

[54] MACHINE FOR CLOSURING CONTAINERS

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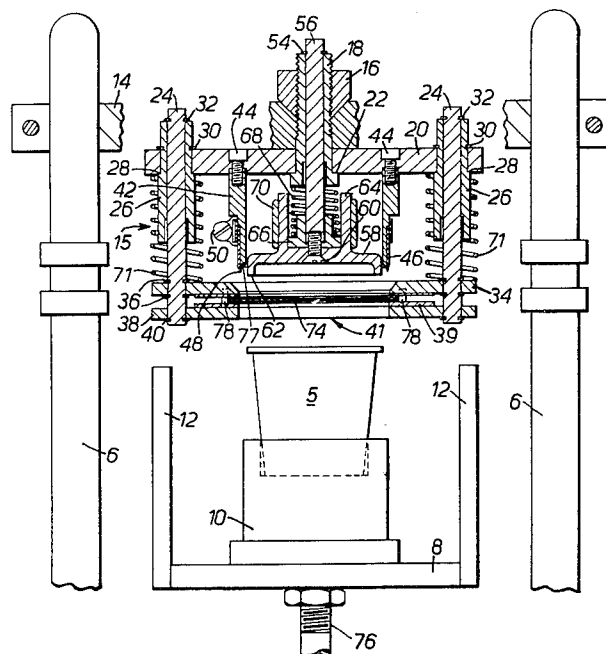
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[57] ABSTRACT

A container closing machine comprises means for guiding a longitudinally movable web of foil or unbacked plastics film. A container to be closed is mounted under the web, and above the web is mounted a sealing and cutting head. The latter comprises a tubular shaped knife blade within which is mounted a generally cylindrically shaped heated sealing tool. The head and the container are arranged to undergo relative movement towards each other so as to clamp the web and to cause the heated sealing tool to press the clamped web against the top of the container. The sealing tool is capable of limited reciprocable movement along the axis of the tubular knife blade, and this movement, in response to the pressure between the tool and the container, brings the knife blade into severing contact with the web during the sealing process.

3 Claims, 5 Drawing Figures



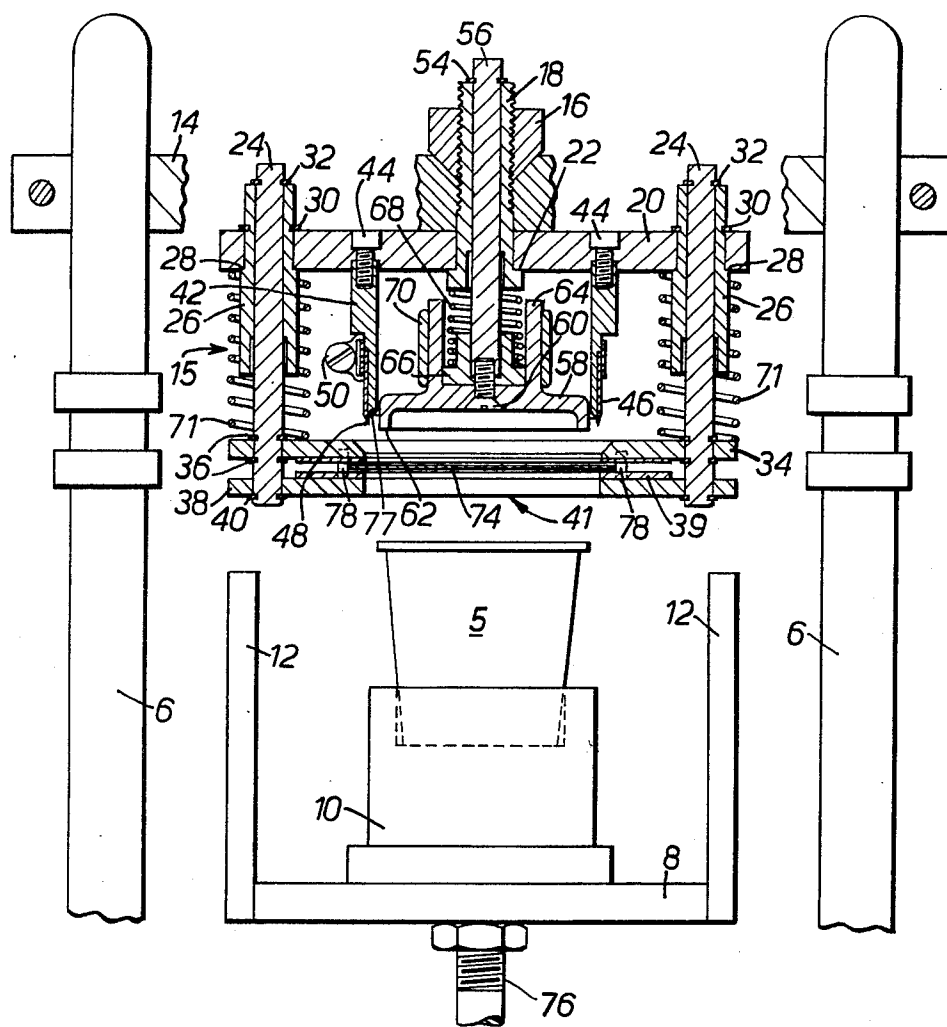
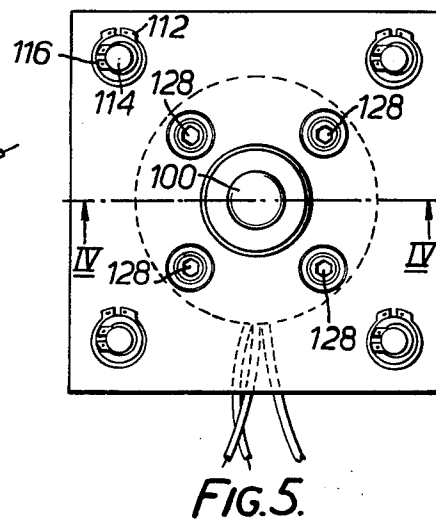
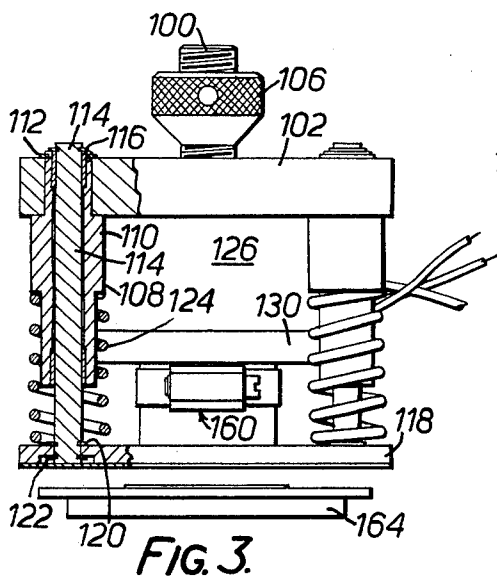
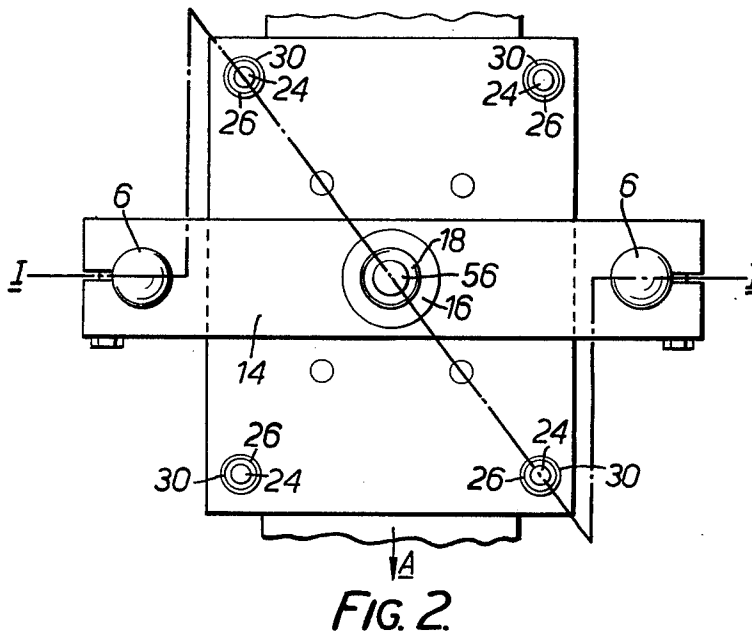


FIG. 1.



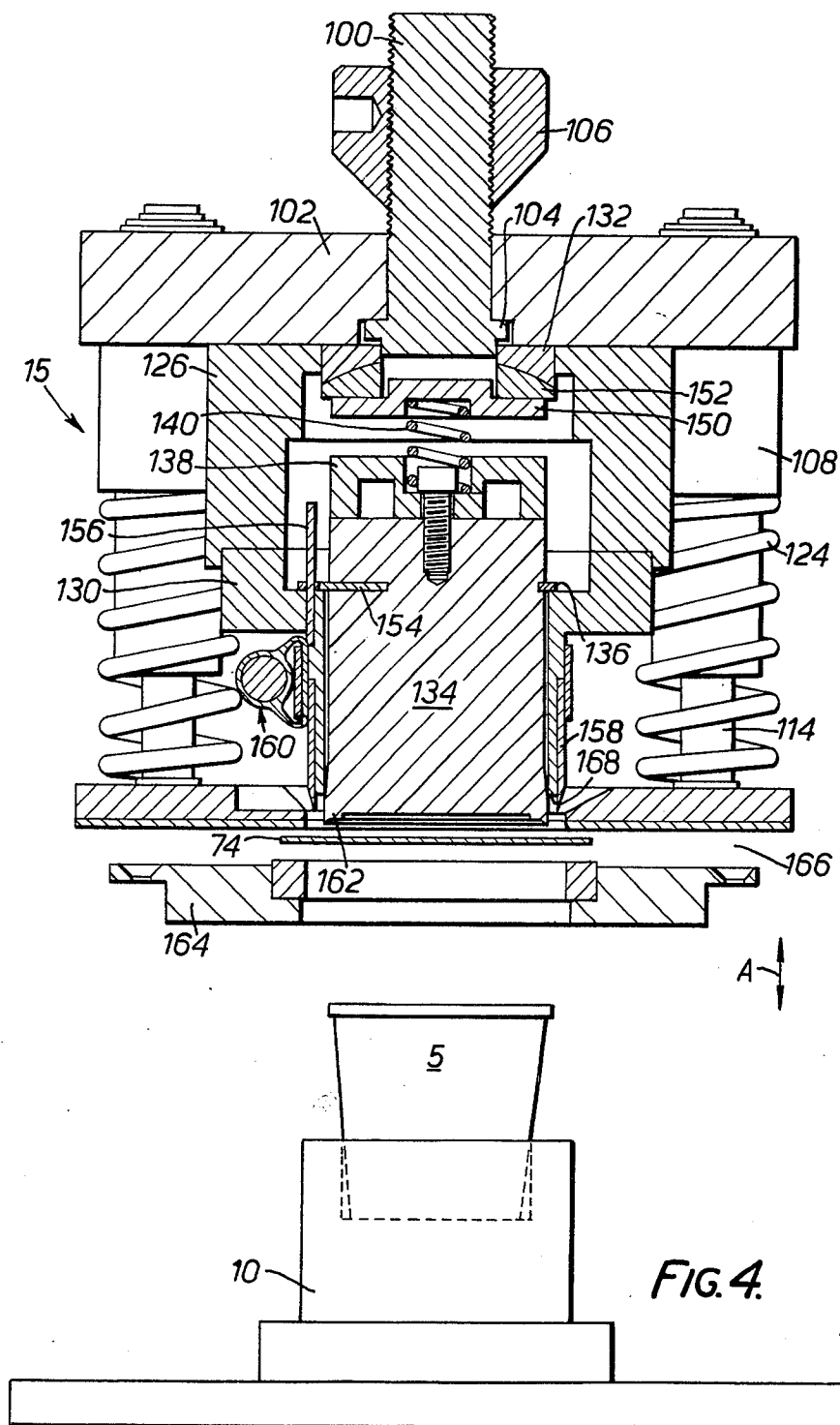


FIG. 4.

MACHINE FOR CLOSURING CONTAINERS

BACKGROUND OF THE INVENTION

The invention relates to the application of closures to containers, and more particularly to the application of diaphragm closures to containers. Diaphragm closures may be made of thin flexible relatively soft and readily deformable material to give a tamper-proof and/or protective frangible closure.

DESCRIPTION OF THE PRIOR ART

It is known to fix diaphragm closures to containers in a number of different ways. For example, pre-cut diaphragm closures may be fitted to containers manually, and sealed to the containers by any suitable means. Clearly, this is a cumbersome and very slow process, quite unsuited to mass production techniques.

Machines and methods are also known in which pre-cut diaphragms are automatically positioned over the ends of containers and then sealed to the containers. Such machines and methods are also disadvantageous in that they involve the individual handling of pre-cut diaphragms.

It is an object of the invention to provide an improved machine and apparatus for applying diaphragm closures to containers.

BRIEF SUMMARY OF THE INVENTION

According to the invention, there is provided a method of fixing a closure of thin flexible material to a container, in which a portion of the closure material greater in area than the end of the container to which it is to be fixed is brought into contact with the said end of the container with a controlled pressure, and the closure material is then sealed to the container, the closure material, closing the end of the container, being severed from the remainder of the material while the material and the container are in contact.

According to the invention, there is further provided apparatus for fixing a closure of thin flexible material to a container, comprising means for supporting the closure material so as to leave free of access an area on one surface thereof greater than the area of an end of the container to which it is to be fixed, means for supporting a container with the end thereof to which the closure is to be fixed facing the said area on the said one surface of the closure material, means operative to cause relative movement between the closure material and the container so as to bring the said one end thereof into contact with the said one surface of the material, means for sealing the material to the said one end of the container around a peripheral area thereof, and means for severing excess closure material around the outside of the periphery of the container while the closure material is supported by the said one end of the container during the sealing process.

DESCRIPTION OF THE DRAWINGS

A machine embodying the invention for applying diaphragm-type closures to containers and a method according to the invention of applying diaphragm-type closures to containers will now be described, by way of example only, with reference to the accompanying drawings in which:-

FIG. 1 is a sectional view through one form of the machine on the line I—I of FIG. 2;

FIG. 2 is a diagrammatic plan view of the machine of FIG. 1;

FIG. 3 is a side view, partly in section, through another form of the machine;

FIG. 4 is a section on the line IV—IV of FIG. 5; and

FIG. 5 is a plan view of the machine of FIGS. 3 and 4.

DESCRIPTION OF PREFERRED EMBODIMENTS

The machine to be described is for applying tamper-proof and/or protective frangible diaphragms to container or pots, one such pot 5 being shown in the drawings. The diaphragms may be made of any suitable material such as foil or un-backed plastics film and are heat-sealable to the pots (either being inherently heat-sealable or having a heat-sealable coating thereon or by means of a separately applied heat-sealable adhesive).

The machine is supported on two rigid stanchions 6 (FIG. 1) from a base plate not shown. A platform 8 is reciprocally mounted on the base plate and rigidly supports a locating block 10 having a recess for receiving and positively locating each pot 5 in turn. Two striker plates 12 extend upwards from opposite sides of the platform 8.

A tie bar 14 is rigidly clamped, by suitable bolts, to the top ends of the stanchions 6. A sealing and cutting head 15 is supported from the tie bar 14 by means of a cone nut 16 which locates in a countersunk hole through the center of the bar 14. The nut 16 threadably engages a bushing 18 which extends through a plate 20 and supports the plate 20 under the tie bar 14 by means of a shoulder 22. Four shafts 24, each slidable in a bushing 26, pass through holes in the plate 20. The bushings 26 are attached to the plate 20 by shoulders 28 bearing on the underside of the plate 20 and are externally grooved to engage circlips 30, downward movement of the shafts relative to the bushes 26 being limited by circlips 32. At their lower ends, the shafts 24 rigidly support a plate 34 by means of circlips 36. A second plate 38 is supported on the shafts 24 against downward movement by circlips 40. A rubber pad 39 is attached to the upper surface of the plate 38. The plates 34 and 38 and the rubber pad 39 have aligned circular holes through them providing a through aperture 41.

A cylindrical cutter support 42 is attached to the upper plate 20 by screws 44. A cylindrical cutter blade 46 having a serrated cutting edge 48 is clamped in a shouldered recess at the lower end of the cutter support 42 by a circular tension clamp 50.

Slidably mounted within the bushing 18, but with its downward movement relative to the bushing limited by a circlip 54, is a rod 56 whose lower end is attached to a circular sealing pad 58 by means of a screw 60. The pad 58 has a downwardly facing recess defining a circular shoulder 62, and its upper side carries an open-topped cylindrical extension 64 in which is located a bushing 66. The bush has a shoulder which locates one end of a compression spring 68, whose other end acts on the bottom end of the bushing 18. The pad 58 is made of material having good heat conducting properties, and an electrically energizable heater winding 70 is fixed around the outside of the cylindrical extension 64.

A cover may enclose the mechanism of the head 15, and a thermocouple (not shown) may be provided to monitor the temperature of the pad 58.

In operation a pot 5 whose top is to be sealed by a diaphragm-type closure is placed in the locating block 10, and a web 74 of the heat-sealable material for forming the diaphragm closure is indexed through the gap between the plates 34 and 38 in the direction of the arrow A on FIG. 2. The platform 8 is then raised by means of a ram-driven rod 76 so as to bring the top circular rim of the pot into contact with the underside of the web 74. This upward movement of the platform 8 causes the upper ends of the striker plates 12 to engage the outer edges of the plate 38, and to push the latter upwardly so that the web 74 is clamped, around a circumferential line outside the pot periphery, between the pad 39 and the plate 34.

Continued upward movement of the platform 8 causes the plate 34 and the shafts 24 to move upwardly relative to the plate 20, and the web 74 in contact with the pot rim moves into contact with the heated sealing pad 58 whose circular rim 62 matches the pot rim, and the heat applied by the pad 58 begins to seal the material of the web 74 to the top of the pot 5, around its periphery.

Continued upward movement of the pot brings the cylindrical extension 64 of the pad 58 into contact with the underside of the plate 20 and further movement of the pad is prevented. By this time, however, the pad and pot will have moved upwards sufficiently far to allow the serrated cutting edge 48 to sever the web 74 around the periphery of the pot 5. This severing action takes place with the web supported by the pot 5 and also by the clamping action of the plate 34 and the pad 39, and preferably after the web has been at least partially sealed to the pot.

The cutter support 42 has a curved lower rim 77 which engages the peripheral portion of the attached diaphragm closure, where it overlaps the periphery of the pot 5 (after it has been severed from the web 74), and forms it down around the rim of the pot.

The platform 8 is then lowered and the plates 34 and 38 and the pad 58 lower under the action of the springs 71 and 68. The sealed pot 5 is then removed and replaced by a fresh unsealed pot, and the web 74 is indexed onwards.

As the upper end of the cylindrical extension 64 is raised into abutment with the plate 20, the pressure at which the web 74 is urged against the peripheral rim of the pot 5 is controlled via the pot lifting rod 76. However, in a modification, the extension 64 is not raised this far, and the pressure is therefore controlled by the spring 68 as well as the rod 76.

Guide pins 78 may be provided to locate the web 74 against sideways movement.

If desired, the rim 77 can be omitted and the blade 48 positioned close to the periphery of the pad 58 so as to cut off the closure material at the immediate periphery of the pot 5.

The cutter 48 need not be completely cylindrical but can be shaped to leave an outwardly extending portion of the web material to act as a pull-tab.

FIGS. 3 to 5 show an alternative construction for the sealing and cutting head 15, and in this case the head 15 is lowered on to the container to be sealed instead of the latter being raised.

The head 15 of FIGS. 3 to 5 is carried by means of a spigot 100 which passes through a plate 102 which it supports by means of a shoulder 104. The spigot 100 carries a cone nut 106 which corresponds to the cone

nut 16 of FIG. 1 and supports the head 15 on a cross head which is not shown in FIGS. 3 to 5.

Four bushings 108 (FIG. 3) extend downwardly from the plate 102 and are held rigidly to the plate by means of shoulders 110 and circlips 112. A stud 114 is slidably mounted within each bushing 108 and its downward movement is limited by means of circlip 116. At its lower end, each stud 114 is fixed to a plate 118 by means of circlips 120 and 122. Compression springs 124 urge the plate 118 downwardly.

A cylindrical housing 126 is held in position on the underside of the plate 102 by means of four screw-threaded studs 128 (see FIG. 5) and these studs extend through and engage and hold a cylindrical former 130. An inverted shallow dish-shaped member 132 is located on the underside of the plate 102 by the cylindrical housing 126 for a purpose to be described.

A cylindrical sealing tool 134 is a relatively loose fit within the former 130 and is prevented from downward movement relative to the former 130 by a circlip 136. The sealing tool 134 has a cap 138 which is screw-fixed to the top of the tool and has a recess locating one end of a low rate compression spring 140. The upper end of this spring is located in a recess within a spring retainer 150 which bears against an aligning member 152 having a surface matching and in contact with the dished surface of the member 132.

Two pins, of which only one, referenced 154, is shown in the Figures, extend radially outwards of the sealing tool 134 with a small angle between them and extend on opposite sides of a vertical pin 156 fixed to the former 130. The pins 154 and 156 prevent the sealing tool 134 from rotating to any significant extent.

The cylindrical former 130 extends downwardly almost to the lower end of the sealing tool 134 and is shouldered to receive a cylindrical cutter blade 158 which is clamped in position by means of a circular tension clamp 160.

The plate 118 is apertured to provide clearance for the lower end of the sealing tool 134 and the cylindrical cutter blade 158, and the lower end of the tool 134 has a downwardly facing recess defining a circular shoulder 162.

The sealing tool 134 is made of material having good heat conducting properties and one or more cartridge-type electrical heaters (not shown in the drawing) are located in the tool 134 within bores extending parallel to its axis. In addition, a thermocouple may be likewise mounted in the tool 134, and the electrical leads for the heaters and thermocouple are shown in FIGS. 3 and 5.

The apparatus also includes a second plate 164 which is apertured to match the aperture in the plate 118 and is mounted, by means not shown, to be capable of movement to and fro in the direction of the arrows A (FIG. 3).

A pot 5 which is to be sealed by a diaphragm-type closure is positioned in a locating block 10 under the head 15. The locating block may be part of an indexable star wheel but does not move vertically.

In operation, a web 74 of the closure material is fed through the gap 166 between the plates 118 and 164. When a pot 5 is in position below the head 15, the whole head is lowered by means, for example, of a pneumatic ram acting on the spigot 100. The plate 118 moves downwards with the plate 164. When the web contacts the top of the pot 5, the rim of the plate 164 is arrested by a fixed stop (not shown) and continued

downward movement of the head moves the plate 118 towards the plate 164 and clamps the web. The circular shoulder 162 of the tool 134 then contacts the closure material around the periphery of the top of the pot. The continued downward movement of the head 15 causes the tool cap 138 to abut against the spring retainer 150 so that the pneumatic ram controls the pressure which the tool 134 applies to the closure material over the pot top. The heat applied by the tool 134 begins to seal the material to the top of the pot 5, around its periphery.

During this process, the upward movement of the tool 134 causes the cylindrical cutting blade 158 to sever the web around the periphery of the pot.

As before, this severing action takes place with the web supported both by the pot 5 and also by the clamping action of the plates 118 and 164, and preferably after the web has been at least partially sealed to the pot 5.

As before, the lower end 168 of the former 130 forms down the overlapping portion of the severed closure material around the rim of the pot.

The head 15 is then raised so that the plates 118 and 164 separate, and the sealed pot 5 is then removed and replaced by a fresh unsealed pot, and the web is indexed onwards.

The mating curved members 132 and 152 give the tool 134 a limited amount of rocking movement and enable it to align itself with the top of the pot 5.

In a modification, the members 132 and 152 can be omitted, and the sealing tool 134 can be supported from the spigot 100 by a relatively high rate compression spring. This spring serves to control the pressure which the sealing tool applies to the top of the pot 5 and at the same time gives the tool a limited amount of float for alignment purposes.

It will be observed that in each embodiment the cutting of the web by the cylindrical knife blade is facilitated by the fact that the cutting operation takes place when the web is supported by the peripheral rim of the pot 5. It is preferable that the cutting operation does not take place until the web has been at least partly heat-sealed to the pot 5, and this helps to prevent the web of material distorting. The actual cutting blade is separate from the heated sealing tool and is therefore unheated and overcomes the possibility of the heat sealed coating on the web material being melted during the cutting operation.

In a modification, the shapes of the cutter blade and sealing tool are varied to suit non-circular pots.

I claim:

1. Apparatus for heat-sealing thin flexible closure material to the periphery of one end of the container, comprising

a base,

means on the base for guiding an indexable web of the closure material and leaving free of access on one surface thereof an area greater than the area of the said one end of the container,

means on the base for locating a container with its said one end facing towards the said area of the material,

means operative to move the locating means and the web guiding means towards each other so as to bring the said one end of the container on the locating means into contact with the said area of the closure material,

the web guiding means including first and second clamping plates which have aligned apertures greater in area than the area of the said one end of the container, the said plates being mounted on the base to be movable relatively towards each other and to define a gap between them for receiving and guiding the said web, and means for arresting movement of one said plate as the container locating means and the web guiding means move towards each other, whereby the other plate clamps the web to the said one plate along a line outside the said area as the container locating means and the web guiding means move towards each other, a heatable cylindrically shaped sealing tool mounted on the base on the opposite side of the web guiding means to the container locating means with its cylindrical axis substantially perpendicular to and centrally of the said apertures,

means for causing relative movement, in a direction perpendicular to the direction of web movement, between the web guiding means and the locating means on the one hand and the tool on the other hand so as to bring the tool into contact with the opposite surface of the closure material with a controlled pressure, after the closure material is supported by the end of the container, the tool having an end sized to match the periphery of the said end of the container whereby the tool applies heat to seal the closure material to the periphery of the said end of the container,

a tubular shaped knife blade mounted on the said base around the outside of the said tool for limited reciprocable movement relative thereto to contact the closure material through the said apertures and around the outside of the periphery of the container as the said relative movement continues in the said perpendicular direction, whereby the knife blade is operative to sever the closure material on the end of the container from the remainder of the web, and

tubular wipe-down means mounted between and to space apart the said tool and the knife blade and fixed to the latter to move therewith, the wipe-down means having an end surface which forms down around the container the annular region of the said closure material between the outer periphery of the container and the knife blade.

2. Apparatus according to claim 1, including means mounting the sealing tool on the said base for rocking movement transversely to the said perpendicular direction to enable it to align with the periphery of the said end of the container.

3. Apparatus according to claim 1, in which the locating means comprises means for holding the container stationary with respect to the said base when the container is located with its said end facing towards the said area of the material, the locating means being mounted below the web guiding means,

the web guiding means comprises means mounted above the locating means for downward movement theretowards, and

the said tool, the said knife blade, and the said wipe-down means are mounted above the web guiding means for downward movement towards the locating means.

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