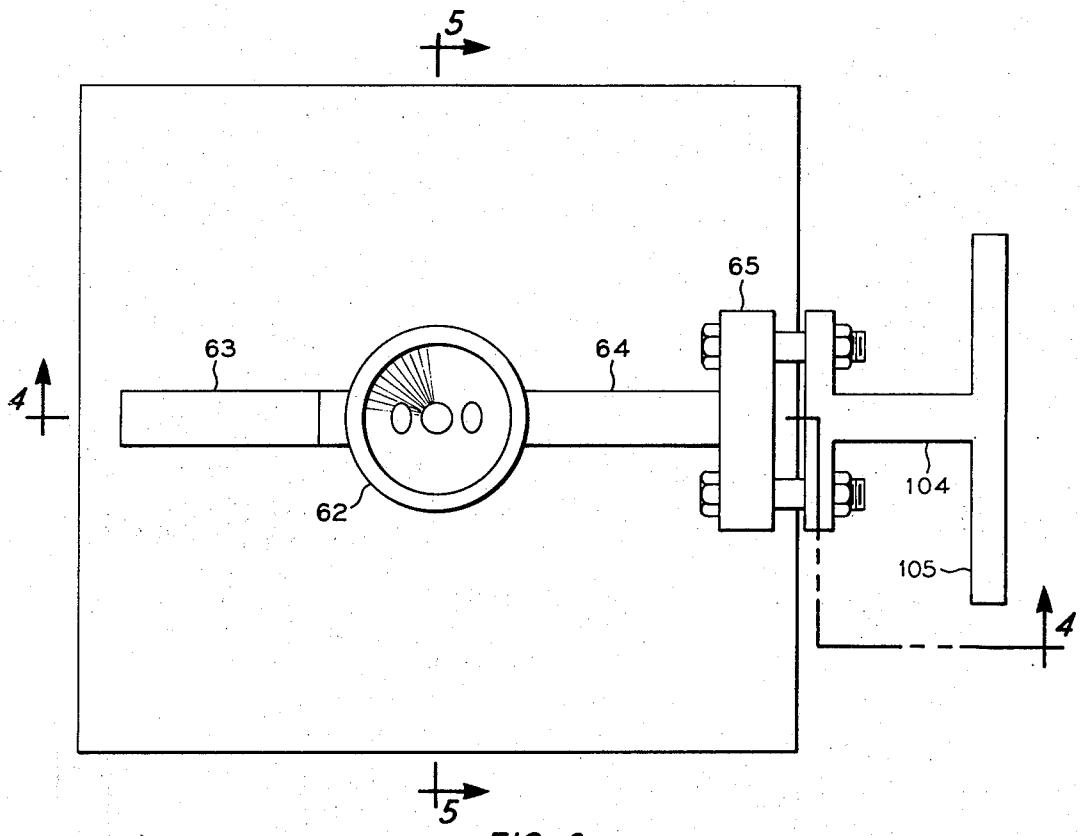

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FIG. 3

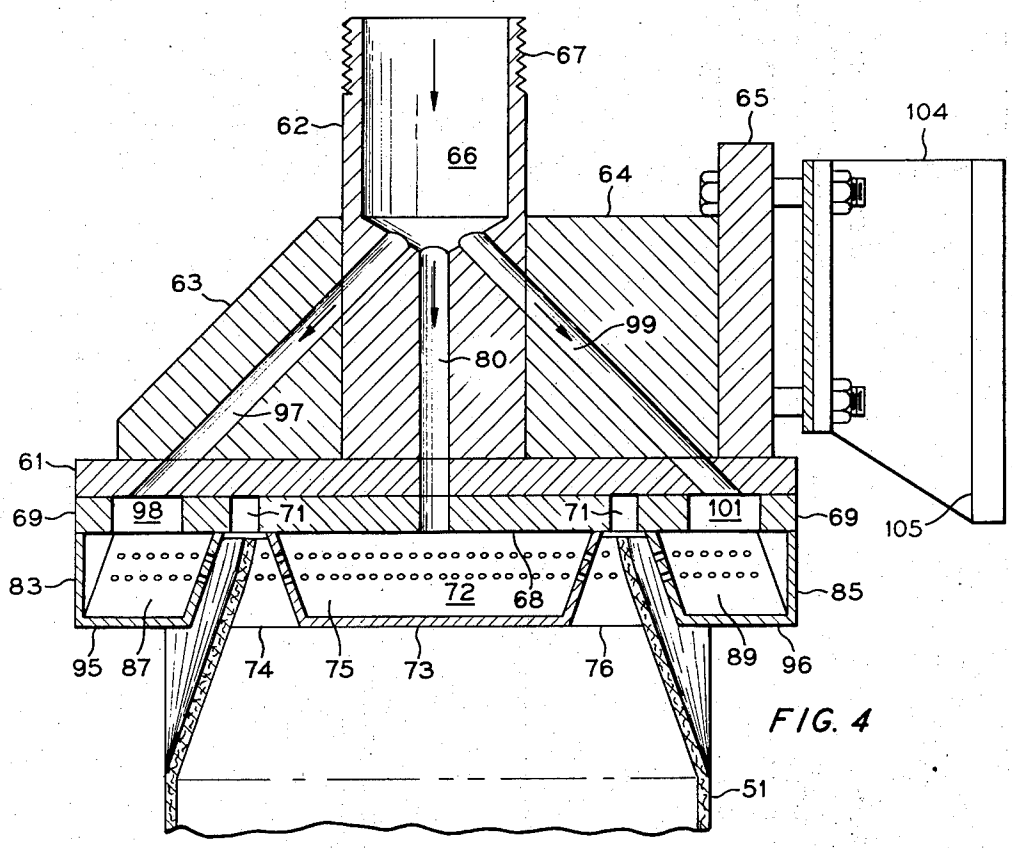

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FIG. 4

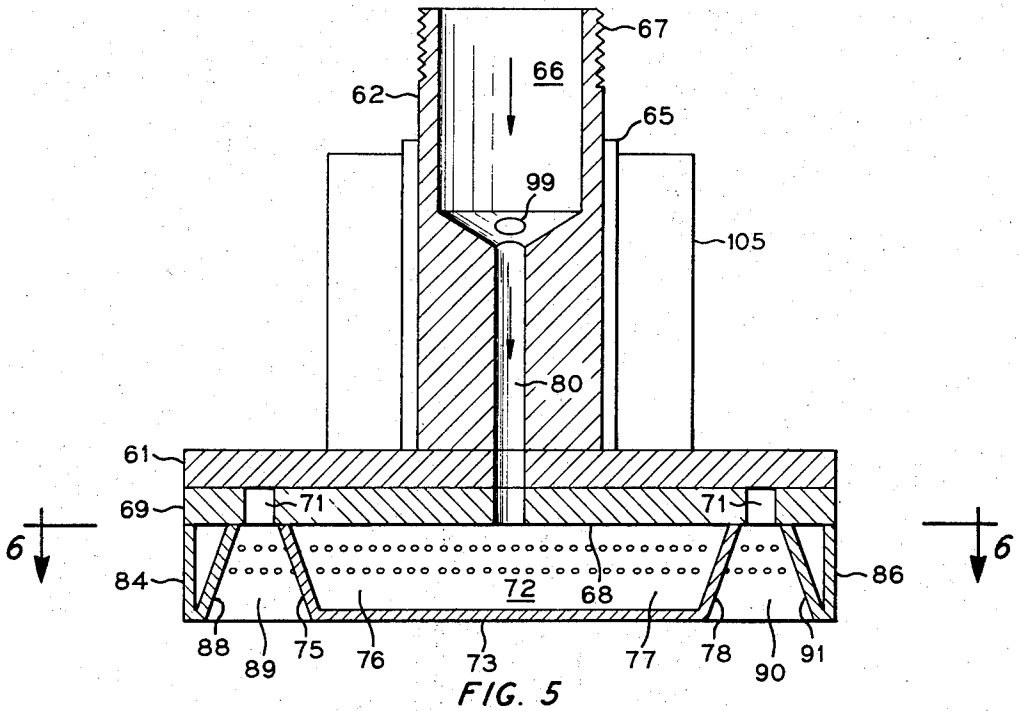

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FIG. 5

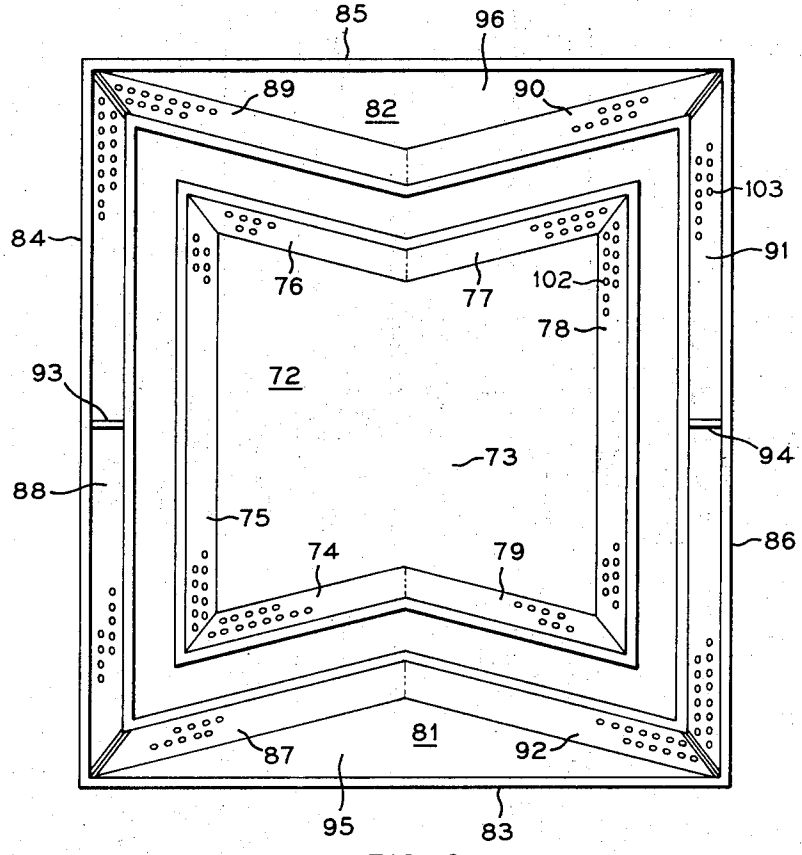

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FIG. 6

HOT AIR HEATER FOR CARTON SEALING MACHINE

This invention relates to method and apparatus for heating the end of a carton prior to sealing the carton.

Hot air heater heads for gable top carton sealing machines having an inner plenum chamber which fits within the open end of the carton and two outside plenum chambers for heating portions of the outside of the carton are known. However, difficulties in achieving a liquid tight seal with this type of heater has been encountered. It is an object of the present invention to provide a new and improved hot air heater head. Another object of the invention is to improve the quality of the seals for carton ends. Another object of the invention is to improve the seals in the top end of a gable top carton. Yet another object of the invention is to reduce the time required for heating the open end of a gable top carton to a suitable bonding temperature. Still another object of the invention is to minimize faulty seals in a carton due to contamination by the product being packaged.

Other objects, aspects and advantages of the invention will be apparent from a study of the specification, the drawings and the appended claims to the invention.

In the drawings, FIG. 1 is a front elevational view of a carton forming, filling and sealing machine embodying the present invention;

FIG. 2 is a simplified elevational view of a carton top heating station suitable for use in the machine of FIG. 1;

FIG. 3 is a top plan view of the heater head structure for the top heating station of FIG. 2;

FIG. 4 is an elevational view in cross section taken along line 4—4 in FIG. 3;

FIG. 5 is an elevational view in cross section taken along line 5—5 in FIG. 3, omitting the container; and

FIG. 6 is a cross-sectional view taken along line 6—6 of FIG. 5.

Referring now to the drawings in detail and to FIG. 1 in particular, the carton forming, filling and sealing machine comprises a forming section **11** and a filling and sealing section **12.** The forming section **11** comprises a sidewall blank feeding and heating subsection **13,** a bottom blank feeding and heating subsection **14,** a forming subsection **15,** and a transfer subsection **16.** The filling and sealing section has two parallel endless conveyor systems **17,** and each conveyor system comprises a filling subsection **18** occupying five conveyor stations, a defoaming station **19,** a score breaking station **20,** a top heating station **21,** a folding and sealing station **22,** a secondary sealing station **23,** a branding station **24,** and a transfer station **25.**

The sidewall blanks **31** manually placed in the sidewall blank magazine **32** are flat, single sheets of paperboard, rectangular in shape, scored to provide five longitudinal panels and a gable-top structure, and coated on both the top and bottom surfaces of each sheet with a thermoplastic material, e.g., polyethylene. The sidewall blanks **31** are successively withdrawn from magazine **32** and intermittently advanced through the sidewall blank heating station **33** to the sidewall blank receiving station **34** for turret **35.** At the sidewall blank heating station **33,** the side margins to be overlapped and the bottom margin of the sidewall blank are heated to a bonding temperature for the thermoplastic coating.

The turret **35** is journalled on a horizontal axis and carries eight circumferentially spaced apart mandrels **36** extending radially from the axis of turret **35.** The cross section of each of mandrels **36** in a plane perpendicular to its longitudinal axis is generally rectangular. Suitable drive mechanism is provided for indexing or effecting intermittent rotation of the turret **35** to move each mandrel from the sidewall blank receiving station **34** through a blank folding station **37;** a bottom end closure forming, applying and sealing station **38;** a secondary bottom sealing station **39;** a stripping station **40;** and three successive nonoperating stations **41, 42** and **43.**

The tubular carton body having a bottom closure sealed thereto is removed from the mandrel **36** at the stripping station **40** and is transferred to a conveyor pocket **45** of one of the two conveyor systems **17.** The product to be packaged is introduced into the open-topped tubular carton in the filling subsection **18.** If desired, any foam resulting from the filling operation can be removed at defoaming station **19.** The scores for the gable-top structure can be initially folded in the score breaking station **20,** resulting in the conventional six-sided top structure. The gable-top ridge panels of the carton are heated in station **21** to a temperature at least as high as the thermal bonding temperature of the thermoplastic coatings on the carton. The heated superstructure is then folded into contact under pressure at the folding and sealing station **22** to effect the bonding of adjacent ridge panels. Secondary sealing station **23** applies pressure to the ridge panels during cooling of the thermoplastic bond. If desired, a data indicia, plant identification or other information can be applied to the bonded ridge panels of the sealed carton at branding station **24.** The formed, filled and sealed carton is removed from its conveyor pocket **45** at the transfer station **25** and placed on a delivery conveyor **46.**

Referring now to FIGS. **2–6,** a filled container **51,** having had the gable-top score lines broken so that the six ridge panels have assumed the six sided configuration is positioned in its conveyor pocket **45** at the top heating station **21.** The heater head **52** for heating the ridge panels is shown in the down position, encompassing the ridge panels of the gable-top structure of container **51.** Air under pressure is supplied through conduit **53** to the inlet of electrical heater **54.** The heated air passes through conduit **55** to the inlet of heater head **52.** While air is the presently preferred heating gas, other gases may be employed instead of air.

The heater head **52** comprises a horizontal base plate **61** to which cylindrical bar **62** and vertical plates **63, 64** and **65** are secured by suitable means, for example, by welding. The upper portion of bar **62** has a large diameter bore **66** formed therein to receive the heated air from heater **54.** The upper end of bar **62** is provided with external threads **67** to facilitate the connection thereof to conduit **55.** A secondary central base plate **68** having a six-sided configuration corresponding to and slightly smaller than the six-sided configuration of the ridge panels of the gable-top structure is secured to the lowerside of the central portion of base plate **61.** An outer secondary base plate **69** having a six-sided opening therein corresponding to and slightly larger than the six-sided configuration of the ridge panels is

secured to the periphery of base plate 61 to form a continuous channel 71 between central plate 68 and outer plate 69 adapted to receive the upper edge of the ridge panels of the container 51. If desired channel 71 can be omitted, and plates 68 and 69 can be formed as a single element. Plates 68 and 69 can also be formed with plate 61 as a single piece. A central plenum chamber 72 is formed by bottom wall 73 and sidewall sections 74, 75, 76, 77, 78 and 79, together with secondary central base plate 68. A passageway 80 extends through the lower portion of rod 62, base plate 61 and secondary central base plate 68 to provide fluid communication between bore 66 and plenum chamber 72. An outer annular plenum chamber comprising first and second compartments 81 and 82 is formed by outer wall sections 83, 84, 85 and 86, inner wall sections 87, 88, 89, 90, 91, and 92, together with secondary outer base plate 69, and bottom walls 95 and 96. In one embodiment the outer annular chamber is divided into two separate compartments by partitions 93 and 94. A passageway 97 extends through rod 62, plate 63, and base plate 61 into opening 98 in secondary outer base plate 69 to provide fluid communication between bore 66 and compartment 81. A passageway 99 extends through rod 62, plate 64, and base plate 61 into opening 101 in secondary outer base plate 69 to provide fluid communication between bore 66 and compartment 82.

The continuous outer sidewall of the central plenum chamber 72 formed by sidewall sections 74, 75, 76, 77, 78 and 79 corresponds to the six-sided opening formed by the six ridge panels of the container 51, but is slightly smaller in dimensions so that the central plenum chamber 72 can enter the carton opening without contact between the carton and the heater head 52 occurring. Sidewall sections 75 and 78 extend along horizontal lines parallel to each other and to the horizontal lines of the ridge panels surmounting the roof panels of the gable top structure of carton 51. Sidewall sections 74 and 79 are joined together between one end of section 75 and the adjacent end of section 78 to form a V having the apex thereof directed toward the central vertical axis of the carton 51 being heated. Similarly, sidewall sections 76 and 77 are joined together between the other adjacent pair of ends of sections 75 and 78 to form a second V having the apex thereof directed toward the central vertical axis of the carton 51 being heated. The sidewall sections 74, 75, 76, 77, 78 and 79 are inclined to the vertical so that they extend downwardly from secondary central base plate 68 and inwardly toward the central vertical axis of container 51 and heater head 52. An angle of inclination to the vertical for sections 74–79 in the range of about 10° to about 30° is satisfactory, with an angle of inclination in the range of about 15° to about 25° being preferred.

The outer wall of the central plenum chamber 72 is provided with perforations 102 therethrough spaced at intervals along the length of each of the six sidewall sections 74–79 for directing jets of heated air at the inner surface of each of the six ridge panels of the carton 51 being heated. The inclination of the outer sidewall formed by section 74–79 and the inclination of the inner surface of the ridge panels of carton 51 are such that the jets of heated gas strike the inner surface of the ridge panels at acute angles and are deflected downwardly into the carton 51. The downward flow of the heated gas along the inside surface of the ridge panels aids in cleaning the inner surface of the ridge panels of any particles or droplets of the material being packaged, thereby minimizing defective sealing of the ridge panels due to the presence of material which would interfere with the effectiveness of the seal. The downward flow of the heated gas along the inner surface of the ridge panels builds up the gas pressure in the container as well as creating turbulence, each of which factor can promote the bursting of any bubbles of foam on the top of a liquid product in the container 51. The heated air escapes from the interior of the carton 51 by moving upwardly through the space between the outer sidewall of plenum chamber 72 and the carton ridge panels. The convergence of this space in the upward direction increases the flow rate of the heated gas along the upper edge of the ridge panels, thereby heating the upper portion of the ridge panels to a higher temperature than the lower portion of the ridge panels. The downward inclination of the hot air jets from the central plenum chamber 72 also reduces the distance the heating head has to enter the carton in order to achieve the desired degree of heating.

The continuous inner wall of the outer plenum chamber formed by the six sidewall sections 87, 88, 89, 90, 91 and 92 also corresponds to the six sided opening formed by the six ridge panels of the container 51, but is slightly larger in dimensions so that the inner wall of the outer plenum chamber and the outer wall of the inner plenum chamber 72 form an annular space into which the ridge panels of the carton 51 can extend without contacting the heater head 52. The sidewall sections 88 and 86 extend along horizontal lines parallel to the horizontal lines of sidewall sections 75 and 78. Sections 87 and 92 are joined together between one pair of adjacent ends of sections 86 and 88 to form a V having the apex thereof directed toward the central vertical axis of the carton 51 being heated. Similarly, sidewall sections 89 and 90 are joined together between the other pair of adjacent ends of sections 86 and 88 to form a V having the apex thereof directed toward the central vertical axis of carton 51. Sidewall sections 83, 84, 86, 87, 88, 91 and 92 form a generally triangular chamber 81 having parallel wing chambers extending from opposite ends thereof. Similarly sidewall sections 84, 85, 86, 88, 89, 90 and 91 form a second generally triangular chamber 82 having parallel wing chambers extending from the opposite corners. This configuration is advantageous in the distribution of the heated gas to the various perforations.

The sidewall sections 87–92 are inclined to the vertical so that they extend downwardly from secondary base plate 69 and outwardly away from the central vertical axis of container 51 and heater head 52. The angle of inclination to the vertical for the sidewall sections 87–92 will generally be in the range of about 5° to about 50° and preferably will be in the range of about 15° to about 30°. The inner wall of the annular plenum chamber 81, 82 is provided with perforations 103 therethrough spaced at intervals along the length of each of the six sidewall sections 87–92 for directed jets of heated gas at the outer surface of each of the six ridge panels of the carton 51 being heated. These jets strike the outer surface of the ridge panels at acute angles and are deflected downwardly away from the top edge of the carton 51. The downward flow of heated gas along the outer surface of the ridge panels cleans this surface of any foreign material such as particles or droplets of the material being packaged. This cleaning

action is very advantageous in the formation of the bond between the outside surfaces of the pair of adjacent ridge panels over each enfolded portion of the gable structure. Heating the outside surfaces of all of the ridge panels gives a more uniform temperature of the coated surfaces to be bonded and reduces the time required for heating. Directing jets of heated gas at the external surfaces of all of the ridge panels also avoids deformation of the open end of the carton due to uneven pressures, thereby minimizing the possiblity of contact between the carton and the heater head.

The bracket **104** is secured to flange **65** by suitable means. Bracket **104** is provided with a plate **105** which fits within a guideway to provide horizontal stability of the heater head **52** as it is vertically reciprocated. Suitable linkage means, not shown, connects bracket **104** to the drive mechanism of the machine to lower heating head **51** to enclose the ridge panels of a carton after the carton has been indexed to top heating station **21.** After the thermoplastic coatings on the ridge panels are heated to a tacky condition, bracket **104** is powered to raise the heating head **52,** permitting the heated carton to be indexed to sealing station **22.**

Reasonable variations and modifications are possible within the scope of the foregoing disclosure, the drawings and the appended claims to the invention.

What is claimed is:

1. In a machine for filling and sealing gable top cartons formed from thermoplastic coated paperboard, a heating head for heating the ridge panels of a filled carton prior to sealing said filled carton, the score lines in the gable top carton forming structure of said carton having been broken to form the six ridge panels thereof into a six sided opening, which comprises a support base, means attached to a central portion of the lower surface of said support base to define a central plenum chamber having a continuous outer perforated wall which has six sections corresponding to the six sides of said opening in said carton, means attached to the peripheral portion of the lower surface of said support base to define an outer annular plenum chamber having a continuous inner perforated wall with six sections corresponding to the six sides of said opening, said outer wall of said central plenum chamber and said inner wall of said outer plenum chamber forming an annular space adapted to receive therein the ridge panels of a prebroken gable top structure of a filled carton without contact between the carton and the heating head, means for introducing heated gas into said central plenum chamber and into said outer plenum chamber, said outer wall of said central plenum chamber having perforations therethrough spaced at intervals along the length of each of the six sections thereof for directing jets of heated gas at the inner surface of each of the six ridge panels of the carton being heated, said outer wall of said central plenum chamber being inclined downwardly from said support base and inwardly toward the vertical axis of the carton being heated at an angle to the vertical in the range of about 10° to about 30° so that said jets of heated gas strike the inner surfaces of said ridge panels at acute angles and are deflected downwardly into the carton.

2. Apparatus in accordance with claim **1** wherein said inner wall of said outer plenum chamber being inclined downwardly from said support base and outwardly from the vertical axis of the carton being heated at an angle to the vertical in the range of about 5° to about 50° so that said inner wall of said outer plenum chamber and said outer wall of said inner plenum chamber are spaced further apart at the bottom of said annular space than at the top of said annular space.

3. Apparatus in accordance with claim **2** wherein said inner wall of said outer plenum chamber has perforations therethrough spaced at intervals along the length of each of the six sections thereof for directing jets of heated gas at the outer surface of each of the six ridge panels of the carton being heated so that the jets of heated gas from said outer plenum chamber strike the outer surface of said six ridge panels at acute angles and are deflected downwardly.

4. Apparatus in accordance with claim **3** wherein a first one and a second one of the six sections of said inner wall of said outer plenum chamber are parallel to each other, a third one and a fourth one of the six sections of said inner wall of said outer plenum chamber are joined together between a first pair of adjacent ends of said first one and said second one to form a V having the apex thereof directed toward the central vertical axis of the carton being heated, a fifth one and a sixth one of the six sections of said inner wall of said outer plenum chamber are joined together between a second pair of adjacent ends of said first one and said second one to form a V having the apex thereof directed toward the central vertical axis of the carton being heated, said outer plenum chamber having a continuous outer wall with four connected sections, a first one and a second one of said four sections being parallel to said first one and second one, sections of said six sections of said inner wall of said outer plenum chamber, a third one of said four sections together with said third one and fourth one of said six sections of said inner wall of said outer plenum chamber forming a first generally triangular chamber, a fourth one of said four sections together with said fifth one and sixth one of said six sections of said inner wall of said outer plenum chamber forming a second generally triangular chamber, and wherein said means for introducing heated gas into said outer plenum chamber comprises first means for introducing heated gas into said first triangular chamber and second means for introducing heated gas into said second triangular chamber.

5. Apparatus in accordance with claim **4** further comprising a first partition wall extending from said first section of said inner wall of said outer plenum chamber to the adjacent one of said first and second sections of the outer wall of said outer plenum chamber, and a second partition wall extending from said second section of said inner wall of said outer plenum chamber to the adjacent one of said first and second sections of the outer wall of said outer plenum chamber to thereby divide said outer plenum chamber into two separate chambers.

6. Apparatus in accordance with claim **5** wherein the outer wall of said central plenum chamber is inclined at an angle to the vertical in the range of about 15° to about 25° and the inner wall of said outer plenum chamber is inclined at an angle to the vertical in the range of about 15° to about 30°.

7. Apparatus in accordance with claim **1** wherein said inner wall of said outer plenum chamber has perforations therethrough spaced at intervals along the length of each of the six sections thereof for directing jets of heated gas at the outer surface of each of the six ridge panels of the carbon being heated so that the jets of

heated gas from said outer plenum chamber strike the outer surface of said six ridge panels at acute angles and are deflected downwardly.

8. Apparatus in accordance with claim 1 wherein a first one and a second one of the six sections of said inner wall of said outer plenum chamber are parallel to each other, a third one and a fourth one of the six sections of said inner wall of said outer plenum chamber are joined together between a first pair of adjacent ends of said first one and said second one to form a V having the apex thereof directed toward the central vertical axis of the carton being heated, a fifth one and a sixth one of the six sections of said inner wall of said outer plenum chamber are joined together between a second pair of adjacent ends of said first one and said second one to form a V having the apex thereof directed toward central vertical axis of the carton being heated, said outer plenum chamber having a continuous outer wall with four connected sections, a first one and a second one of said four sections being parallel to said first one and second one sections of said six sections of said inner wall of said outer plenum chamber, a third one of said four sections together with said third one and fourth one of said six sections of said inner wall of said outer plenum chamber forming a first generally triangular chamber, a fourth one of said four sections together with said fifth one and sixth one of said six sections of said inner wall of said outer plenum chamber forming a second generally triangular chamber, and wherein said means for introducing heated gas into said outer plenum chamber comprises first means for introducing heated gas into said first triangular chamber and second means for introducing heated gas into said second triangular chamber.

9. Apparatus in accordance with claim 8 further comprising a first partition wall extending from said first section of said inner wall of said outer plenum chamber to the adjacent one of said first and second sections of the outer wall of said outer plenum chamber, and a second partition wall extending from said second section of said inner wall of said outer plenum chamber to the adjacent one of said first and second sections of the outer wall of said outer plenum chamber to thereby divide said outer plenum chamber into two separate chambers.

10. Apparatus in accordance with claim 1 wherein the outer wall of said central plenum chamber is inclined at an angle to the vertical in the range of about 15° to about 25°.

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