Aug. 11, 1959 J. B. WILSON 2,898,974

APPARATUS FOR HEAT-SEALING METALLIC LINERS IN CONTAINERS

Filed May 28, 1957 2 Sheets-Sheet 1

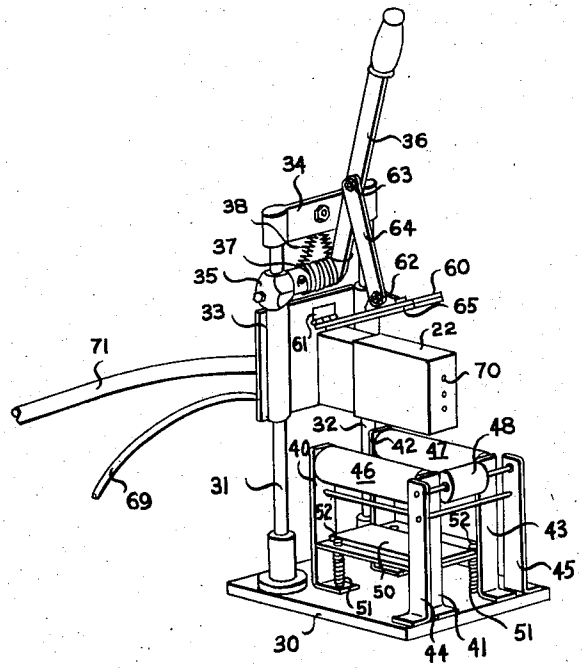


Fig. 1

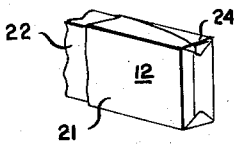


Fig. 2

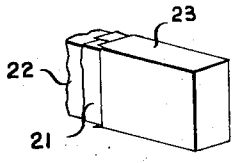


Fig. 3

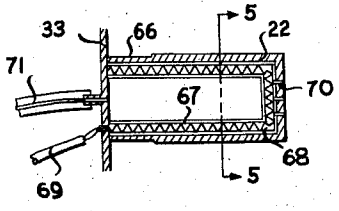


Fig. 4

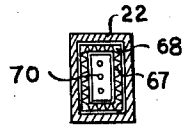


Fig. 5

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APPARATUS FOR HEAT-SEALING METALLIC LINERS IN CONTAINERS

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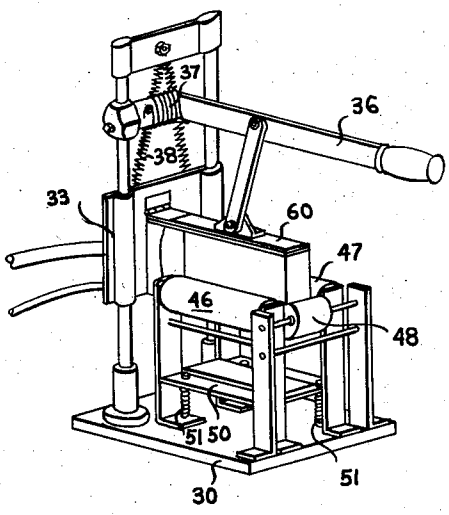


Fig. 6

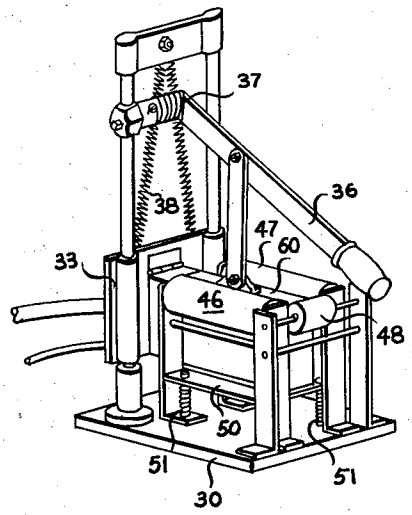


Fig. 7

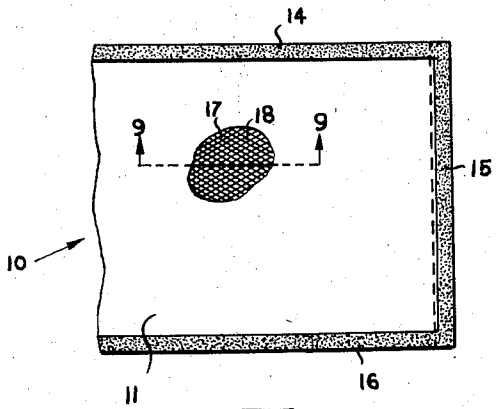


Fig. 8

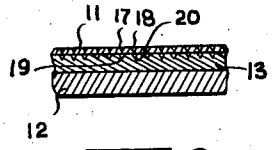


Fig. 9

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APPARATUS FOR HEAT-SEALING METALLIC LINERS IN CONTAINERS

John B. Wilson, Louisville, Ky., assignor to Reynolds Metals Company, Richmond, Va., a corporation of Delaware

Application May 28, 1957, Serial No. 662,140

9 Claims. (Cl. 154—1)

This invention relates to an improved apparatus for securing metallic liners to containers and, more particularly, to a heat-sealing apparatus in which a metallic liner may be installed in a container in an improved manner in order to produce a neat, sealed lining substantially unscarred by its contact with the apparatus employed in installing of the liner.

While various forms of apparatus have been employed heretofore for heat-sealing particular non-metallic liners to the interior of containers by employment of both heat and pressure, difficulty has been encountered when attempting to use such apparatus for securing metallic liners in those containers. Such difficulties frequently include the galling of the thin metallic surface when removed from pressure contact with a heated metallic mandrel, the non-uniformity of the seal of the liner to itself, or of the liner to the container wall, and the wrinkling of the liner during the sealing operation. It is these and similar disadvantages of the known procedures which it is a purpose of my invention to overcome.

An object of the invention is to provide an improved apparatus for securing a metallic liner preform to a container.

Another object is to provide an improved apparatus for applying sealing pressure to a metallic liner preform disposed in contact with the interior of a container.

Another object is to provide an improved heat-sealing mandrel incorporating a means for stripping a lined container therefrom.

A further object is to provide an improved means for actuating a movable heat-sealing mandrel and for automatically retracting the mandrel to a container receiving and discharging position.

Other objects and advantages will become apparent as the description proceeds and when considered in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective view of one form of heat-sealing apparatus in normal position prior to use;

Fig. 2 is a diagrammatic view showing a liner preform in position upon the mandrel;

Fig. 3 is a diagrammatic view showing the liner preform and container in position upon the mandrel;

Fig. 4 is a longitudinal sectional view through the mandrel;

Fig. 5 is a sectional view on line 5—5 of Fig. 4;

Fig. 6 is a perspective view of the apparatus at an intermediate stage of operation;

Fig. 7 is a perspective view of the apparatus at another intermediate stage of operation and with all contacting sealing surfaces simultaneously in operation;

Fig. 8 is a developed view of a portion of an improved metallic liner with a portion of the line-embedded metallic foil being shown; and

Fig. 9 is a sectional view on line 9—9 of Fig. 8 and to a greatly enlarged scale.

In accordance with my invention, I arrange, either manually or automatically, an unsealed metallic liner preform upon a metallic mandrel which is adapted to be heated and with the metallic surface of that liner in contact with the metallic mandrel. A container to which the liner is to be sealed is then disposed in surrounding relation to the liner preform. The container and liner are clamped together against the mandrel, preferably along the side of the liner which is to be sealed to itself, as well as to the container and this clamping pressure is maintained until the sealing operation is completed. The mandrel with the liner and container in place is then moved to successive positions against pressure applying members which seal the liner to the container, except at one open end. Upon completion of the sealing operation, the mandrel is retracted to a discharge and loading position, at which time the lined container is removed and a new preform and detached container is subsequently installed on the mandrel.

While the invention in its broader aspects is adapted for heat-sealing non-metallic liners or liners of various metallic materials to containers, I prefer to employ the improved liner comprising an aluminum foil layer laminated with a microcrystalline wax layer to a layer of tissue paper and known by the trademark Reyseal and as disclosed more fully in the copending application of Raymond E. Jacke, Serial No. 638,016, filed February 4, 1957, and assigned to Reynolds Metals Company. Referring now to Figs. 8 and 9, the liner designated generally at 10 preferably comprises a rectangular shaped, laminated sheet having on one side a thin sheet 11 of metallic foil, preferably aluminum, and on the other side a somewhat thicker sheet 12 of a porous material, such as tissue paper. A centrally located layer 13 of a heat sealing composition, such as a micro-crystalline wax is provided between sheets 11 and 12. Accordingly, when heat is applied to the liner, the wax tends to flow through the tissue sheet and to become available for bonding to a surface in contact therewith. However, since it is desirable, if not essential, in some usages of lined containers to have the metallic sheet 11 bonded to itself along side and end seals, I also provide for passage of the wax through the otherwise impervious metallic sheet 11. This preferably is accomplished by lightly puncturing the sheet 11 along peripheral edges, as seen at the bands 14, 15 and 16, as by passing thereover an abrading means, such as a rouletting wheel, or roller covered with emery cloth, or the like, while under sufficient pressure to form bands of spaced pin-holes of sufficient size to permit the heated wax to exude therethrough for sealing purposes.

Furthermore, due to the tendency of the thin metallic sheet 11 to be abraded or galled by moving contact with a heated metallic mandrel, wrinkling of the metallic sheet, or wear thereof, or both, may occur in manufacture of the lined container unless provision is made to overcome the same. As taught by the Jacke invention, these disadvantages may be overcome by line-embedding the metallic sheet into the layer of wax therebeneath. As seen in Figs. 8 and 9, a series of closely spaced parallel small grooves 17 are formed in one direction across the entire outer surface of sheet 11, these grooves being intersected by a similar series of grooves 18 at a suitable intersecting angle thereto. As the respective grooves 17 and 18 are formed, companion projections 19 and 20 are extruded on the lower side of the sheet 11, these projections being embedded in the material comprising layer 13. The formation of the grooves may readily be made, for example, by pressing the sheet 11 against a knurled die prior to incorporation of the sheet into the remainder of the liner. As a result of the minute surface air channels thus provided in the outer surface of sheet 11, good slipping characteristics are found when motion occurs between that sheet and the surface of a metallic mandrel. Moreover, expansion of the metallic sheet due to heating

can take place without warping or wrinkling of the surface of the sheet as a whole.

With the foregoing in mind, an unsealed liner perform of the described Reyseal material and generally shown at **21** in Figs. 2 and 3, upon being suitably folded by any conventional folding apparatus, is adapted for positioning endwise upon mandrel **22**, later to be described. It will be understood that in this folding operation, one end of liner **10** projects axially of the liner preform to form an open end which may slip snugly upon the mandrel, the other end of that liner having band **15** folded upon itself, and the sides of that liner having bands **14** and **16** folded upon themselves in interlocked arrangement as shown by said Jacke application. Thus, as seen in Fig. 2, the tissue lamination of the liner is exteriorly exposed and the metallic side **11** of the liner is in contact with the mandrel.

The side seal of the preform is in general the most important seam to seal, since it must sustain bulging stresses of the filled container and is usually extended over the end portion of the container as seen generally at **24** in Fig. 2. As an important feature of the invention, this side seal is disposed on the side of the mandrel which is to receive a prolonged and uninterrupted pressure.

Following positioning of the unsealed, folded preform upon the mandrel, a conventional container **23**, open at one end and sealed at its sides and other end, is positioned over the preform in substantially enveloping relation thereto and with its inner surface in contact with the tissue layer **12** of that preform. This container may be of any suitable material to which the liner will adhere, but I prefer to use a conventional cardboard container.

Reference now is made to Fig. 1 showing one form of apparatus embodying the invention and adapted for efficiently lining the container above mentioned. While the apparatus is shown detached from the means for folding the preform, and for filling the lined container, it will be understood that, if desired, it may be incorporated into known packaging machinery by suitable modification thereof to the end that a compact and high speed assembly for container forming, container lining, container filling, and container sealing may be used.

As shown, one satisfactory form of manually operable, inexpensive and mechanically simple apparatus may include a stationary base plate **30** upon which a pair of guide rods **31** and **32** are mounted for support and guidance of a carriage **33**. Adjacent their upper ends, the guide rods are braced by a transverse bar **34** and at a suitable location above the uppermost retracted position of the carriage, a stationary housing **35** for a rotatable stub shaft journalled therein, is securely mounted upon a guide rod.

Extending from the outer end of the stub shaft is an actuating member or lever **36** normally held in fully retracted position as by a torsion spring **37** fixed at one end to an abutment on the stationary housing and at the other end to the movable handle. One or more tension springs **38** fixed at one end to the stationary bar **34** and at the other end to the movable carriage **33**, serve to hold the carriage in retracted position where it is available for ready insertion or removal of the liner preform and container with respect to the mandrel.

Projecting from the carriage is a hollow metallic mandrel **22**, rigidly affixed as by bolts or welds (not shown) to the carriage **33** at a central location thereof, and adapted for reciprocable movement in a predetermined path as the carriage moves along the guide rods. A framework comprising pairs of spaced posts **40, 41; 42, 43**; and **44, 45**, is rigidly mounted upon the base plate **30** in surrounding relation to two sides and one end of the path of mandrel movement and with the upper ends of the posts terminating in a plane slightly below the bottom of the fully retracted mandrel. Disposed between posts **40** and **41** is a pressure applying member, preferably a cylindrical, rubber-like roll **46**, rotatably journalled in the posts and having a diameter which is sufficient to cause the surface of the roll to press firmly against an outer side of container **23** as the mandrel is moved past the roll **46**. Likewise, a pressure applying member, such as roll **47** mounted between posts **42** and **43** and a pressure applying member, such as a shorter roll **48**, mounted between posts **44** and **45**, are provided for pressing firmly against another outer side and an end respectively of the container during the mandrel movement.

Located between the respective posts and disposed in the path of movement of the mandrel is a platen **50**, preferably of a flat rubberlike material and resiliently mounted upon compression springs **51** which surround guide rods mounted at one end upon base plate **30** and having limiting stops **52** at the other end to limit the upward movement of the platen. This platen is adapted to press firmly against the lower side of the container when the mandrel is lowered to its bottommost position.

Mounted upon the face of carriage **33** is a master pressure applying plate **60** pivotable about hinge **61** and having a boss **62** on its upper face. Pivotally secured upon the boss **62** and upon a pin **63** located at an intermediate point on handle **36** is a link **64** connecting the handle and the master plate **60**. The plate **60** preferably is flat and has a surface **65** of rubberlike material adapted to press upon the upper side of container **23** when installed upon the mandrel. As will thus be apparent, when handle **36** is in normal retracted position under the influence of spring **37**, the master pressure applying plate likewise is in raised position with respect to mandrel **22**, and the perform and container may be readily installed upon or removed from the mandrel.

Referring now to Figs. 4 and 5, the mandrel may have any suitable polysided configuration, but as shown herein is of parallepiped shape with an undercut portion **66** adjacent its mounting upon the carriage **33**. As a result of this undercut portion, the extended open end of the liner preform is not pressed into close contact with the heated mandrel, thus permitting the wax layer of the liner to remain unmelted at its extreme open end. Disposed within the metallic mandrel on all sides and at the outer end thereof is a high resistance electrical coil **67** embedded in a ceramic or other suitable heat resistant electrical insulator **68** and connected to an electrical conductor **69** leading through carriage **33**. This conductor may lead to any suitable circuit forming no part of the present invention and which may apply current to the coil **67** under control of a conventional powerstat which varies voltage to maintain a predetermined surface temperature on the mandrel. Moreover, any suitable switching means may be employed to apply and cut off current to the mandrel at desired times.

At its outer end the hollow mandrel is provided with a plurality of small apertures **70** through which a gaseous medium under pressure may be expelled. Leading into the mandrel through carriage **33** is a hose connection **71** suitably attached to a pressure source which may be controlled by any suitable valve (not shown) adapted to be actuated at the time the liner is completely sealed within the container in order to strip the container from the retracted mandrel and then to be actuated to close off the source, until the stripping of the subsequent container is desired. It will be understood that both the conductor **69** and hose **71** are mounted for partaking of the movement of the reciprocable carriage **33**.

The operation of the apparatus will now be noted from a comparison of Figs. 1, 6 and 7. With the mandrel, carriage and master pressure plate in the fully retracted position of Fig. 1, the metallic liner preform **21** is positioned endwise upon the mandrel and with its most difficult to seal side seam, as seen at **24**, in position below master pressure plate **60**. The container to be lined is then slipped on over the liner preform leaving the extreme portion of that preform out of direct contact with

the mandrel surface due to the undercut **66** of that mandrel. With heat being applied to mandrel **22**, the handle **36** is lowered, whereupon plate **60** is brought into contact with the upper side of container **23** which in turn presses against the side seam **24** of the preform which in turn presses its metallic inner surface **11** against the metallic surface of mandrel **22**. This pressure by master plate **60** is continuously applied during the entire lining operation with the result that not only is the tissue layer of the liner securely bonded to the inner surface of the container, but also the metal-to-metal seal at seam **24** is securely bonded by virtue of the extended application of pressure. However, despite this prolonged application of pressure of a metallic foil against a hot metallic surface, no scarring or galling of the liner occurs when the container is removed due to the above described line-embedded feature of the liner material.

After lowering the plate **60** into operative contact with the upper side of container **23**, further pressure upon handle **36** through its hinged connection with carriage **33** begins to force that carriage downwardly against the action of springs **38**. As the carriage moves downwardly, carrying the mandrel therewith, pressure rolls **46** and **47** force the sides of the container into contact with the liner preform and at the same time the pressure roll **48** forces the end of the container into contact with the end of that preform. It will be noted that these rolls provide only a line contact with the sides and end of the container, but that two such phases of contact result, during both the downward movement and during the subsequent upward movement. At the time when rolls **46**, **47** and **48** complete their first passage across the surfaces of the container, the continued pressure of handle **36** (Fig. 7) forces the mandrel into contact with the platen **50**. Further movement of the mandrel downwardly compresses springs **51**, causing the underside of the container to be forced against the liner and that liner, in turn, to be forced against the underside of the hot mandrel. After holding the handle **36** in fully depressed position for the time necessary to bond the liner to the underside of the container, the handle is then lifted upwardly, being assisted by the torsion spring **37** and by the tension springs **38**. During its upward movement, the second phase of pressure application by rolls **46**, **47** and **48** occurs, the application of pressure by master plate **60** having been continuous throughout the operation.

When the mandrel carriage and handle are returned to the position of Fig. 1, pressure fluid is then released through hose **71** and the lined container is automatically stripped from the mandrel without tearing or marring of the metallic surface of the liner.

It has been found that by employing the described apparatus in conjunction with the Reyseal liner, a superior appearance of lined container is secured. The entire inner surface of the container is substantially smooth, without wrinkles and without torn surfaces. A tight metal-to-metal seal along the side and end seams of the container results, which makes the lined container particularly well suited for containing liquids and foodstuffs and for later hermetic sealing following filling of that container.

Having thus described the invention and having shown one form of apparatus embodying the same, it will be apparent that various modifications can be made, without departing from my invention, I therefore, do not wish to be limited to the particular modification as shown and contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Apparatus for securing a heat-sealable liner in a container comprising, a movable mandrel for receiving a liner preform and a detached container substantially completely surrounding said preform, said preform and container being insertable endwise upon said mandrel and removable endwise therefrom, a pressure plate member for pressing said liner and container together against a first side of said mandrel and for holding the same in contact during the lining operation, a resiliently mounted member for pressing said liner and container together against a second side of said mandrel opposite to said first side thereof, means disposed adjacent the path of travel of said mandrel and adapted to press said liner and container together against the remaining sides and one end of said mandrel during its movement into and from engagement with said resiliently mounted member, means for moving said mandrel, and means for applying heat to said mandrel thereby to seal said liner preform to said container.

2. Apparatus as defined in claim 1 including means normally holding said mandrel in retracted position for ready insertion and removal of said liner preform and container, said mandrel moving means being connected to said pressure plate member for moving said mandrel against the action of said mandrel retracting means.

3. Apparatus for securing a heat-sealable metallic liner in a container comprising, in combination, a movable metallic mandrel for receiving a liner preform and a detached container substantially completely surrounding said preform, said preform comprising a folded laminated sheet having a metallic surface in contact with said metallic mandrel, a bonding surface in contact with said container and an intermediate wax layer between said metallic and bonding surfaces, and with said folded preform having an unsealed seam disposed along a first side of said mandrel, said preform and container being insertable endwise upon said mandrel and removable endwise therefrom, a pressure plate member for pressing said liner and container together against said first side of said mandrel, and for holding the same in contact during the lining operation, a resiliently mounted member for pressing said liner and container together against a second side of said mandrel opposite to said first side thereof, means disposed adjacent the path of travel of said mandrel and adapted to press said liner and container together against the remaining sides and one end of said mandrel during its movement into and from engagement with said resiliently mounted member, means for moving said mandrel and means for applying heat to said mandrel thereby to melt said wax layer and to seal said bonding surface to said container and said seam to itself.

4. Apparatus as defined in claim 3 including a hollow mandrel having a controlled source of pressure fluid connected thereto and apertures in said mandrel end directed against the end of said lined container thereon, whereby said container may be stripped from said mandrel by means of pressure fluid emerging from said apertures.

5. Apparatus for securing a heat-sealable liner in a container comprising a framework having a carriage movably mounted thereon, a mandrel rigidly mounted on said carriage for receiving a liner preform and a detached container substantially completely surrounding said preform, means normally holding said carriage and mandrel in a retracted position, means mounted upon said framework and disposed in the path of travel of said mandrel for pressing said liner and container together against three sides and one end of said mandrel, a pressure plate member for pressing said liner and container together against one side of said mandrel and for forcing said carriage from said retracted position thereby to carry said mandrel into contact with said means disposed in its path of travel, means for moving said pressure plate to cause travel of said movable carriage, means for retracting said pressure plate to a position normally out of contact with said mandrel, and means for applying heat to said mandrel thereby to seal said liner to said container.

6. Apparatus as defined in claim 5 wherein said means mounted upon said framework for pressing said liner and container together against said mandrel includes ro-

tatably mounted rolls disposed adjacent the path of mandrel travel and engageable by the sides and end of said container.

7. Apparatus as defined in claim 5 wherein said means mounted upon said framework for pressing said liner and container together against said mandrel includes a resiliently mounted platen disposed in the path of mandrel travel and engageable by one side of said container.

8. Apparatus for securing a heat-sealable liner in a container comprising a framework having a carriage movably mounted thereon, a mandrel rigidly mounted on said carriage for receiving a liner preform and a detached container substantially completely surrounding said preform, means normally holding said carriage and mandrel in a retracted position, means mounted upon said framework and disposed in the path of travel of said mandrel for pressing said liner and container together against three sides and one end of said mandrel, a pressure plate member hinged at one end to said carriage and adapted to press said liner anl container together against one side of said mandrel, a carriage actuating lever mounted upon said framework and movable against the action of

said carriage retracting means, means connecting said actuating lever to said pressure plate member whereby said pressure plate may engage said mandrel during the entire movement of said carriage, and means for applying heat to said mandrel thereby to seal said liner to said container.

9. Apparatus as defined in claim 8 including means interposed between said actuating lever and framework for holding said lever and connected pressure plate normally in retracted position.

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