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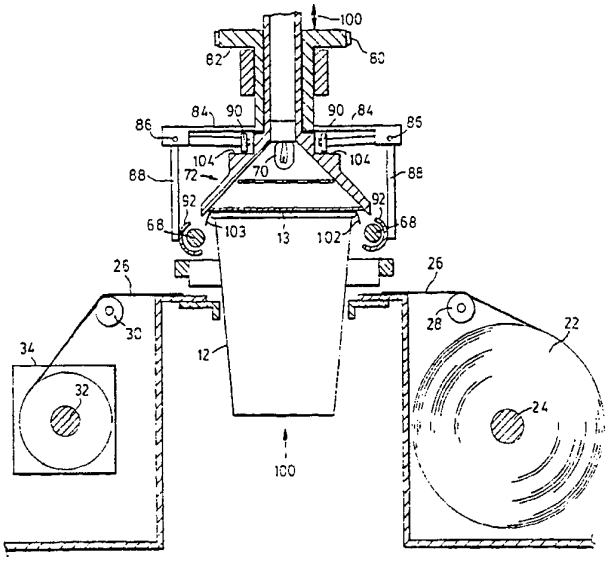
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(54) **Title:** METHOD AND APPARATUS FOR SEALING OPEN-TOPPED CONTAINERS



(57) **Abstract**

An open-topped container (12) is sealed with a heat-shrinkable plastic film (102), by first positioning a piece of the plastic film across the open top and then sealing the plastic film against the container at a sealing area (15) around the upper margin of the container. The sealing step involves radiating the sealing area with radiation having a substantial infrared component, and either the film or the container or both is or are darkened at least at the sealing area, so as to absorb a substantial portion of the radiant energy. Alternatively or in addition to the film or container being darkened in the sealing area, an energy-absorbing body may be interposed between the radiation source and the sealing area, close to the sealing area. A first radiant energy source (68) is provided to direct energy towards the sealing area, and preferably a second radiant energy source (70) is provided to direct energy down onto the top of the container once sealed, to tauten the film across the top.

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METHOD AND APPARATUS FOR SEALING OPEN-TOPPED CONTAINERS

TECHNICAL FIELD

This invention relates to the sealing of open-topped containers using heat-shrinkable plastic film. In particular, the invention relates to a method of sealing such containers, and to apparatus for implementing the method. A particular application is to seal food or beverages inside the containers, although the applications are not limited to food and beverages.

BACKGROUND ART

Presently in the fast food drink industry it is typical to serve a drink in a paper, plastic or other disposable cup topped with a preformed plastic lid. The plastic lid fits tightly over the lip formed at the top of, for example, a paper drink cup, and may include apertures to permit straws or openings to be formed in the lid to directly drink the contents of the cup.

Unfortunately, there are many problems associated with the use of these plastic lids. For example, the lids are generally expensive. Further, the lids are bulky and create problems in storage and in disposal. Further, the seal formed by the lids is dependant upon the lid being placed on properly, and can leak if not properly placed. Finally, the handling of the lid is not completely hygienic.

In order to overcome these problems, various devices and methods have been proposed in which a cover such as a plastic film is placed on an open-topped container and then heated to shrink it into sealing engagement with the top of such a container. Examples of such devices can be found in the following United States patents: U.S. Patent Nos. 3,260,775; 3,354,604; 3,460,317; 3,491,510; 3,494,098; 3,507,093; 3,621,637;

3,877,200; 3,838,550; 3,916,602; 4,035,987; 4,184,310 and 4,562,688. While the solutions proposed by these prior devices and methods are interesting, they fail to provide a sufficiently cost efficient, easy and inexpensive alternative to preformed rigid plastic lids. As a consequence, rigid plastic lids remain in widespread use. Some of the main failings of these prior devices are that they are bulky, noisy, unresponsive, and expensive. Heating systems comprising blowing air over a hot element and then onto a film require large amounts of unnecessary heat, even when in standby mode, which makes temperature control very difficult. Further, continuous elevated temperatures are expensive to maintain and may be deleterious to the immediate environment.

DISCLOSURE OF INVENTION

Aside from the benefits of increased hygiene and reduced waste, the invention is directed to providing a practical device which has commercial utility. One aspect of the invention is to provide an energy efficient way of sealing open-topped containers which avoids any substantial build-up of heat and the resulting waste of energy. An intermittent source of radiant energy is used, and the radiant energy is directed to the specific place where heat is required. Thus, heat is originated only where it is needed, when it is needed. A cool, quiet, safe and efficient device results.

In the invention, the open-topped container is sealed with a heat-shrinkable plastic film, by first positioning a piece of the plastic film across the open top and then sealing the plastic film against the container at a sealing area around the upper margin of the container. The sealing step involves radiating the sealing area with radiation having a substantial infrared component, and either the film or the container or both

is or are darkened at least at the sealing area, so as to absorb a substantial portion of the radiant energy. Alternatively or in addition to the film or container being darkened in the sealing area, an energy-absorbing body may be interposed between the radiation source and the sealing area, close to the sealing area.

The apparatus of the invention includes a housing adapted to receive the container, means for positioning a piece of the film across the open top, the piece of film being sufficiently large to overlap onto a sealing area around the upper margin of the container, and means for radiating the sealing area with radiation having a substantial infrared component, so as to shrink the film onto the sealing area.

In the preferred embodiment of the invention, a first radiant energy source is provided to direct energy towards the sealing area, and a second radiant energy source is provided to direct energy down onto the top of the container once sealed, to tauten the film across the top.

Further features of the invention will be described or will become apparent during the course of the detailed description which follows.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a perspective view of a device according to the invention in use;

Figure 2 is a front sectional view of an open-topped container according to the invention with a heat shrunk cover in place;

Figure 2a is a top view of the container of Figure 2.

Figure 3 is a front view of the container of Figure 2 having a darkened upper band;

Figure 4 is a top view of the device of Figure 1, with the top wall broken away to show the contents;

Figure 5 is a sectional view taken along lines 5-5 of Figure 4;

Figure 6 is a view similar to Figure 5 with the container in a raised position;

Figure 7 is a view of a part of the device of Figure 1; and

Figure 8 is a view along lines 8-8 of Figure 7;

Figure 9 is an alternative configuration for a knife element shown in Figure 5;

Figure 10 is a view along lines 10-10 of Figure 9;

Figure 11 is a schematic sketch of an electronic control circuit for the invention;

Figure 12 is an alternative embodiment of a microswitch system according to the invention;

Figure 13a is a view along lines 13-13 of Figure 12 in a first position; and

Figure 13b is a view along lines 13-13 of Figure 12 in a second position.

BEST MODE FOR CARRYING OUT THE INVENTION

As outlined above, the invention permits an open-topped container to be sealed with a heat-shrinkable plastic film. By any suitable means, a piece of the plastic film is positioned across the open top of the container, overhanging the edges. The area around the upper margin of the container is then radiated, the radiation having a substantial infrared component. Either the film or the container, or an interposing body, in combination or singly, is or are adapted to absorb a substantial portion of the energy, at least in the area where the seal is to be effected. This causes the

plastic film to shrink around the upper portion of the container, thus effecting a seal.

The thin film can be adapted to absorb energy by being made from a tinted material, or by being coated with an energy absorbent coating, e.g. by printing. The ability of the opaque or coated film to absorb radiant energy will vary depending upon what type of tinting or coating is used. A darker or more opaque film will absorb more energy.

The container may be adapted to absorb radiant energy, and thus produce heat in a preferred location, by including a darkened bank 15 in the area where heat generation is desired, such as just below the rim. For aesthetic reasons, black bands may not be acceptable, but other coloured bands will also work. With a cooler colour, the exposure to the radiant energy source may need to be slightly longer. However, the length of time of exposure to the radiant energy source can be adjusted in the invention through adjustments to the timer T2. A gap 17 may be incorporated into the band 15 to permit the end user to lift the shrunken cover off the container if so desired. Locating heat generation means on the container is especially useful in instances where a mostly transparent film is desired.

Both the film and the container may be coloured, if desired, so that each absorbs a portion of the energy. In the event that the container is sensitive to heat, such as may be the case with a wax-coated or plastic container, it may be desirable to have only the film adapted to absorb radiant energy.

Alternatively, an absorbent body can be interposed between the sealing area and the radiation source, closely adjacent to the film. An example of a preferred interposed absorbent body is a darkened aluminum screen 112, which moves closely adjacent the

edge 103. The darkened portion of the screen will absorb energy and then transmit it as heat.

The film 26 is preferably a biaxially oriented shrink film having a preferred thickness of between 40 and 120 gauge. Good results have been achieved with a 75 gauge polyvinyl chloride film purchased from Reynolds Metals Company at Richmond, Virginia. Other films, such as copolymers, polyolefins and the like may also be appropriate. The film, to be most useful, must be food-grade contact-approved by the appropriate regulatory authorities (except of course in applications which do not involve food or beverages). A 7½ inch (19 cm) outer diameter roll of 75 gauge shrink film, which includes a 3-inch (7.6 cm) diameter fibre core, will yield approximately 8,000 covers according to the invention. The film is capable of shrinking about 40% biaxially, although only about 15% shrinkage is typically required in the invention. The film should be relatively easy to puncture, e.g. with a straw, but should resist tear propagation.

In any of the above alternatives, radiant energy is used, rather than natural or forced convection or other means. Radiant energy travels relatively unimpeded through transparent mediums such as air or transparent film. It turns to heat useful for shrink applications only when it is absorbed. A theoretical body capable of absorbing all radiant energy striking it is known as an "ideal black body". By conforming more or less to the ideal black body, the rate, amount and location of heat generation can be controlled.

Another advantage of using radiant energy is that it can be turned on and off virtually instantaneously, and can be focused and directed to the location it is desired, at the speed of light, without excessive stray heat energy being produced. The energy

source does not have to be on continuously, or on standby in readiness for a container, which is the case with hot air systems. The cooling needs of the apparatus are therefore minimal, necessitating only a very small fan, or possibly even no fan at all.

In the preferred embodiment of the invention, a first radiant energy source directs energy towards the sealing area, and a second radiant energy source is provided to direct energy down onto the top of the container once sealed, to tauten the film across the top.

The apparatus of the invention includes a housing adapted to receive the container, means for positioning a piece of the film across the open top, sufficiently large to overlap onto a sealing area around the upper margin of the container, and means for radiating the sealing area with radiation having a substantial infrared component, so as to shrink the film onto the sealing area.

Figure 1 shows the apparatus 10, for use in sealing an open-topped container 12, such as a cup for soft drinks. The housing 10 includes an opening 14 of sufficient size to allow placement of the container 12 within the housing 10. In the embodiment of Figure 1, placement of the container 12 within the opening 14 is accomplished manually, illustrated by a hand 16.

Turning to Figure 5, there is shown a cross-sectional schematic view of the operational components of the device 10 of Figure 1. The container 12 is shown in the opening 14. The opening 14 is defined by side walls 18 and 20 of the device 10. Shown on the right-hand side is a roll of thin plastic film 22 on an axle 24. The film 26 passes over a roller 28 across the top of the container 12 across a second roller 30 and onto a take-up axle 32. A rewind motor 34 can rotate the pickup axle 32 in the direction of arrow 36 to advance the film 26

across the top of the container 12 and cause the roll of film 22 to rotate in the direction of arrow 38. Alternatively, the advancing of the film 26 could be accomplished manually by turning a lever or knob mounted on take-up axle 32.

In Figure 5, the container 12 is positioned by a locator identified generally at 40. The locator 40 is shown in more detail in Figures 7 and 8. Turning to Figure 7, there is shown a plate 42 having a pair of opposed guides 44 and 46. The plate 42 also has an opening 48 located between the guides 44, 46. The guides 44 and 46 are substantially mirror images of each other, and therefore the following discussion in respect of the guide 44 applies equally to guide 46.

The guide 44 comprises a rub rail 50 which contacts an outer edge of a container 12. Extending from the plate 42 are two posts in respect of each guide 44, 46. In respect of the guide 44 there is a stop post 52 and a guide post 54. A slot 56 is formed in the guide 44 and a spring 58 is housed between the guide post 54 and the end of the slot 56. A pin 59 may be used to secure one end of the spring 58. A washer 60 is used to retain the other end of the spring 58 within the slot 56. The washer 60 is placed around the guide post 54. Between the free end 55 of guide post 54 and the washer 60 is a further spring 61. The spring 61 allows the guide plate 44 to articulate away from the plate 42 to facilitate removal of the container 12 from the device 10.

As can be seen in the drawings, the guide 44 can move laterally in the direction of double-ended arrow 62, guided by means of the stop 52 and the guide post 54 with the slot 56. The curved portion 64 of the rub rail 50 provides a tactile indication to anyone inserting a container 12 into the locator that the container is

appropriately located, i.e. centred under the plate opening 48.

Turning to Figure 8, the locator 40 of Figure 7 is shown in cross-sectional view. As can be seen, the guides 44 and 46 are positioned on adjacent side edges of a container 12. The plate opening 48 is shown together with the plate 42. The thin film 26 is also shown stretched across the top 13 of the container 12.

It can be seen from the drawings that the container 12 can be moved in the direction of double ended arrow 65 into position beneath plate opening 48. During this period, the guides 44 and 46 will gradually open and then close about the periphery of the container 12. Thereafter, as shown in Figure 8, the container 12 is free to be moved in the direction of double ended arrows 66 as will be discussed below. Containers 12 of various diameters can thus be accommodated, since all containers will be centred by the locator beneath the plate opening 48. This is desirable in a food services environment where cup size selections may vary, typically including at least small, medium and large.

It should of course be understood that although some container positioning means is required, the specific positioning means described here is certainly not essential. Any suitable means could be employed. Alternatively, although certainly not ideal, full reliance could be placed on correct manual positioning of the container, with no specific positioning means for the container.

Turning now to Figure 5, a container 12 is shown centred in locator 40. A first radiant energy source 68 and a second radiant heater 70 can now be explained. Located above the centred and located container 12 is a top shrink hood 72. The second radiant heater 70 is located within the top shrink hood 72. The

top shrink hood 72 includes a shield 74 of glass or other approved transparent material which does not absorb IR radiation, and a heat transfer means 76. In some circumstances the shield 74 may not be required. However, to prevent the possibility of splashes reaching the second radiant energy source 70, it is preferred. Good results have been achieved when the heat transfer means 76 is made from a screen aluminum material painted a dark colour, such as black. The dark aluminum heats and cools quickly which is desirable in the circumstances.

A preferred type of energy absorbing body 76 is a darkened aluminum screen. The body 76 is placed very closely adjacent the top portion of the cut section 102 and may be in contact therewith. The darkened screen or body 76 absorbs some of the energy, creating heat and transferring it onto the top portion. Energy not blocked by the screen will pass through and is available to be absorbed by the film if the film is capable of doing so. Screen 76 is especially useful where the film used in mostly transparent and cannot absorb sufficient radiation to effect shrinkage. Aluminum is a suitable material because it will cool rapidly, when the energy source 70 is shut off, thereby preventing premature shrinkage of a top portion on a subsequent container upon being first introduced into the hood 20.

A pierce tool 78 is also shown extending outwardly from the heat transfer means 76. The purpose of the pierce tool 78 is to make a vent opening in the thin film to allow gases such as carbon dioxide from a soft drink to escape the container, if such venting is required or desired.

An alternative to pierce tool 78 is to form small opaque portions 79 in the shrink film which are relatively more opaque than the surrounding film. These

opaque portions or "dots", being more absorbent than the surrounding film, will cause a hot point which may perforate the film as more fully explained below. If desired the hot points can be made in a specified pattern to form a sipping opening or the like, as shown in Figure 2A. Also shown in Figure 2 is a straw 122 with a pointed end 124 which can assist in piercing the film, shown in place as 126. A fluid, such as a soft drink is shown at 128. The plastic film should be of a type in which a tear does not readily propagate.

Also shown in Figure 5 is a knife or film cutting blade 94 to which is attached a heating element 96. The heated blade 94 ensures a quick clean cut of the thin film, upon the thin film contacting the blade 94. As can be seen from Figure 5, the blade 94 is below the top hood 72, so the film will be cut to shape just prior to or about the same time as the container 12 contacts the hood 72. Good results have been achieved when the blade is made from a two point centre face steel cutting rule, and maintained at a temperature of between 275°F to 400°F. This format appears to limit smoke and fume generation.

The knife 94 may be circular in shape, or may be as shown in Figures 9 and 10. It will be noted that the knife 94 in Figures 9 and 10 includes a rounded oblong section 95. This will result in a similarly shaped section being formed in a cut piece of film, as described below, which can be used as a convenient pull tab for removing a cover which has been shrunk onto a container 12. The thin film 26 has a width greater than the width of the knife 94 so that a trim 27 (see Figure 5) is left after the cut is made, and the trim 27 is strong enough to allow the film 26 to be advanced by a tensile force without tearing.

It should be clearly understood that any suitable cutting means can be used to produce the cut piece 102. The invention is not limited to the specific cutting means described here. For example, even better results may be achieved using a blunt heated cast iron blade, a hot wire, or some other conventional film cutting means.

As an alternative to the film being pushed up against the blade, a solenoid may be triggered by insertion of the cup, to push the knife down against a surface. The surface may be covered with thin silicone rubber sheeting or the like, if desired.

In some circumstances, it may be desirable to urge the film onto the cup. Therefore, the invention also comprehends the use of a spring wire 110, which trails (or leads) the revolving first radiant heat means 68, and urges the edge 103 into contact with the container 12 just below the top 13.

Turning now to Figure 6, the operation of the apparatus will be explained. In Figure 6 the container 12 has been raised in the direction of arrow 100. This has had the effect of pushing the film 26 upwardly into engagement with the heated film cutter blade 94. This has caused a cut portion of the film shown as 102, which could be about 15 cm in diameter for example, to be draped across the top 13 of the container 12, which could be about 12 cm in diameter for example. The dimensions of the cut portion and of the container obviously may vary, as long as there is a sufficient overlap.

At this point the hood 72 is holding the cut piece of film 102 generally in place. Raising the container 12 further also raises the hood 72. Rollers 90 then contact a ledge 104 formed on the outer surface of the hood 72. Further upward movement causes the movement of the first radiant energy source 68 about the pivot

point 86 until the first radiant energy source 68 is closely adjacent to a draped over edge of cut portion 102 shown as 103. Contact is then made at a limit switch, as explained below in respect of Figure 11, which energizes a motor 99 (shown in Figure 4). Upon energization of the motor 99, the belt 80 revolves, causing the rotating arms 84 to revolve, rotating the first radiant energy source 68 about the periphery of the top of the container 13. Simultaneously with the energization of the motor 99 and the rotation of the first radiant energy source 68, the first radiant energy source 68 is energized to cause radiant energy to be directed towards the dangling edge 103 of the cut portion 102 of the film 26.

It has been found that the preferred radiant energy sources are Tungsten Halogen Lamps. About 70% of the energy produced by these lamps is in the preferred wavelength range of the infrared (750 millimicrons and beyond).

These lamps are compact, durable, inexpensive and readily available. Lamps in the range of 200 to 300 watts are suitable. Other energy sources which produce sufficient infrared radiant energy may also be used, the choice of such sources being within the ordinary skills of those working in this technical field.

Positioning the first radiant energy source 68 closely adjacent to the downward edge 103 of the cut portion 102 is preferred because radiant energy obeys the inverse squared rule in which the amount of energy is proportional to the inverse of the square of the distance from the source. By locating the first radiant energy source 68 close prior to being energized, more energy can be usefully used and focused away, for example, from an operator's hands. Also, by the pivoting action, the operator's hands are kept clear of the energy source 68, until the container 12 is in position.

Turning now to Figure 4, the belt 80, pulley 82 and drive motor 99 are all shown. Also shown are two rotating arms 84 and two first radiant heaters 68. Obviously, fewer or more radiant heating elements could be used according to space requirements and preference. However, when the drive motor operates at 100 rpm, two radiant heat means 68 provides good results. By varying the size of the pulley 82, the speed of revolution of the first radiant energy source 68 can also be varied. Good results have been achieved when the pulley 82 is configured to cause the first radiant energy source 68 to rotate at 100 rpm.

Also shown in Figure 5 is a drive belt 80 which connects a pulley 82 with a motor. Attached to the pulley 82 are a pair of arms 84. The arms 84 rotate when the pulley 82 is rotated by the belt 80. Depending from the arms 84 about pivot points 86 are pivot arms 88. Pivot arms 88 include a roller 90 at one end and the first radiant energy source 68 at the other end. Preferably, a reflector is provided such as the reflector 92 shown outside the first radiant energy source 68, to focus the radiant energy on the sealing area

After a predetermined length of time (typically about one second or less in prototypes of the invention), the first radiant energy source 68 is de-energized and the second radiant energy source 70 is energized by a timer 120. The second radiant energy source 70 energy is directed through the glass shield 74 onto an energy absorbing body 76. This transfer of heat causes a shrinking of the top portion across container 12 of the cut portion 102. Thereafter, the sealed container 12 can be lowered and removed from the apparatus. Preferably a buzzer signals the operator as to when the container may be removed. Attempting to remove the container prematurely may result in a defective seal, or in a cover

which is not taut, but otherwise is not harmful, i.e. no damage to the apparatus can be caused.

The second radiation stage is not essential to effecting the seal, but produces a more aesthetically pleasing seal, and is therefore preferred. Also, if the seal is intended to be punctured by a straw, then this stage facilitates that by ensuring that the plastic is stretched taut across the opening of the container.

Turning to Figure 11, a schematic of an electrical system 150 for the invention is disclosed, which sets out in more detail the interaction between the container 12 and hood 72 location, and the activation of the various components described above.

One of the characteristics of the electrical design is that it must allow for the varying rates that the container 12, which is moved by a human hand, enters and leaves the device 10. It must not be essential that the container be moved at a certain rate.

Another characteristic of the electrical design is that it must be capable of being adjustable to variations of film shrinkage caused by alterations of the energy absorbency or opaqueness of the film. It is anticipated that users of the device will require their own particular colours, printed messages or transparent area on their container covers.

In the preferred embodiment the raising and lowering of hood 72 and the motion of locator 40 will trigger micro-switches which engage timers as described below. Certain events must take place as hood 72 is raised and other events must take place when hood 72 is lowered.

Referring to the wiring system 150, F1 is a fuse. When the main switch 170 is turned on, a pilot light R1 lights up. Then, switches S1 and S2 are manually turned on. As shown, S1 turns on resistance

heater 96 when thermostatic switch 97 is closed, which heats the knife 94. A thermostatic control is shown at 97. When S2 is turned on, it activates motor 99 and also signals timer T1. Also shown is a relay TM-1. The timer T1 engages motor 34 and advances the film 26 for a single "space", which is determined by the time set on timer T1. Thus when the machine is activated and ready to operate by turning on switch S2, a fresh piece of film 26 is automatically presented. Switch LS1 is situated on plate 42, (shown in ghost outline in Figure 7) so that when guide 46 rotates outwardly on withdrawal of the container, LS1 also signals timer T1 which engages motor 34 and advances the film in a like manner.

Also shown are switches LS2 and LS3 which close when hood 72 moves upward. These switches activate a second timer T2 which activates relay TM-2 which in turn activates first radiant energy source 68. On the downward motion switch LS3 opens and thereby prevents timer T2 from activating source 68 again.

On the downward motion of hood 72, switch LS4 closes, which activates timer T3 which through a relay TM-3 activates radiant energy source 70 for a predetermined time.

Figure 12 shows in schematic form the microswitch interconnections. On the left hand side of Figure 12 are the belt 80 around the pulley 82. A shaft 200 extends upwardly from the top hood 72. A connecting rod 202 is attached to shaft 200, and will rise and subside with the hood 72 being raised and lowered. Remote from shaft 200 there is a rack 204 connected to the rod 202 which interacts with a pinion 206, in a manner shown by double ended arrows 208. Also shown are a cam shaft 210 attached to eccentric cams 212.

Shown in Figures 13A and 13B are the means of closing electrical circuits upon rotation of the cam

shaft 210 by the pinion 206. A secondary roller 214 is located on a pivot arm 216. When cam 212 is rotated in one direction an electrical spring clip 218 is forced into contact with an electrical contact 220 closing a circuit. Upon being rotated in an opposite direction, the cam 212 urges the pivot arm 216 up and out of the way, and does not close the circuit, as shown in Figure 13B.

It will be appreciated by those skilled in the art that the foregoing description relates to a preferred embodiment and that various modifications can be made without departing from the broad scope of the appended claims. Some of these modifications have been discussed above and others will be apparent to those skilled in the art.

For example, the spinning first radiant energy source 68 could be replaced with a row or ring of fixed position bulbs. However, the process would be slightly more difficult to control, since the total energy output would likely be greater, and more energy expensive. Thus, the moving first energy source 68 is preferred.

Another alternative to a spinning first radiant energy source would be to use a custom bulb in the shape of a ring which surrounds the container.

INDUSTRIAL APPLICABILITY

The invention provides an improved method of sealing open-topped containers using heat-shrinkable plastic film, and apparatus for implementing the method.

CLAIMS:

1. A method for sealing an open-topped container (12) with a heat-shrinkable plastic film (102), comprising the steps of first positioning said plastic film across said open top and then sealing said plastic film against said container at a sealing area (15) around the upper margin of said container, characterized in that said sealing step involves radiating said sealing area with radiation having a substantial infrared component, and further characterized in that at least one of (a) said film and (b) said container is darkened at least at said sealing area in the case of said container, or at least in the area which will contact the sealing area in the case of the film, so as to absorb a substantial portion of said radiant energy.

2. A method as recited in claim 1, characterized by the further step of radiating the portion of said film extending across said container, after said sealing step, in order to shrink same sufficiently to render the film taut.

3. A method for sealing an open-topped container (12) with a heat-shrinkable plastic film (102), comprising the steps of first positioning said plastic film across said open top and then sealing said plastic film against said container at a sealing area (15) around the upper margin of said container, characterized in that said sealing step involves radiating an energy-absorbing body (112) adjacent the sealing area interposed between the sealing area and the source of the radiation.

4. A method as recited in claim 3, further characterized in that at least one of (a) said film and

(b) said container is darkened at least at said sealing area in the case of said container, or at least in the area which will contact the sealing area in the case of the film, so as to absorb a substantial portion of said radiant energy.

5. A method as recited in claim 3, characterized by the further step of radiating the portion of said film extending across said container, after said sealing step, in order to shrink same sufficiently to render the film taut.

6. Apparatus for sealing an open-topped container (12) with a heat-shrinkable plastic film (102), characterized by:

a housing (10) adapted to receive said container;

means (24, 28, 30, 32) for positioning a strip of said film across said open top, sufficiently large to overlap onto a sealing area (15) around the upper margin of said container; and

means (68) for radiating said sealing area with radiation having a substantial infrared component, so as to shrink said film onto said sealing area.

7. Apparatus as recited in claim 6, where at least one of (a) said film and (b) said container is darkened at least at said sealing area in the case of said container, or at least in the area which will contact the sealing area in the case of the film, so as to absorb a substantial portion of said radiant energy.

8. Apparatus as recited in claim 6, characterized by a second radiation source (70) arranged to radiate the portion of said film extending across said container, so

that after sealing, said film may be caused to shrink so as to become taut.

9. Containers (12) for use in apparatus for producing containers with a heat-shrinkable plastic film (102) positioned across an otherwise open top, where said apparatus employs radiation having a substantial infra-red component, said containers being characterized by an energy-absorbing dark band (15) around the upper margin of said container.

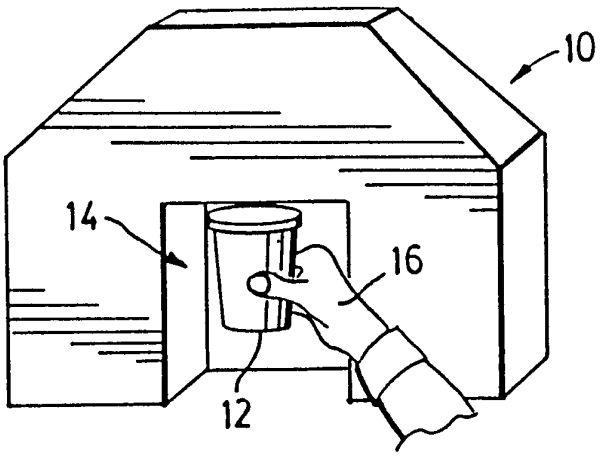


FIG. 1

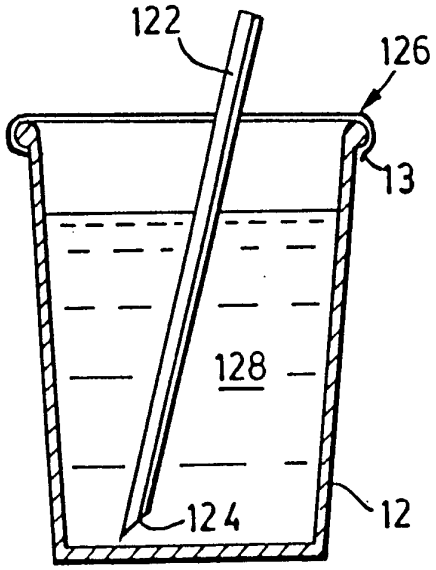


FIG. 2

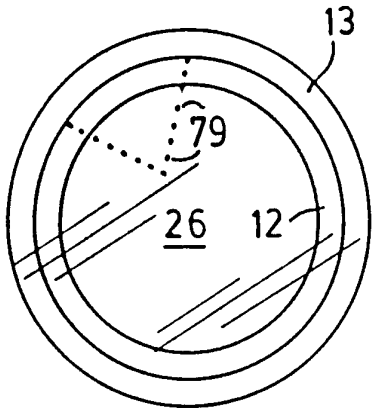


FIG. 2A

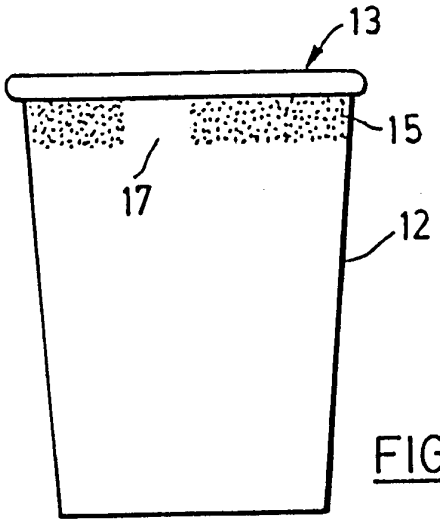


FIG. 3

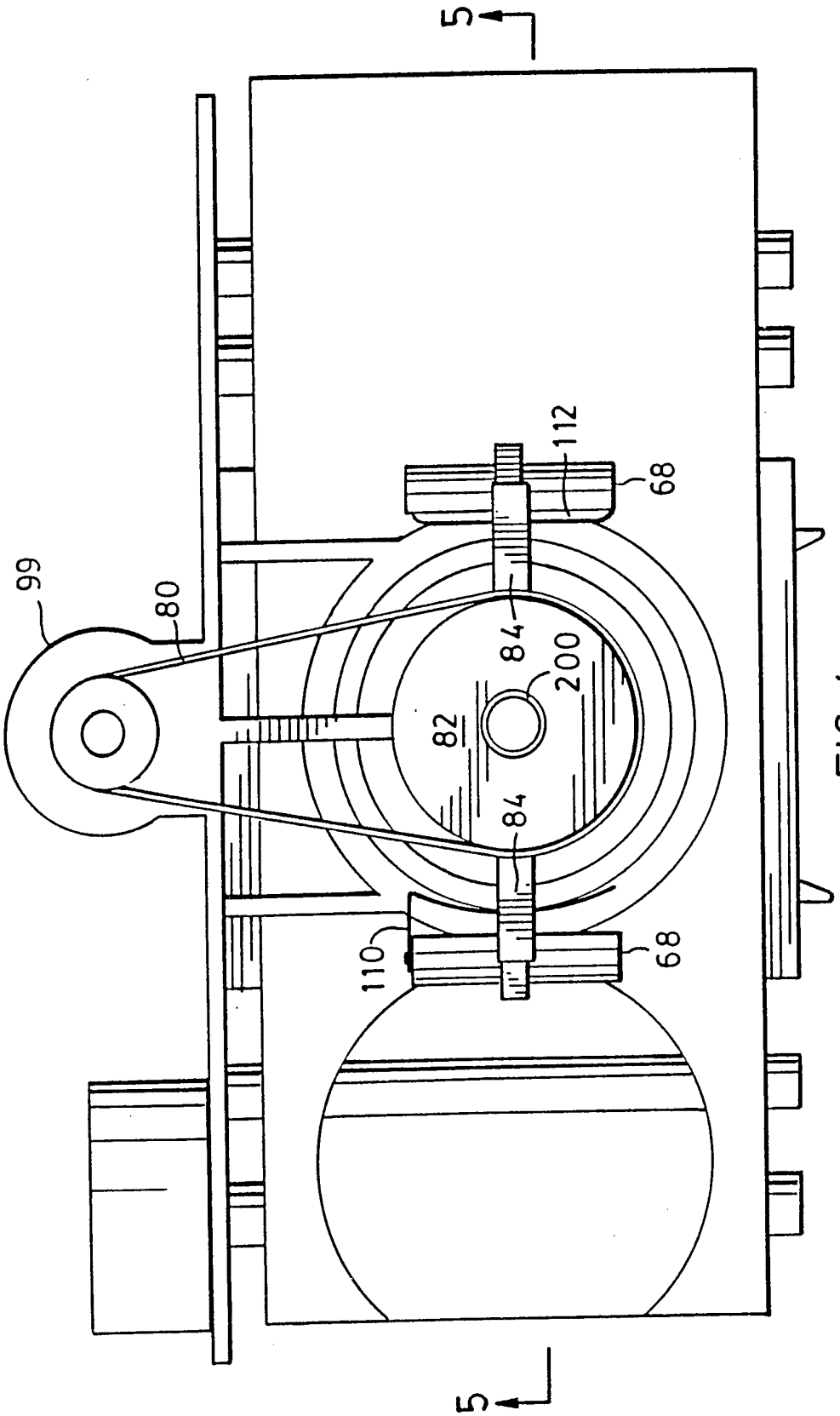


FIG. 4

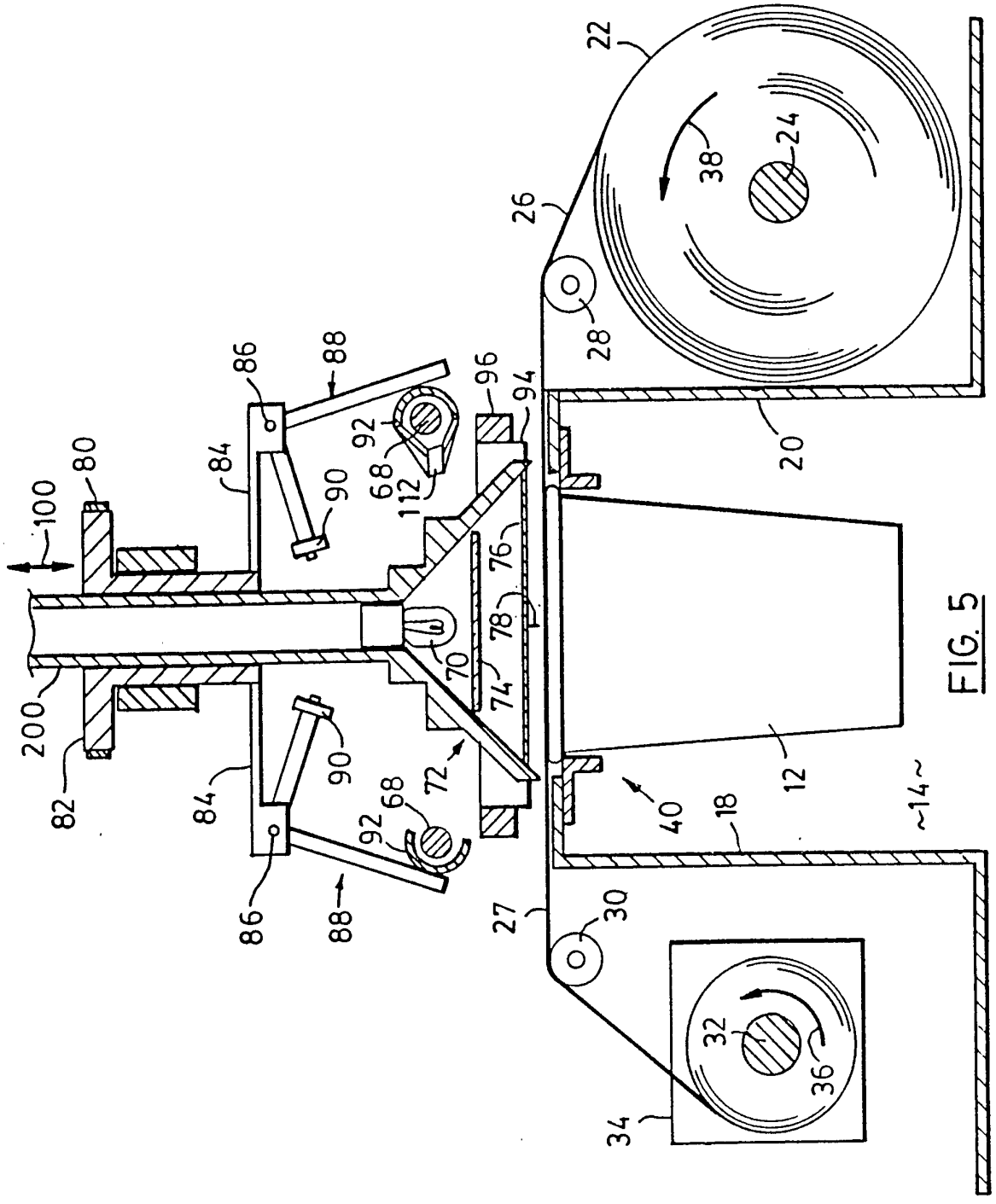

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FIG. 5

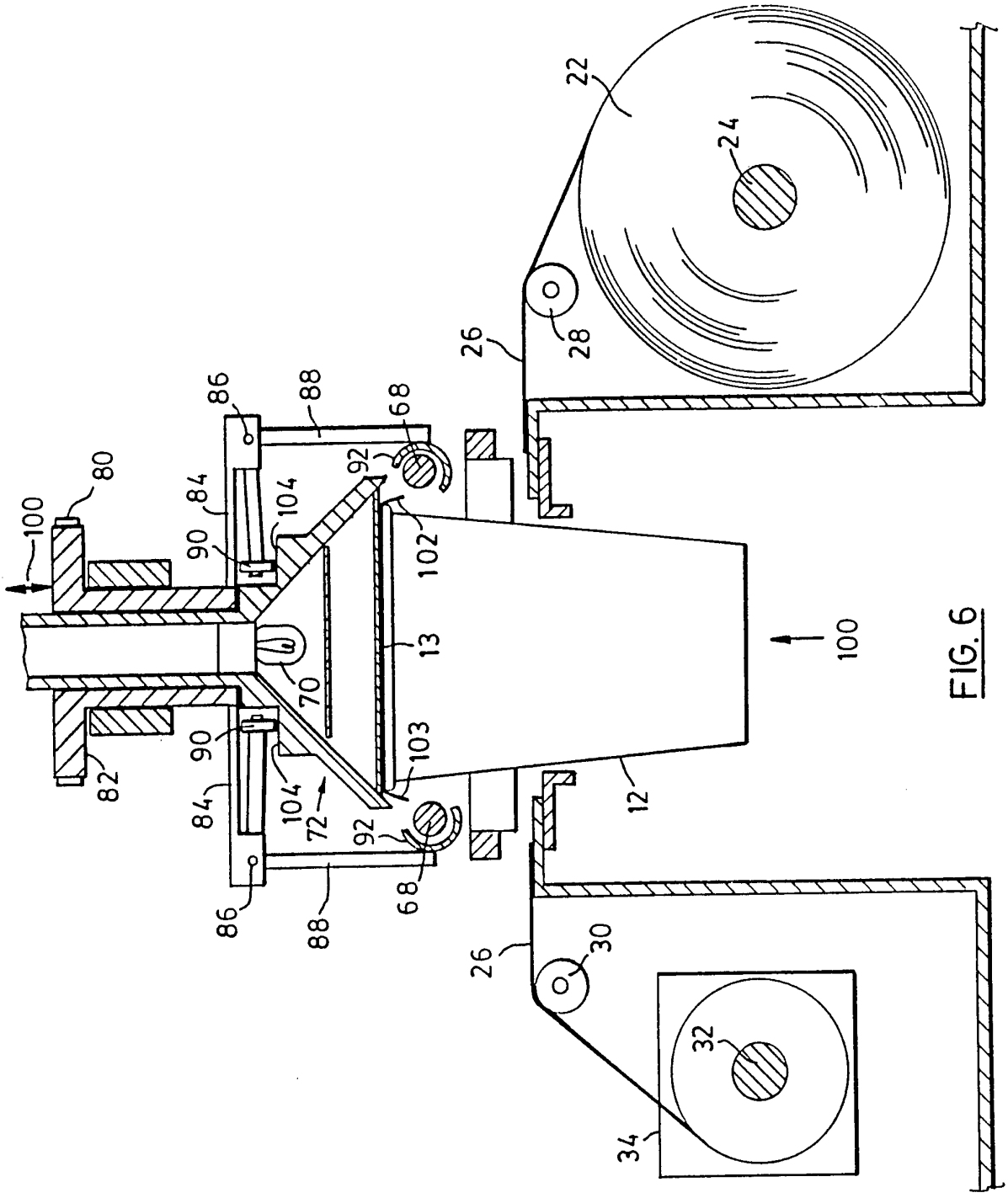

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FIG. 6

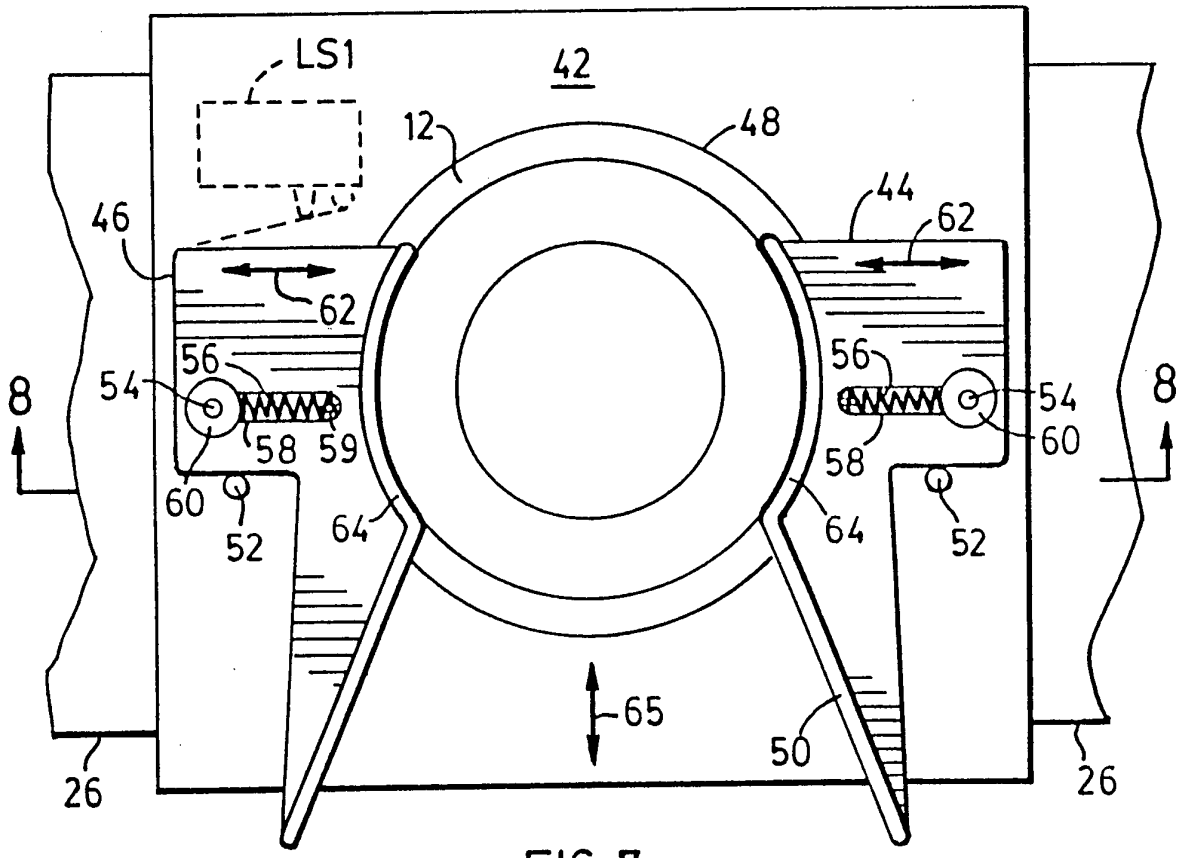

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FIG. 7

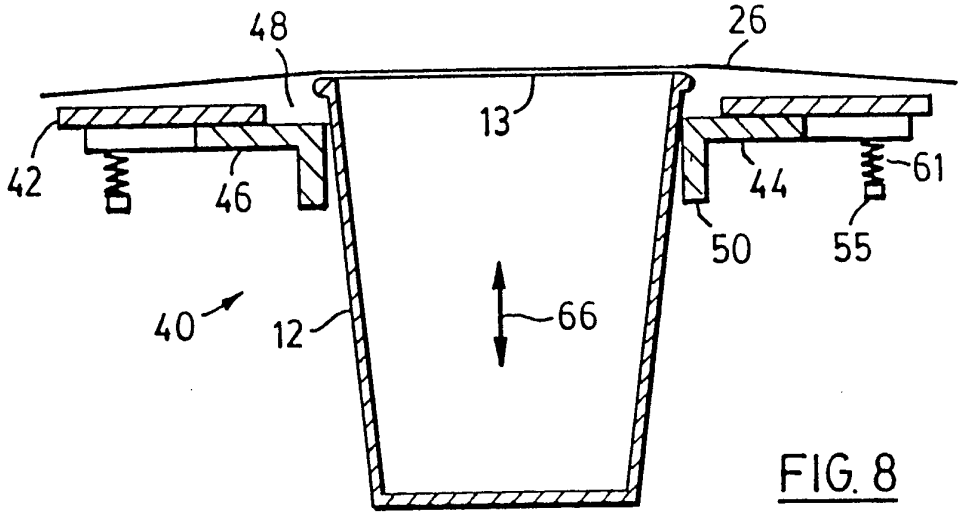

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FIG. 8

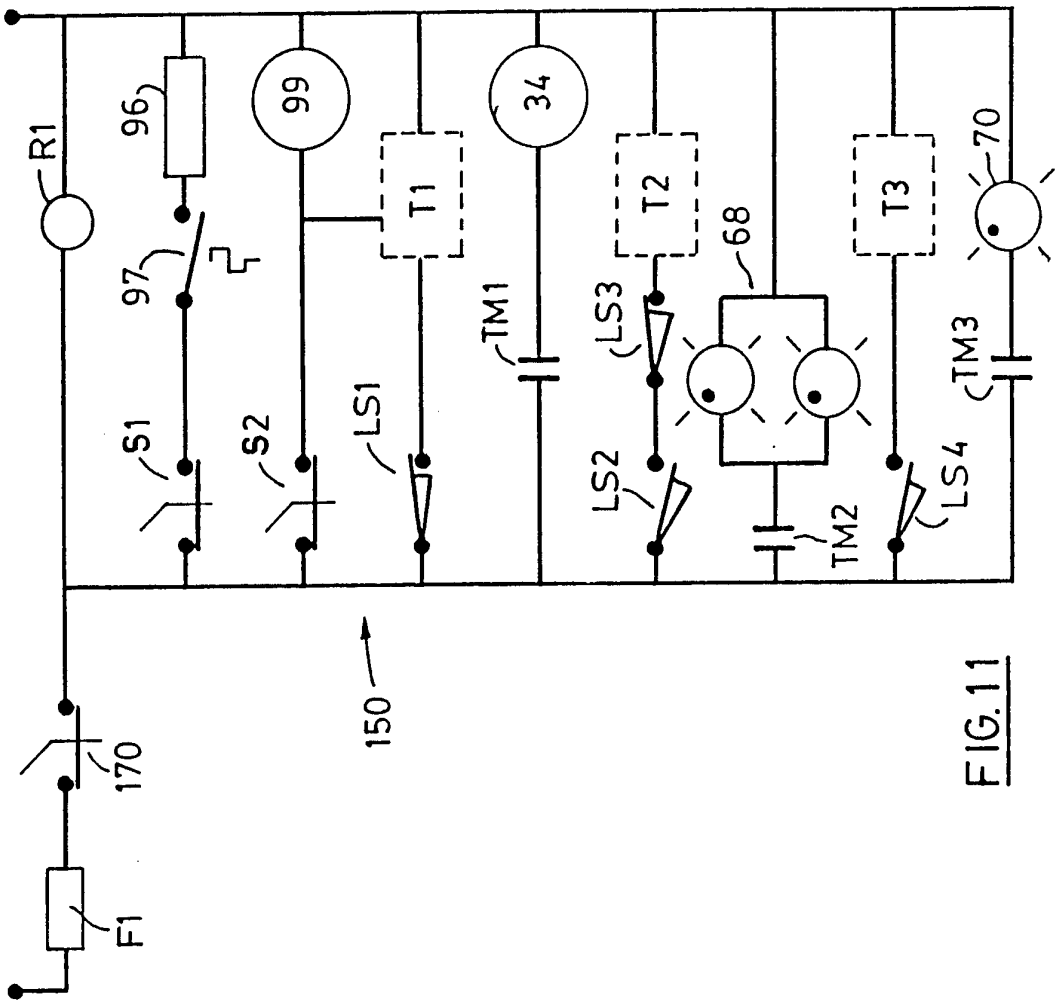


FIG.11

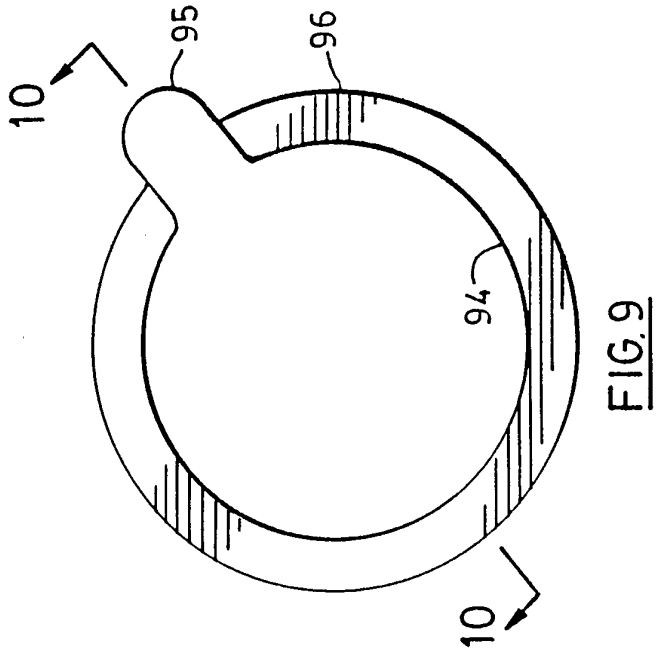


FIG.9

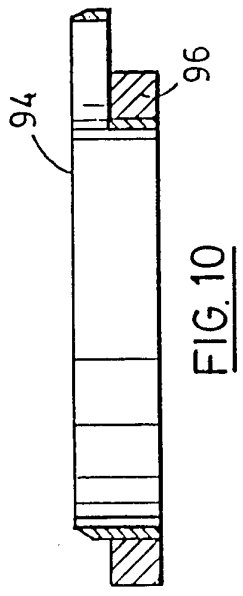


FIG.10

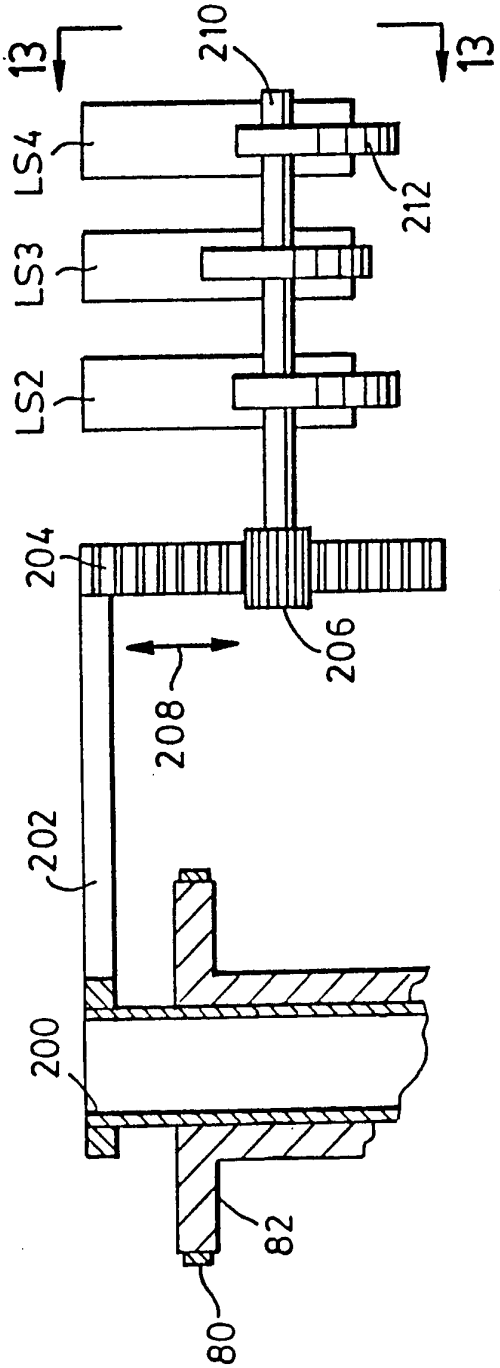


FIG.12

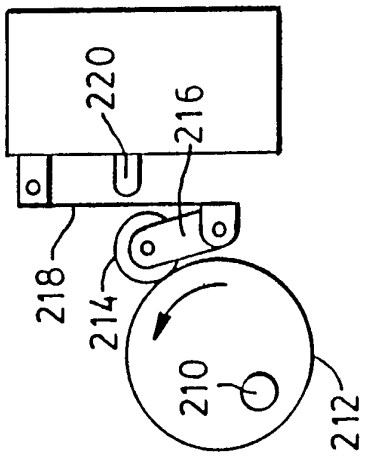


FIG.13B

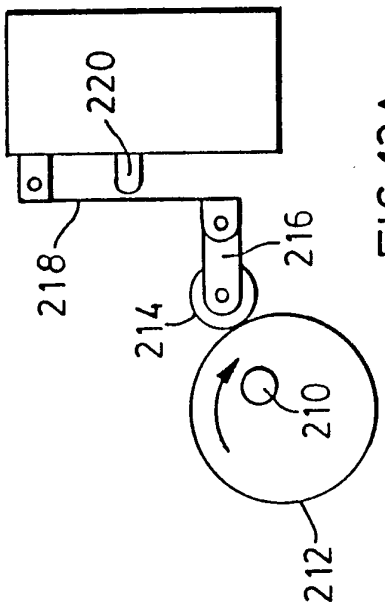


FIG.13A

INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/CA 93/00399

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65B7/16 B29C65/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65B B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	US,A,5 249 410 (BAKKER ET AL.) 5 October 1993 see the whole document ---	1-9
X	AU,D,2 733 767 (JAMES M. HEILMAN AND PAUL R. HOFMANN) 27 March 1969	6
Y	see page 2, line 1 - page 3, line 19 see page 9, line 9 - page 10, line 26 see figures ---	1-5,7-9
Y	GB,A,2 022 501 (BECKMAN INSTRUMENTS) 19 December 1979 see page 3, line 106 - line 120 --- -/--	1,2,7-9

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
9 June 1994	30. 06. 94

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lanaspeze, J

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INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/CA 93/00399

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE,B,17 79 656 (ELTRO GMBH & CO GESELLSCHAFT FÜR STRAHLUNGSTECHNIK) 31 May 1972 see column 4, line 31 - column 5, line 22	3-5
A	EP,A,0 437 847 (TETRA PAK HOLDINGS S.A.) 24 July 1991 see column 3, line 38 - line 48	1,4,7
A	FR,A,1 543 503 (JAMES M. HEILMAN ET PAUL HOFMANN) 25 October 1968 see page 3, left column, line 50 - right column, line 60 see figures	1,2,5,6, 8
A	US,A,3 507 093 (MARION) 21 April 1970 see claims; figures	1,6,9

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INTERNATIONAL SEARCH REPORT

...ormation on patent family members

Intern al Application No
PCT/CA 93/00399

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US-A-5249410	05-10-93	NONE		
AU-D-2733767	27-03-69	NONE		
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		FR-A,B	2427952	04-01-80
DE-B-1779656	31-05-72	NONE		
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		DE-T-	69004945	28-04-94
		ES-T-	2047814	01-03-94
		JP-A-	4211434	03-08-92
		SE-A-	9000154	17-07-91
		US-A-	5113479	12-05-92
FR-A-1543503		NONE		
US-A-3507093	21-04-70	NONE		