Nov. 28, 1967 S. W. AMBERG ET AL 3,354,604

RECEPTACLE CAPPING MACHINE AND METHOD

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Fig. 1.

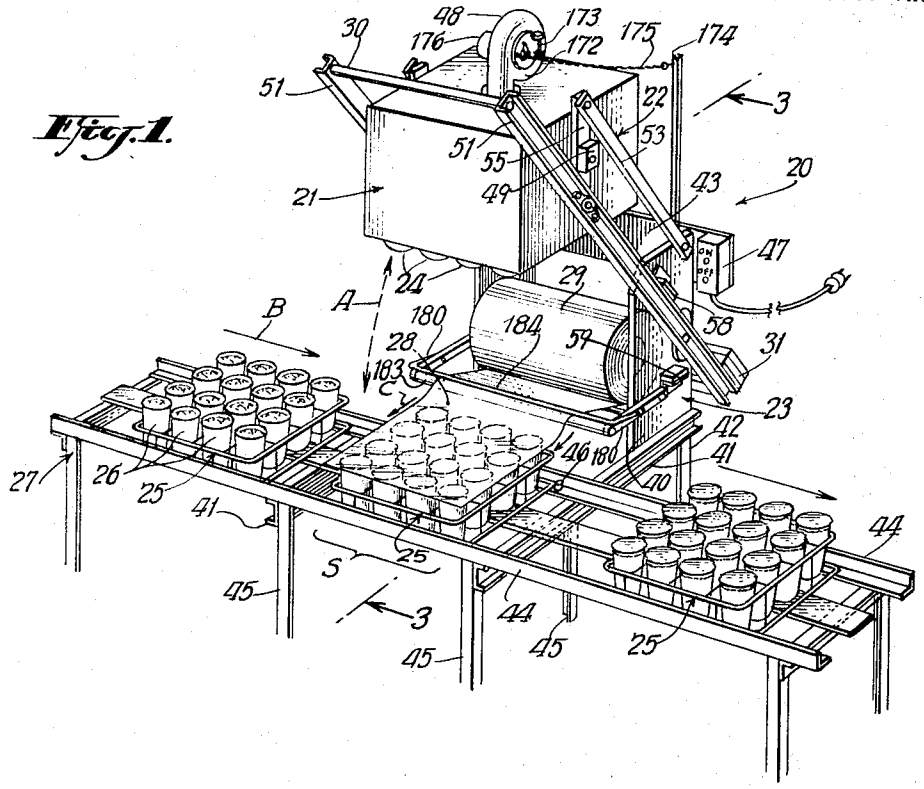
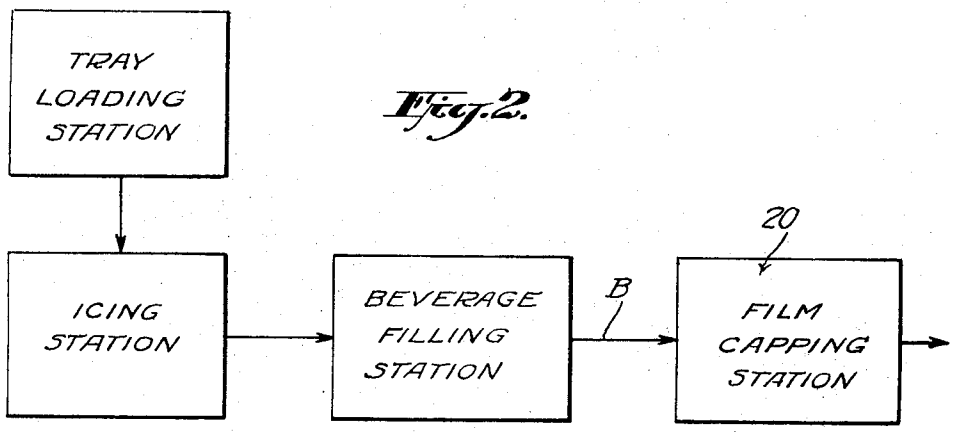



Fig. 2.





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RECEPTACLE CAPPING MACHINE AND METHOD

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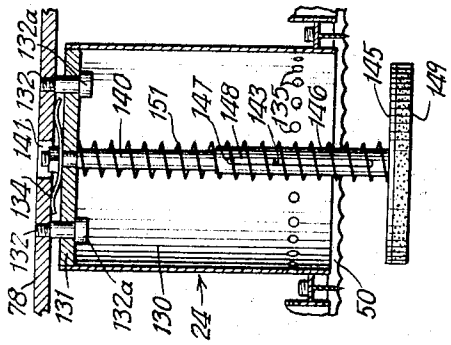


Fig. 1A.

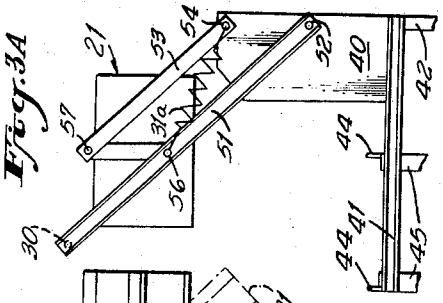


Fig. 1.

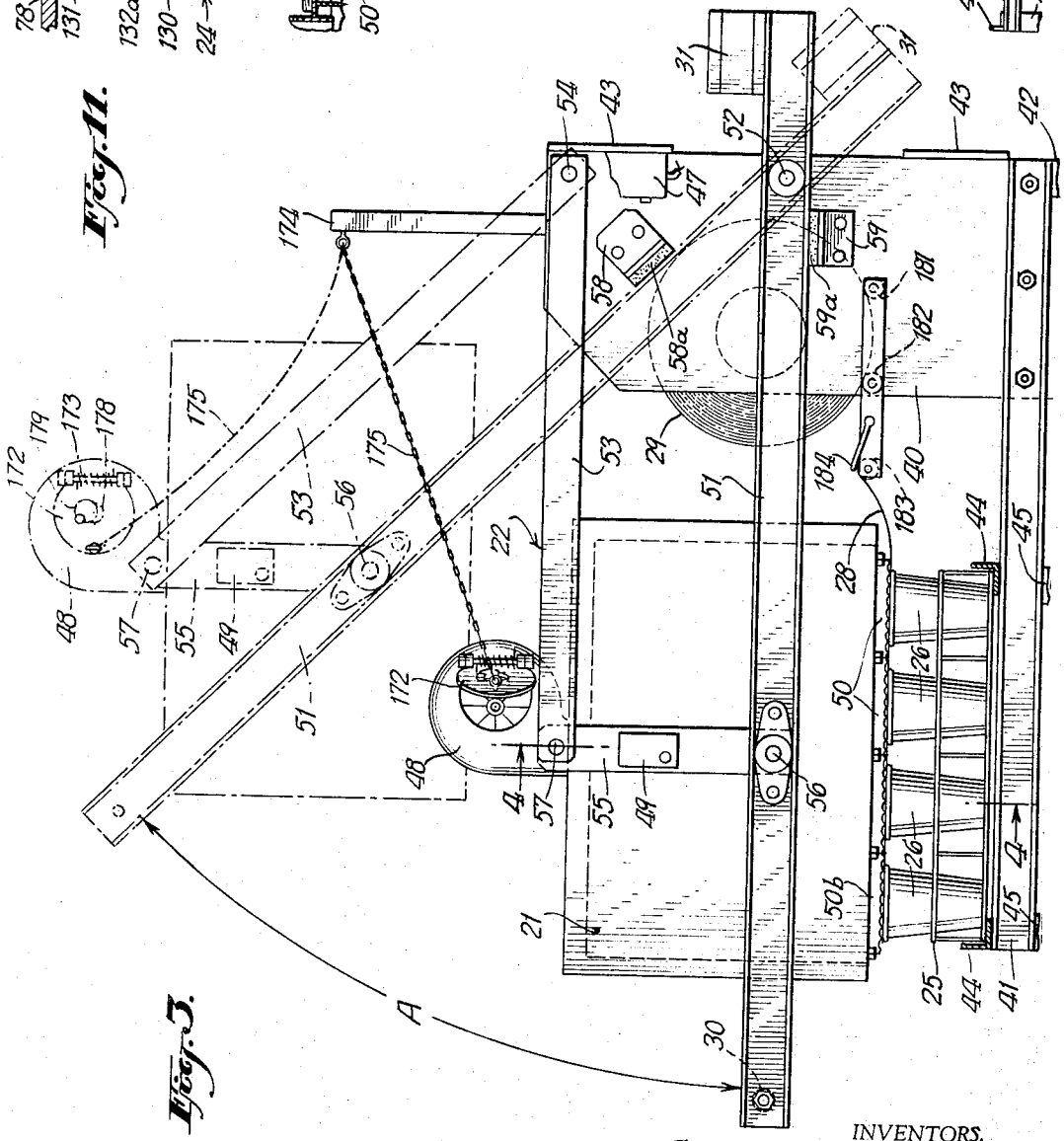


Fig. 3.

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RECEPTACLE CAPPING MACHINE AND METHOD

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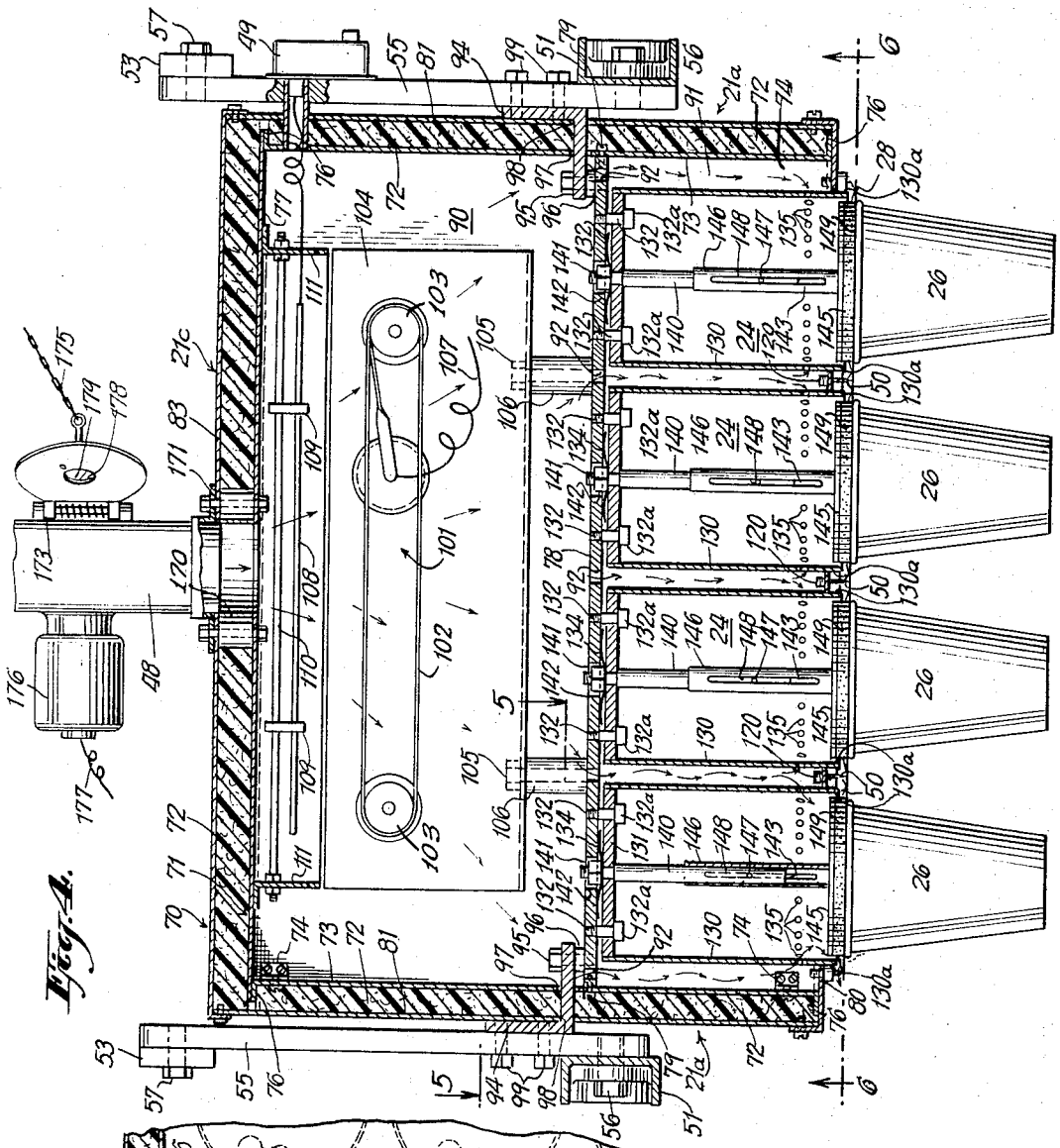


Fig. 4.

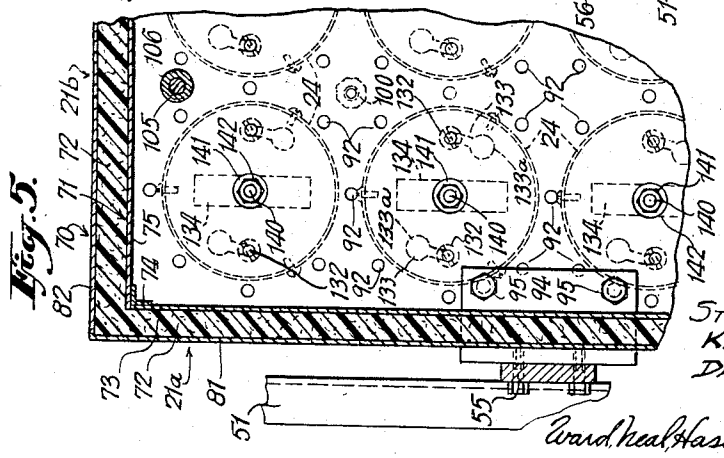


Fig. 5.

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RECEPTACLE CAPPING MACHINE AND METHOD

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Fig. 6.

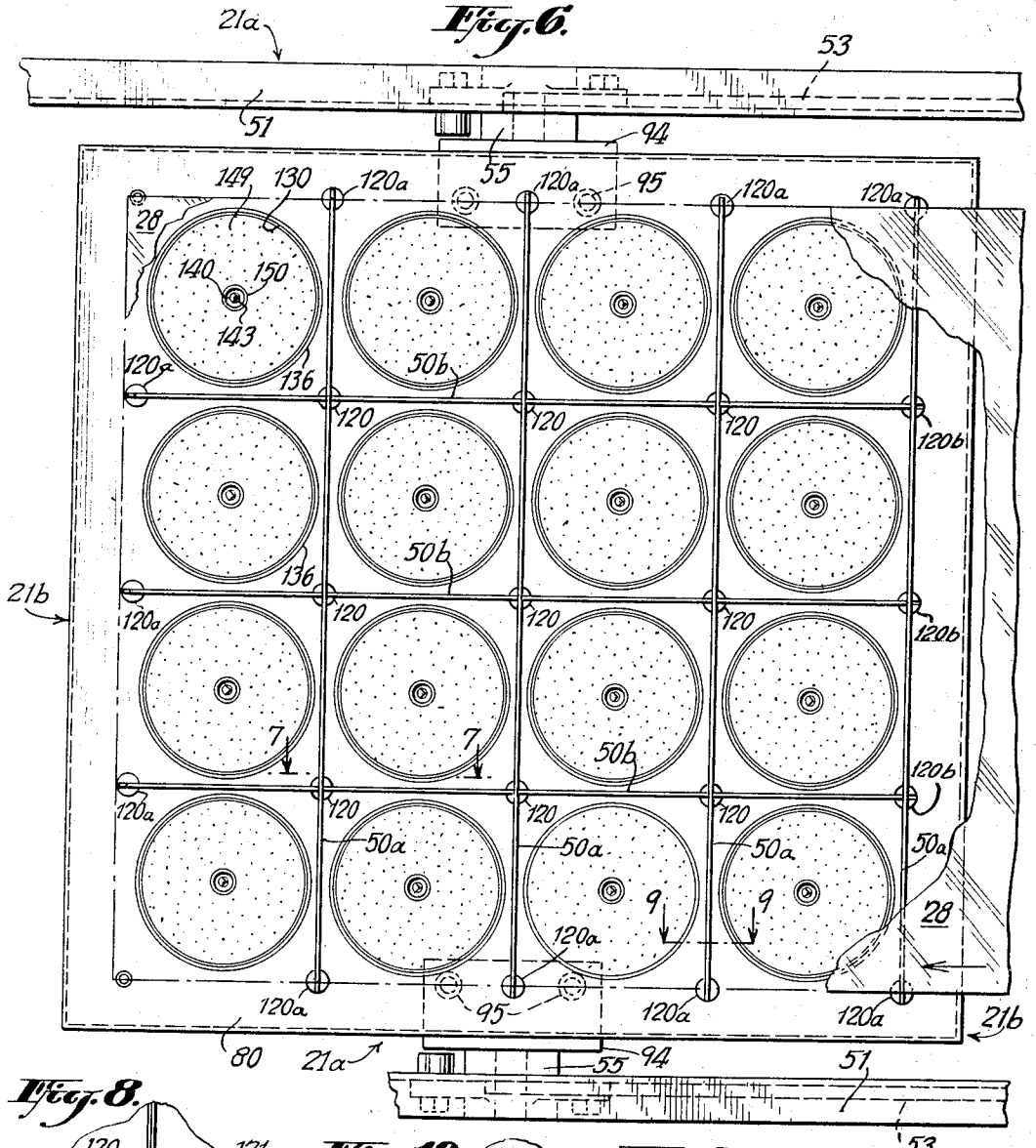



Fig. 8.

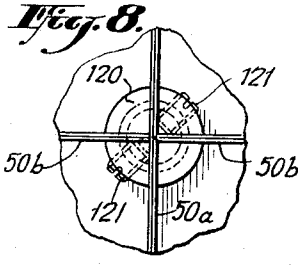



Fig. 10.

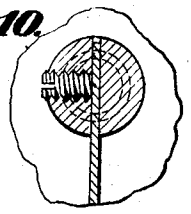


Fig. 9.

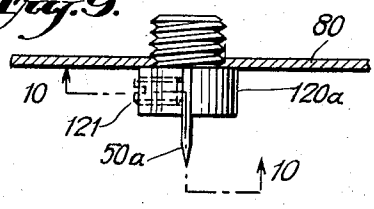
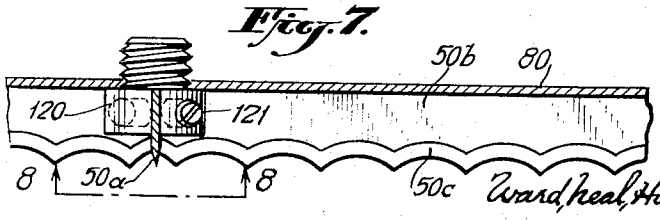



Fig. 7.



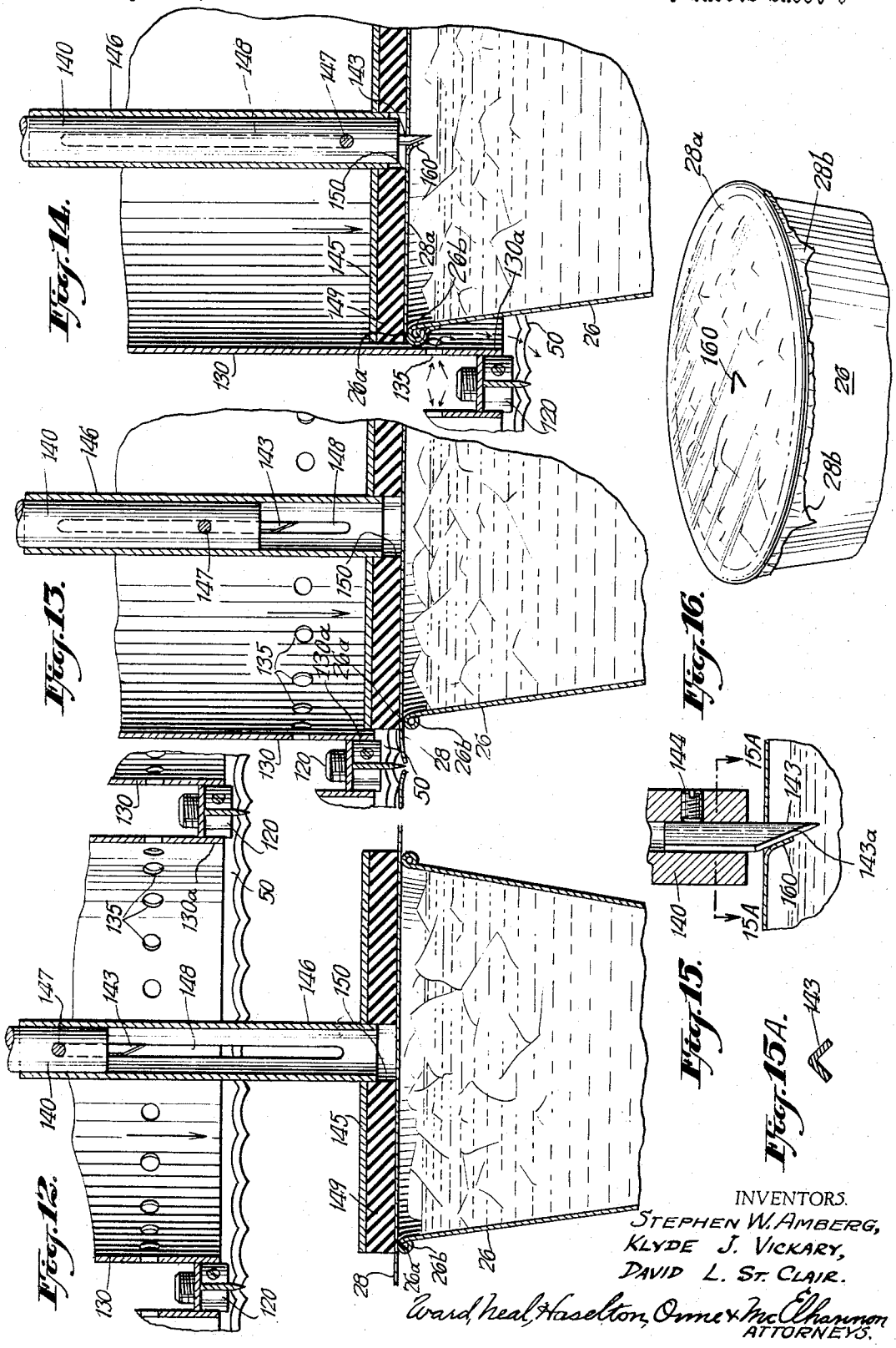

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3,354,604

# RECEPTACLE CAPPING MACHINE AND METHOD

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36 Claims. (Cl. 53—42)

This invention relates to capping techniques and more particularly to a machine for simultaneously forming and applying shrink-film type closures to receptacles such as paper drinking cups or the like.

Methods and apparatus for applying shrink-film closures to receptacles are known. Prior processes and apparatus have involved the use of thin film material such as polyethylene for closures, an oversized piece of the polyethylene being placed upon and across the receptacle mouth opening and heat being applied to the peripherally extending excess polyethylene material to shrink the same into bunched, contact relation with the periphery of the receptacle while maintaining the central area of the polyethylene in relatively cool condition so that it will not shrink. It is known that, where the receptacle contains liquid or the like, such closures are relatively leak-proof, and that the closure is relatively resilient in its shrunken edge regions so that the same may be easily removed from the receptacle using the fingers since the shrink-film closure is not actually bonded to the receptacle.

However, and even though processes and apparatus for continuous application of such closures to continuously fed receptacles are known, the shrink-film capping techniques of the past are not well suited or adaptable for use for high speed and repetitive capping operations such as would be necessarily employed, for example, in capping drinking cups or the like for sale by vendors of refreshments at stadiums, sports arenas, and other public places where present day rules prohibit the distribution of such refreshments in bottles or cans. Nowadays a vendor of beverage refreshments at a stadium or the like carries a tray of bottled or canned beverages and a supply of paper drinking cups into which he pours the beverage upon sales being made, and it is apparent that the vendor is limited in the number of bottles or cans which he can carry due to their weight, and that the necessity for opening each bottle or can and pouring the beverage into a drinking cup is a relatively time-consuming operation which, together with the frequency with which he must return to a central distribution point for a further supply of the bottled goods, imposes a limitation on the volume of sales which he might otherwise make within a given period of time.

Ideally, the vendor might double the number of individual beverage servings which he might carry and also considerably improve the rapidity of his distribution thereof were the beverage servings already contained in the drinking cups within which they must be distributed. However, prior to the present invention, no economical and practical technique for prefilling and capping such drinking cups has been known. While the cups are easily prefilled using existing filling apparatus, the cost of conventional paper or plastic closures and the labor required in manually or automatically placing the same on each filled drinking cup offsets the aforementioned advantages to the actual vendor. Although shrink-film closures themselves are known to be relatively inexpensive, the unavailability of a suitable machine for applying such closures to literally thousands of such drinking cups at speeds commensurate with the rate of distribution thereof has prohibited their use for the purpose.

The present invention provides a relatively inexpensive machine for simultaneously capping a plurality of receptacles, such as a trayful of drinking cups containing either hot or cold beverages or the like, using closures of the shrink-film type, the machine being capable of accurately and economically capping from 9,600 to 15,000 of such drinking cups per hour with virtually no wastage of the shrink-film material. In its preferred embodiment, the machine is semi-automatic in operation, and requires the services of only one operator. It can accommodate a variety of cup sizes without adjustment, and will not cause distortion of the mouth rims of any of the same. The machine is compact, requiring a working area of only 32 inches by 48 inches, is lightweight, and is transportable. It requires no frequent or sensitive adjustments to assure good operation, is easily cleaned of spilled beverages or the like, and requires only routine maintenance. The type of shrink-film closure which the machine applies conforms to sanitary requirements in that the areas of the receptacle mouth rim which will be in contact with the lips while drinking are effectively covered by the closure material. Moreover, in its preferred embodiment, the machine incorporates means for piercing the closure at the time the closure is applied in such manner as to permit escape of gases from carbonated or hot beverages or the like, yet not permit spilling of the beverage from the capped receptacle.

Briefly describing the shrink-film capping machine which is provided by the present invention, a box-like air heating chamber momentarily stores and preheats a common supply of air which, during a capping operation, is delivered through circumferentially disposed apertures in each of a plurality of capping heads which are mounted within a lower section of the chamber. The chamber is mounted on a pantograph linkage arrangement for manual and momentary lowering to bring the several capping heads into surrounding relation with a corresponding number of receptacles on which shrink-film closures are to be applied. All of the receptacles have first been covered by a common web of shrink-film closure material which is fed from a roll thereof mounted on the machine frame structure which also supports the pantograph linkage and heating chamber unit. An air blower mounted atop the unit is operated continuously, but includes a butterfly damper arrangement which opens and permits a surge of outside air into a heating chamber only at times when the multiple chamber is lowered on to the receptacles to be capped. Although a relatively small blower opening permits limited air flow at all times through the heating chamber, the damper type operation of the blower produces a purging of preheated air from the chamber such that air of uniform temperature flows downwardly first around the several individual capping heads and then uniformly into each of the individual capping heads for the purpose of shrinking the closure film in the desired manner. The coincident heating of the capping heads may also contribute to the efficiency of the shrinking operation, as will be explained. The chamber unit further carries a grid-like pattern of knives which automatically sever the web of shrink-film material into oversized individual closure pieces as the unit is lowered into capping association with the trayful of receptacles. The heating of the knives, by heat from the chamber, contributes to cutting efficiency.

Each capping head includes a can-like cylinder, having diameter somewhat larger than the diameter of one of the receptacles to be capped. Mounted within each of the capping head cylinders is a vertically slidable plunger having a clamping disc at the lower end thereof, the disc having diameter at least generously equal to the diameter of the receptacle to be capped. The arrangement is such that each plunger including its clamping disc normally projects below the lower end of the cylinder within which

it is mounted. Thus, at times between capping operations, the discs are not exposed to heat, either as radiated by the heating chamber or by impingement of heated blow air. When the heating chamber unit is brought down upon the group of receptacles, the clamping discs come into contact with, and thereafter rest by gravity upon the mouth rims of the respective receptacles so as to effectively clamp the interposed shrink-film material therebetween. Further lowering of the chamber unit causes a cutting of the polyethylene material into individual oversized pieces as aforesaid, and moves the capping heads into surrounding relation with the respective receptacles, their respectively associated clamping discs clamping the shrink-film material on the mouth rims of the receptacles. The underside face of each clamping disc is covered with an insulating material, such as soft rubber, so that the central area of each shrink-film closure is shielded from heat, thereby preventing any shrinking of the portion of the closure which spans the mouth rim of any receptacle. Commensurate with this further lowering of the chamber unit a centrally located plunger needle associated with each capping head automatically pierces the closure film in a particular manner, and for a purpose to be explained. Simultaneously, the air blower butterfly damper is opened, and heated air is blown through the interiorly located and circumferentially disposed apertures within each capping head cylinder and into contact with the excess polyethylene film material which surrounds the periphery of each respective receptacle so as to promptly and effectively shrink the same. The chamber unit is held in this position for only a few seconds, whereupon all of the shrink-film closures are simultaneously formed. Each of the receptacles has a conventional beaded lip surrounding the mouth opening thereof, and it will be found that the film shrinks into position below this beaded lip so as to protect the same against subsequent exposure to contamination.

After the few seconds required for forming the closures, the heating chamber unit is moved upwardly out of engagement with the now capped receptacles, whereupon the newly introduced air which remains in the heating chamber is already being heated for the next capping operation. It will be noted that, as the chamber is lifted, the plunger elements fall gravity to their initial positions so that their clamping discs project below the lower ends of the capping head cylinders within which they are mounted. An alternative embodiment provides a spring return of the plungers to their initial positions.

Prior to being capped, the receptacles have been placed in trays and have been filled with the liquid, and perhaps ice, which they will contain. It is therefore seen that the herein described capping apparatus may be appropriately stationed within a production line sequence of receptacle dispensing, receptacle filling, and icing, and receptacle capping operations.

These and other objects, features and advantages of the present invention will become more fully apparent from the following detailed description of a preferred embodiment thereof, when taken together with the accompanying drawings in which:

FIGURE 1 is a perspective view showing a shrink-film capping machine in accordance with the present invention;

FIGURE 2 is a diagrammatic showing of a sequence of operations of which the machine of the present invention may form an integral part;

FIGURE 3 is an enlarged side elevation of the machine of FIGURE 1 as it would appear at an intermediate position thereof during the capping operation, the view being taken as indicated by lines **3—3** of FIGURE 1;

FIGURE 3A is a side elevation, to a reduced scale, of a modified form of the machine of FIGURE 1 as it would appear prior to a capping operation;

FIGURE 4 is a further enlarged front sectional elevation taken at lines **4—4** of FIGURE 3;



FIGURE 5 is a fragmentary sectional showing as viewed from lines **5—5** of FIGURE 4;

FIGURE 6 is a view taken at lines **6—6** of FIGURE 4 to show the underside of the heating chamber unit of the machine;

FIGURE 7 is a further enlarged and fragmentary side sectional showing of a typical knife element mounting of the machine as seen, for example, from lines **7—7** of FIGURE 6;

FIGURES 8–10 inclusive are detailed fragmentary showings, to the scale of FIGURE 7, of the knife element mountings of the machine;

FIGURE 11 is a cross-sectional side elevation, to a reduced scale, illustrating a modification of the capping heads of the machine;

FIGURES 12–14 inclusive are sequential showings of a typical capping head at several of its positions with respect to a receptacle during a capping operation, the views being in enlarged cross-sectional and fragmentary side elevation;

FIGURES 15 and 15A are fragmentary side- and cross-sectional elevations, respectively, to a further enlarged scale showing the details of the closure puncturing needle which is incorporated in each capping head of the machine; and

FIGURE 16 is a fragmentary showing in perspective of a receptacle which has been capped by the machine of the present invention.

Referring to FIGURE 1, a shrink-film capping machine in accordance with the invention is generally indicated by reference numeral **20**. A box-like heating chamber unit **21** is mounted by means of a pair of pantograph linkages **22** on a fixed frame **23** so that the individual capping heads **24**, which are mounted within the unit **21**, always face downwardly during movement of the unit as indicated by the arrow A. As illustrated by the drawing, a tray **25** containing perhaps sixteen beverage-filled but uncapped receptacles **26** is moved along the stationary conveyor **27** in the direction of arrow B to a capping station, indicated by the letter S, under the chamber unit **21**; a web **28** of shrink-film material, such as irradiated biaxially oriented polyethylene film, is drawn from the roll **29** thereof across the receptacles to cover all of their open tops; whereupon the operator grasps the handle bar **30** and moves the heating chamber unit **21** downwardly on to the receptacles. He holds the chamber **21** in the downward position covering the receptacles for about three seconds or so, and then relaxes or releases his grasp whereupon the chamber unit **21** will move upwardly in response to gravity pull exerted by a counterweight **31**. By means as will be described, this simple downward movement of the heating chamber unit **21** appropriately severs the web **28** and individually caps all of the receptacles **26** by shrinking the individual film pieces thereover, whereupon the tray **25** of capped receptacles is again moved along the conveyor **27**, in the direction of arrow B, to discharge position beyond the capping station S, as shown.

As shown diagrammatically by FIGURE 2, the shrink-film capping machine **20** may be utilized in a production line arrangement including a tray loading station where the drinking cups are automatically dispensed from a cup dispenser and loaded in the trays, an icing station where a measured quantity of cracked ice is automatically dropped into each cup on the tray, and a beverage filling station where, for example, a carbonated beverage is metered into each cup. The arrow B in FIGURE 2 shows the direction in which the trays are moved through the several stations to the capping station S at the machine **20**, as illustrated in FIGURE 1.

The trays **25** are such that about an inch or so of spacing exists between the mouth rims of adjacent receptables so that, when the overlying web **28** is severed as will be described, the separate shrink-film closure pieces will overlie and project about one-half inch or more outwardly of the periphery of each receptacle mouth rim.

These peripherally projecting portions of the closure pieces will ultimately be shrunk about the mouth rims of the respective receptacles to thus form the completed shrink-film closures.

It is contemplated that any tray **25** will be adapted to receive conventional paper drinking cups in any of various sizes, including 7-, 9-, 10- or 14-oz. capacity, so that such cup sizes may be handled without need for changing of the tray style or size. In this connection, it should be pointed out that an advantage of the capping machine of the present invention resides in its capability to cap a relatively broad range of cup sizes without necessity for changing of its capping heads, or altering the machine in any manner. Moreover, the inclusion of independently slidable capping head plungers makes it possible to simultaneously cap cups having differing heights and arranged in the same tray, if such need were to arise.

Referring now to the details of construction and operation of the capping machine **20**, FIGURE 1 shows that the frame **23** is formed by a pair of vertically disposed side plates **40** which are attached to the respective of the spaced apart base channels **41**, the latter being attached at one of their ends to the conveyor **27** and supported at the other of their ends by respective vertical legs **42** as indicated. A pair of back plates **43** (FIGURES 1 and 3) attached between the side plates **40** complete the basic rigid framework. Of course, the conveyor **27** need only be as long as the width of the machine at the capping station S, if desired, so that the tray guide rails **44** having such length, together with the base channels **41** and pairs of vertical legs **42** and **45** and cross-bracing (not shown) as needed, provide a suitable table structure for the machine. In any event, each of the tray guide rails **44** is provided with preferably two tray stops **46** (only one of which is visible in FIGURE 1) to facilitate positioning of a tray **45** at the capping station S, with the receptacles **26** below the respective capping heads **24**.

As will become apparent, all of the connections and features of the machine are self-contained, and the entire apparatus has relatively light weight so that the same is conveniently transportable to any desired operating location.

One of the back plates **43** is extended laterally as shown in FIGURE 1 to provide a suitable mounting for the machine Off-On switch **47**. Conventional 110 volt, 60 cycle current is fed through the switch **47** and by wiring (not shown) to the air blower **48** mounted atop the heating chamber unit **21** and to the electric heater which is within the chamber **21** as will later be described, the circuit to the heater including a manually adjustable thermostat **49** carried by the chamber unit **21**.

The heating chamber unit **21** is mounted for substantially vertical movement on the frame **23** by the pantograph linkages **22** at the respective sides of the machine. That is, and as most clearly illustrated by FIGURE 3, the pantograph linkages **22** maintain the underside of the chamber in horizontal position throughout the range of its movement to provide a substantially direct downward movement thereof when the capping heads **24** and grid-like pattern of knives **50** engage the shrink-film web **28** and receptacles **26**. This assures clean cutting of the web **28** by the knives **50** in manner as will be described; avoids lateral pressure on the web **28** as might cause distortion in the ultimately formed closures; and assures accurate positioning of each capping head **24** in proper relation with respect to the respective receptacle with which it is associated during the capping operation without danger of striking the mouth rim thereof should the receptacle not be in fully upright position for example.

Each pantograph linkage **22** is formed by one of the side plates **40**; an arm **51** which is pivotally connected to the side plate **40** through a bearing **52**; a stabilizer link **53** also pivotally connected to the side plate **40** by a bearing **54** which is vertically spaced from the bearing **52**; and a vertical support plate **55**, which is attached in fixed relation to the chamber unit **21**, and to which the arm **51** and stabilizer link **53** are also pivotally connected as by the respective bearings **56** and **57**. As measured between the pivot points provided by the bearings **56** and **57**, the support plate **55** has length which is equal to the vertical distance on side plate **40** between the pivot points provided by bearings **52** and **54**. Thus, the support plate **55** and side plate **40** are always maintained in vertical parallel relation throughout the range of pivotal movement in the direction of arrow A of the arm **51** and its parallel stabilizer link **53**.

The range of pivotal movement of the pair of pantograph linkages **22** is determined by upper and lower bumper stops **58** and **59**, respectively, which are attached to each of the side plates **40** as indicated in FIGURES 1 and 3, and which are engaged by the arms **51** at the upper and lower limits of travel of the latter. Each bumper stop **58**, **59** is provided with rubber padding **58***a*, **59***a* (FIGURE 3), respectively, to cushion any shock of impact of the arms **51**. An angular range of movement of about forty-five (45) degrees has been found satisfactory to provide adequate working clearance when a tray of receptacles is placed at the capping station while providing a relatively short reach for the operator in grasping the handle bar **30** which is attached between the end extensions of the arms **51** beyond the chamber unit bearing **56**.

The opposite ends of the respective arms **51** are extended beyond the side plate bearings **52** to receive a counterweight **31** which extends and is attached between the same as indicated in FIGURES 1 and 3. Considering the weight of the chamber unit **21**, blower **48**, etc. acting through the bearing points **56** at a fixed distance from the side plate bearings **52**, the weight of counterweight **31** is such as to promote an easy return of the arms **51** to their upward position against the upper bumper stops **58**. Thus, it will be found that little manual effort is required to move the apparatus up or down. In an alternative embodiment as shown in FIGURE 3A, the counterweight arrangement is eliminated and a coil spring **31***a* of low modulus and attached between each of the side plate bearing points **54** and the bearing points **56** on the respective arms **51** is used to achieve the same effect. However, it was found that less pulling effort is required by a properly selected counterweight, and therefore such embodiment is preferred.

Turning now to a description of the heating chamber **21** itself, reference is made to the front sectional elevation thereof as shown in FIGURE 4, the fragmentary view of FIGURE 5, and the underside view of FIGURE 6. These views show the chamber unit **21** to be formed by a metal outer box structure **70** and a symmetrical but smaller metal inner box structure **71**, the generally uniform spacing between the two at both sides **21***a* and both ends **21***b* and at the top **21***c* being filled with insulation material **72**, such as fiberglass.

The inner box structure **71** is formed by a pair of side plates **73** suitably joined, as by bolt brackets **74**, to the respective end plates **75**. The upper and lower edges of the side and end plates **73**, **75** have outwardly turned flanges **76**. A top plate **77** rests on the surface provided by the upper flanges and is bolted or otherwise suitably attached across the top of the structure, and it will be noted that the bottom of the inner box structure **71** will be closed by the bottom plate **80** of the outer box structure **70**. Bottom plate **80** is not insulated. The outer box structure **70** is similarly formed by a pair of side plates **81**, a pair of end plates **82** (FIGURE 5), and a top plate **83** bolted or otherwise joined together by means (not numbered) so that, together with its bottom plate **80**, a chamber enclosing structure is formed.

The inner box structure **71** further includes a heavier, horizontally disposed divider plate **78** located somewhat

centrally of its height as shown in FIGURE 4, the same being peripherally attached to the side plates **73** and end plates **75** as by bolts **79**. This divider plate **78** divides the heating chamber unit **21** into an upper section **90** and a lower section **91**, the upper section **90** serving as a plenum or temporary air storage chamber within which a volume of air introduced by the air blower **48** is preheated prior to its delivery to the individual capping heads **24** as will be described, the lower section **91** serving as a hot air conductor and distribution chamber for delivering a uniform supply of the heated air to each of the several capping heads. Thus, an otherwise natural concentration and surge of heated air from the centermost area of the preheater section is interrupted, or broken up, so as to assure even distribution of uniform temperature air to all of the capping heads **24**. The preheated air will be delivered from upper section **90** into lower section **91** through the divider plate openings **92**, these openings **92** being disposed in surrounding relation to each of the capping heads **24** as shown in FIGURE 5. In the preferred embodiment, openings **92** are each 5/16" in diameter, eight of the same surrounding each capping head, with the openings **92** at adjacent capping heads being common, as shown.

The relatively heavy divider plate **78** also serves as the base of support of the heating chamber unit **21** in its attachment to the respective support plates **55** of the pantograph likages **22**, as previously mentioned. Referring particularly to FIGURES 4 and 5, it is seen that at each side **21***a* of the chamber unit **21** there is a relatively short length but heavy angle iron bracket **94** which is firmly attached to the divider plate **78** by threaded bolts **95** which are threaded into the latter. Collar-like rubber spacers **96** surround each bolt **95** below the brackets **94** so as to assure clearance between the brackets **94** and divider plate **78** for free flow of heated air through those air openings **92** which are closely adjacent the brackets **94**, and to cushion any impact during operation. The brackets **94** extend through slits **97** and **98** in the respective side plates **73** and **81** of the inner and outer box structures **71**, **70**, support for the box structures being provided at these slit openings, and the brackets **94** are attached as by bolts **99** to the respective pantograph linkage support plates **55**.

In addition, the inner box divider plate **78** supports each of the individual capping heads **24** as will be described, and braces the outer box structure bottom plate **80** by means of five posts **100** (only one of which is shown in FIGURE 5) which span the vertical distance between the plates **78** and **80** at appropriately spaced intervals for the purpose of preventing flexing of bottom plate **80** during operation as might otherwise interfere with the cutting action of the knives **50** for example.

The upper section **90** contains a heating element which, in the preferred embodiment, is an electric heater **101** of the ribbon type. The heater ribbon **102** is spirally wound along and between the pair of insulating rods **103** which span between a pair of heater mount brackets **104**. Each of the brackets **104** is adjacent one of the respective ends **21***b* of the chamber unit, and each is attached, as by bolts **105**, in spaced relation to the inner box structure divider plate **78** by a pair of spacers **106** so that air circulation is not impeded. Thus, the heater **101** is suspended centrally of the upper section **90** and spans the preheat zone of the heating chamber unit **21**. Electrical connection of the heater is made to the Off-On switch **47** (FIGURE 1) by wiring as is only diagrammatically indicated by numeral **107** in FIGURE 4.

The upper section **90** also contains the thermostat bulb **108** of the thermostat **49**. The thermostat bulb **108** is located above the heater **101** and centrally of the area of the upper section **90**, the same being mounted by bulb clamps **109** to a bulb mounting rod **110** which is supported at its ends by brackets **111**. The brackets **111** are shown as being attached to the inner box structure top plate **77**, but it is apparent that they may be attached to the respective top edges of the heater mount brackets **104**, if desired.

At the underside of the heating chamber unit **21**, and attached to the outer box structure bottom plate **80**, is a grid-like pattern of knives **50** as more clearly illustrated by FIGURE 6. During operation, the knives will cut the shrink-film web **28** into separate, square-shaped closure pieces for each receptacle, as previously mentioned and as will be further explained. Because the width of the shrink-film web **28** is properly selected to avoid wastage of the closure material, the illustrated knife pattern omits knife elements along both sides **21***a* of the heating chamber unit. Further, and because it is expected that the machine operator will not pull any appreciable excess web material from the roll **29** during operation, a knife element is omitted from along the front end edge of the unit, as illustrated at the left side of the FIGURE 6 showing. Thus, the pattern of knives **50** is formed by four transversely extending knife elements **50***a*, and three rows of knife elements **50***b* extending between the ends **21***b* of the unit. Of course, the knife element **50***a* which is adjacent the rearward end **21***b* of the machine severs all of the several closure pieces from the web **28** of shrink material which has been manually drawn across the tray of receptacles in the direction of arrow C (FIGURES 1 and 6) as aforementioned.

A typical side elevation of any of the knife elements **50***a* or **50***b* is illustrated by the enlarged showing of FIGURE 7, albeit FIGURE 7 is actually that of a knife element **50***b* as seen from lines **7—7** of FIGURE 6. It is seen that each of the knife elements has an arcuately scalloped cutting edge **50***c*, and that the knife elements are mounted by disc-like knife holders **120** which are threaded into suitable apertures (not numbered) in the bottom plate **80** at the knife element locations of intersection. The knife holders **120** have suitable cross-cut grooves (not numbered) which receive the knife elements as illustrated in plan view in FIGURE 8, set screws **121** being provided in each knife holder for firmly holding the knives. FIGURES 7 and 8 indicate that the transverse knife elements **50***a* extend continuously across the width of the unit, whereas knife elements **50***b* are short sections each extending between the transverse knife rows. As illustrated by FIGURES 9 and 10, the knife holders **120***a* which support the ends of the knife elements **50***a* and the knife elements **50***b* at only one end of the rows thereof, are slightly different from knife holders **120** in that only a single cross-cut knife groove is required, rather than criss-cross knife grooves as in the holders **120**. A third type of knife holder **120***b* (FIGURE 6), having a T-shaped knife holder groove arrangement, is employed at the opposite end of the three rows of knife elements **50***b*, as indicated. The knife holders are of metal so that the knives become heated by conduction through the uninsulated bottom plate **80**.

In an alternative embodiment (not illustrated), the bottom edge of each sealing tube **130** is flared outwardly to appropriate dimension and sharpened so that the bottom edge of the sealing tube itself provides a knife edge for cutting the closure pieces.

Referring now to the construction of the individual capping heads **24**, reference is made to FIGURES 4, 5 and 6 wherein it is shown that each capping head **24** includes an aluminum can-like cylinder or sealing tube **130** having a relatively thick (3/8") aluminum top plate **131** attached, as by peripherally disposed screws (not shown) through the tube **130** adjacent its upper end. The lower end of the tube **130** is open, and the tube has length such that its open lower end projects through an opening **136** (FIGURE 6) in the outer box structure bottom plate **80**, the bottom plate opening **136** closely conforming to the outer diameter of the tube **130**. The lower ends of the tubes **130** project a short distance (about 5/16" in the preferred embodiment), below the bottom plate **80**, and the knife elements of the grid-like pattern of knives **50** are located midway between the adjacent bottom plate open-

ings, the knife elements projecting below the lower edges of the can-like sealing tubes **130**, all as shown in FIGURE 4. In the preferred embodiment, the knives **50** project ½" below the bottom plate **80**.

Each tube **130** is mounted in fixed position, but removably, within the lower section **91** of the heating chamber unit **21** by two diametrically spaced bolts **132** which are each threaded into the underside of the inner box structure divider plate **78**. The bolts **132** have enlarged heads **132***a* and, referring to FIGURE 5, it will be understood that each of the top plates **131** are arcuately slotted on diametrically opposite sides as at **133** for attachment to the pair of bolts **132**. The arcuate slots **133** have width to receive the shanks of the bolts **132**, and each slot **133** has a widened portion **133***a* at one end thereof for clearance of the bolt head **132***a* so that, by passing the widened portions **133***a* over the bolt heads **132***a*, and then pivoting the tube **130** a few degrees of arcuate movement, the tube may be conveniently, but removably attached to the divider plate **78**. A leaf spring **134** is mounted on the top plate **131** of each sealing tube to bias the tube downward when so attached, thereby assuring a firm connection. Removal of any sealing tube is effected by pivoting the tube in opposite direction until the widened portions **133***a* of the slots **133** are aligned with the bolt heads **132***a* thus disengaging bolts **132** from the slots **133**, and then permitting the tube **130** to drop past the bolts **132**.

Towards its lower end, but located within the lower section **91** of the heating chamber unit, each sealing tube **130** has a large number of relatively small, circumferentially disposed hot air distribution apertures **135** as shown in the figures of the drawings. In the preferred embodiment, twenty-four No. 25 drill (.149" dia.) holes are evenly spaced about the tube circumference at a location $1\frac{9}{32}$" from the bottom end. The tubes **130** project about half that distance, or about $\frac{5}{16}$" below the bottom plate **80** as aforesaid, and therefore the apertures **135** are situated about the same distance above the bottom plate **80** within the lower section **91**.

As shown in FIGURE 4, a plunger shaft **140** is attached, as by a nut **141**, to the top plate **131** of each capping head **24** so as to extend downwardly on the central longitudinal axis of the sealing tube **130**. It will be noted that the nut **141**, which is threaded on to a threaded end of the plunger shaft **140** which projects through the top plate **131**, also attaches the leaf spring **134** to the top of the top plate **131**, as previously mentioned. Apertures **142** are drilled through the divider plate **78** for clearance of nuts **141**, as shown. At the lower end of the plunger shaft **140** a plunger needle **143**, is attached, as by a set screw **144** (FIGURE 15), the point of the needle being at about the elevation of the tube apertures **135**.

The plunger needle **143** is shown in detail in FIGURES 15 and 15A. For sanitary reasons, the needle is of stainless steel. From FIGURE 15A, it is seen that the needle **143** is made from a thin strip of the metal, the strip being bent longitudinally midway of its width to form a right-angled section. The point end of the needle is chamfered and ground to a sharp point and sharp edges at both sides, the latter being indicated at **143***a* in FIGURE 15. Thus, as illustrated in FIGURE 16, the needle will form a V-shaped flap **160** in the center of the finished receptacle closure **28***a* as the chamber unit **21** is lowered thereover during the capping operation as illustrated, and as will be described in connection with FIGURES 12–14.

However, it should be noted that the provision of the plunger needle **143** is optional, the flap **160** only being required to permit escape of gases when receptacles containing either carbonated or hot beverages are capped. Moreover, it should be noted that the particular angled shape of the flap **160** permits escape of gases from the capped receptacle, but exhibits the phenomenon of not permitting the contained liquid to escape, even though the filled and capped receptacle is inverted.

Mounted for freely slidable movement on each of the vertically disposed plunger shafts **140** is a metal, disc-shaped plunger plate **145** carried by a tubular plunger stop **146**, the latter being sleeved around and slidable on the plunger shaft **140**. The slidable mounting of the plunger stop **145** on the plunger shaft **140** is effected by a laterally projecting roll pin **147** which is attached to the plunger shaft and which engages a longitudinally extending slot **148** of the tubular plunger stop **146**. In the preferred embodiment, the length of the slot **148**, and therefore the permissible distance of slidable movement of the plunger plate **145**, is 2". A rubber plunger disc **149**, of soft density neoprene sponge rubber, is cemented to the underside of each plunger plate **145** as shown, and both the plunger plate **145** and plunger disc **149** are centrally apertured, as at **150**, for passage of the plunger needle **143** and plunger shaft **140** therethrough. In the preferred embodiment, the arrangement is such that the underside of the plunger disc **149** will normally project about ⅞" below the lower end of the sealing tube **130** with which it is associated. As illustrated in FIGURE 6, the diameter of the plate **145** and plunger disc **149** is about ⅛" less than the inside diameter of the sealing tube **130**, the latter being about 3¾" in the preferred embodiment. Thus, due to the weight of the plunger plate, plunger stop, and plunger disc, the plunger will normally fall by gravity to its projecting position (see FIGURE 12) between capping operations, and will exert gravity pressure to momentarily clamp the shrink-film web **28** against the mouth rim of a receptacle **26** (see FIGURE 13) during capping operations.

Referring to FIGURE 11, it is seen that in an alternative embodiment a coil spring **151** of low modulus may be sleeved around the plunger shaft **140** and plunger stop **146**, extending between plunger disc **145** and the capping head top plate **131**, to increase the clamping pressure, if desired.

Referring now to FIGURES 1, 3 and 4, the air blower **48** is mounted atop and centrally of the heating chamber unit **21**, its discharge being into the upper preheating section **90** through the blower aperture **170** which passes through the outer box structure top plate **83**, the insulation **72**, and the inner box structure top plate **77** as shown in FIGURE 4. At maximum intake opening, the blower **48** delivers about 55 c.f.m. Suitable blower mounting and support means **171** are provided. The side air intake opening (not numbered) of the blower **48** is covered by a butterfly valve **172** which is hingedly connected to the blower by a vertical hinge **173** at the rearward side of the valve **172** and intake opening. The hinge **173** includes a spring (not numbered) which biases the valve **172** to its position closing the blower intake opening. Extending between the opposite, forwardly facing side of the butterfly valve **172** and a stanchion **174** (FIGURES 1 and 3) of the fixed frame **23** is a chain **175**, its length being such that the valve **172** remains closed when the heating chamber unit **21** is in its uppermost position as shown in FIGURE 1 and opens as indicated in FIGURES 3 and 4 as the chamber unit **21** is moved downwardly, in the direction of arrow A, during a capping operation. The blower motor is indicated by reference numeral **176**, the same being electrically connected to the Off-On switch **47** through suitable wiring as diagrammatically indicated by numeral **177** (FIGURE 4). Thus, the blower motor **176** is in operation at all times after the machine **20** has been started, as is the air heater **101** and thermostat **49**.

Because the butterfly valve **172** is in closed position covering the blower intake, air will not be blown into the chamber unit preheat section **90** (excepting as will be described) while the chamber unit **21** is in its upper position as shown in FIGURE 1. However, the butterfly valve **172** is centrally apertured, as at **178**, to permit a small amount of intake air to the blower **48** for the purpose of permitting a limited amount of air circulation at all times within chamber unit **21** for maintaining uniform temperature therein. A flap **179** is pivotally attached

across the aperture **178**, as indicated in FIGURES 3 and 4, to permit adjustment of the amount of intake air to the blower when the butterfly valve **172** is closed, closing of the flap **179** being suggested during cold weather to reduce heat loss.

Referring now to FIGURES 1 and 3, a pair of roller brackets **180** are attached, respectively, to side plates **40** of the fixed frame **23** at an elevation about that of the underside of the heating chamber unit **21** when in its lowered position, these brackets **180** mounting rollers as will be described to provide a centerless mounting for the roll **29** of shrink-film material. As indicated by dotted lines in FIGURE 3, the web **28** of shrink-film material will therefore always feed from the same elevation and angle as the roll **29** is expended. The roll **29** of material sits between a rearward located rubber-coated fixed roll **181** and a freely rotatable roller **182** which is spaced forwardly of the roll **181**. Being incapable of rotation, the rearward fixed roll **181** provides the necessary drag on the roll **29**. Spaced forwardly of the roller **182** is another freely rotatable pick-up roller **183**. A rod **184**, which is pivotally mounted at its bent end extensions as indicated, holds the film web **28** in engagement with the pick-up roller **183** to prevent the web **28** from dropping behind the roller **183**, as might otherwise occur in response to a breeze of air or the like.

The roll **29** of shrink-film is placed on the drag roll **181** and roller **182** so that the web **28** unwinds from the bottom of the roll **29** and over the tops of the rollers **181**, **182** and **183**. The web **28** is pulled forward to its "pick-up position" whereat its end edge hangs over the pick-up roller **183**, and the rod **184** is brought to rest against the upper surface of the web **28**. The machine **20** is now loaded with shrink-film material and, when plugged into a suitable electrical source, is ready to operate.

The "On" button of the Off-On switch **47** is pushed, whereupon the air blower **48** will start and the heater **101** will begin to heat the air within the preheat section **90** of the chamber unit **21**. The thermostat **49** is manually adjusted so that the heater **101** holds the air temperature within the preheat section at about 350 degrees F. The heating chamber unit **21** is in its uppermost position as shown in FIGURE 1 by reason of the action of the counterweight **31** as previously described. Because of the small aperture **178** at the blower intake, a limited amount of air circulation is permitted within the chamber unit **21** and, thus, after about twenty-five minutes of warm-up time, the entire inner box structure **71** will become heated, including the capping heads **24** which are mounted therein. However, it will be noted that because they depend, or project below the underside of the heating chamber unit **21**, the capping head plunger discs **149** will not be heated even though a small amount of heated air is being emitted from the unit through the capping head sealing tube apertures **135**.

Referring to FIGURE 1, the tray **25** is loaded with beverage-filled receptacles **26** and moved into the capping station S. The machine operator then draws the shrink-film web forward until it overlies all of the receptacles **26**, and overlaps the front row thereof about one-half inch or so, as indicated in FIGURES 1 and 3. The operator then grasps the handle bar **30** and pulls the chamber head unit **21** downwardly until the pantograph arms **51** rest against the lower bumper stop **59**, this being the lowered position of the chamber unit. He holds the chamber unit **21** in this position for about three seconds, whereupon he releases his grasp, or otherwise eases the chamber unit **21** to its upper position whereat the pantograph arms **51** are against the upper bumper stops **58**. By this simple operation, all of the receptacles will be simultaneously and individually capped with shrink-film closures **28***a* in the manner illustrated in FIGURE 16.

Referring to the operational sequence as illustrated by FIGURES 12–14, it will be understood that as the heating chamber unit **21** is moved downwardly, the capping head plunger discs initially contact the shrink-film web **28** to clamp the same against the mouth rims **26***a* of the receptacles **26** as illustrated by FIGURE 12. Continued downward movement of the chamber unit **21** brings the grid-like pattern of knives **50** into contact with the web **28** to cut the now tensioned web span between each of the individual receptacles, and to form the individual closure pieces **28***a*, as illustrated by FIGURE 13. Further continued downward movement of the chamber unit **21** initially brings the downwardly projecting bottom ends **130***a* (FIGURE 4) into contact with the peripherally extending and laterally projecting oversized portions of the individual closure pieces **28***a* to initiate a downward bending or turning thereof, and thereafter brings the several sealing tubes **130** into surrounding relation with their associated plunger discs **149** and the mouth rims **26***a* of the receptacles **26** as shown by FIGURE 14, this condition being maintained for a few seconds as aforesaid. As the unit is brought to this position, the plunger needle **143** punctures the closure piece **28***a* as aforesaid.

In this last position of the sealing tubes **130** with respect to the plunger discs **149** and receptacles mouth rims **26***a*, the force of the heated air, which is being blown into the tubes **130** through the tube apertures **135**, impinges upon the oversized portion of the shrink-film (which surrounds the respective receptacle mouth rims) to shrink the same to form the completed closure **28***a*. It will be noted that the sealing tubes **130** are positioned such that the air blown through apertures **135** is directed immediately below the beaded lip **26***b* of each receptacle **26**, and that the peripherally extending oversized portion of the shrink-film material will shrink against the receptacles below the beaded lip **26***b*. Thus, the beaded lip **26***b*, which normally is in contact with the mouth while drinking, is protected for sanitary purposes. It will further be noted that, due to the insulating characteristic of the rubber plunger discs **149**, the central area of the shrink-film, which spans the mouth area of the receptacle **26**, remains unheated and therefore will not shrink. Moreover, it will be found that the shrunken corner portions of the square closure pieces **28***a* leave tabs **28***b* (FIGURE 16) of the closure to facilitate its removal using the fingers.

As the chamber unit **21** is moved upwardly after the capping operation is completed, the plunger discs **149** will initially remain in gravity contact with the closures **28***a* until the sealing tubes **130** have moved out of their surrounding relation with the receptacles. Thus, heated air being emitted through sealing tube apertures **135** will not impinge upon the unshrunken central areas of the closures, as otherwise might partially shrink and distort the same.

The tray **25**, now containing the capped receptacles, is then moved away from the capping station S.

Thus has been described a shrink-film capping machine which achieves all of the objects of the invention.

What is claimed is:

**1**. Apparatus for simultaneously applying individual shrink-film type closures from a common web of shrink-film material to the respective mouth rims of a plurality of open-ended receptacles, said apparatus comprising an air-heating chamber unit carrying a plurality of capping heads for applying said closures to the respective receptacles, and means between adjacent capping heads for severing said common web of shrink-film material to form individual oversized closure pieces respectively disposed on the mouth rims of said plurality of receptacles, each said capping head comprising a sealing tube having an open end for surrounding the mouth rim of one of said receptacles, and plunger means including a transversely disposed disc for engaging and holding shrink-film material against said receptacle mouth rim, said disc being smaller than said open end of the sealing tube, and said plunger means being mounted for longitudinal movement centrally of said sealing tube from a first posi-

tion of said disc wherein the disc projects a distance outwardly of said open said to a second position of said disc wherein the disc is within said sealing tube near said open end, said disc being normally disposed in its said first position and being movable from its said first position to its said second position responsive to its said engagement with said receptacle mouth rim, each said sealing tube having peripherally disposed aperture means for introducing air from said chamber unit to the interior of said sealing tube at a location between its said open end and said second position of said disc.

2. Apparatus according to claim 1 wherein said plunger means includes a longitudinally disposed plunger shaft mounted in substantially fixed position within said sealing tube, said disc being mounted for slidable movement on said plunger shaft, and said plunger shaft having an attached plunger needle, said needle having a pointed end disposed at a location between said second position of said disc and said open end of said sealing tube, said disc being apertured to permit projection of said needle therethrough.

3. Apparatus for simultaneously applying individual shrink-film type closures to the respective mouth rims of a plurality of open-topped receptacles, said apparatus comprising a substantially enclosed chamber unit including a bottom wall and having divider means dividing the interior thereof into an air preheat chamber section and an air distribution section, said divider means having means for the passage of air therethrough, a plurality of sealing tubes for applying said closures to the respective receptacles, said sealing tubes being mounted within said distribution section in spaced apart relation to provide air distribution passages therebetween and each having an inner closed end and an opposite open end opening through said bottom wall of the chamber unit, and each said sealing tube further being apertured about its periphery at a location along its length for communication with said air distribution section of the chamber, heater means disposed within said air preheat chamber section, said air preheat chamber section having volume capacity for containing a substantial quantity of air, and air blower means for intermittently blowing air into said air preheat chamber section whereby its said contained quantity of air is purged through said divider means, said distribution section, and said sealing tube apertures, and into all of said sealing tubes.

4. Apparatus according to claim 3 wherein said air blower means comprises a blower having an air discharge opening and an air intake opening, a butterfly valve normally closing said air intake opening, means providing continuous operation of said blower, and means for intermittently opening and closing said butterfly valve.

5. Apparatus according to claim 4 wherein said butterfly valve includes means providing an opening for passage of a limited, continuous supply of air to said blower air intake opening.

6. Apparatus for simultaneously applying individual shrink-film type closures to the respective mouth rims of a plurality of open-topped receptacles, said apparatus comprising a substantially enclosed air-heating chamber unit, divider means including air passage means therethrough and dividing the interior of said chamber unit into an upper section and a lower section, said upper section having volume capacity for containing a substantial quantity of air, heater means mounted within said upper section for heating said contained quantity of air, a plurality of capping heads for applying said closures to the respective receptacles, said capping heads being mounted within said lower section in spaced apart relation to provide air distribution passages therebetween and each said capping head comprising a vertically disposed sealing tube having a closed top end and an open bottom end opening to the underside of said chamber unit for surrounding the mouth rim of one of said receptacles, and plunger means including a horizontally disposed portion for holding shrink-film material against said receptacle mouth rim, said portion having peripheral size which is smaller than said open end of the sealing tube, and said plunger means being mounted for vertical movement centrally of said sealing tube from a lower position of said plunger portion wherein it projects a distance below said open end to an upper position of said plunger portion wherein it is within said sealing tube near said open end, each said sealing tube having peripherally disposed aperture means at a location between said sealing tube open end and said upper position of said plunger portion, air blower means mounted on said chamber unit, and means providing discharge from said blower of a substantial volume of air into said upper section for purging said contained quantity of air through said divider means, said lower section, and said sealing tube apertures and into all of said sealing tubes.

7. Apparatus according to claim 6 wherein said divider means comprises a divider plate in parallel spaced relation with respect to said chamber unit bottom wall, and each said capping head is removably attached at its said top end to said divider plate.

8. Apparatus for simultaneously applying individual shrink-film type closures to the respective mouth rims of a plurality of open-topped receptacles arranged in a pattern of substantially equally spaced apart aligned rows and columns, said apparatus comprising a heated air chamber unit having a bottom wall, means mounting said chamber unit for substantially vertical movement between an up position spaced away from said receptacles and a down position engaging said receptacles, said chamber unit carrying a plurality of capping heads arranged in a corresponding pattern of equally spaced apart rows and columns for applying said closures to the respective receptacles, each said capping head comprising a sealing tube having an open bottom end opening through said chamber unit bottom wall for surrounding the mouth rim of one of said receptacles, and knife means projecting below said chamber unit bottom wall for severing a unitary web of shrink-film material disposed across the mouth rims of all of said receptacles when said chamber unit is moved to its said down position, said knife means being arranged to sever said web at locations midway of the spacings between said receptacles to form oversized individual shrink-film closure pieces covering the respective open tops of said receptacles, each said capping head further comprising means for clamping one of said shrink-film closure pieces against the mouth rim of said one receptacle with which the said capping head sealing tube is associated, and means for blowing heated air from said chamber unit simultaneously into all of said sealing tubes to shrink the oversized portions of said closure pieces into engagement with said receptacles.

9. Apparatus according to claim 8 wherein said knife means comprises a grid-like pattern of knife elements attached to said chamber unit bottom wall, said knife elements extending midway along and within all of the respective spacings between said capping head sealing tubes.

10. Apparatus according to claim 9 wherein each of said knife elements has an arcuately scalloped cutting edge.

11. Apparatus for simultaneously applying individual shrink-film type closures to the respective mouth rims of a plurality of open-topped receptacles arranged in spaced apart relation, said apparatus comprising a unit including a bottom wall, means mounting said unit for movement between an up position spaced away from said receptacles and a down position engaging said receptacles, said unit carrying a plurality of vertically disposed sealing tubes arranged in corresponding spaced apart relation for applying said closures to the respective receptacles, each said sealing tube having an open bottom end opening through said chamber unit bottom wall for surrounding the mouth rim of one of said receptacles,

and a knife element attached to and projecting below said unit bottom wall at a location midway between each said sealing tube for severing a unitary web of shrink-film material disposed across the mouth rims of all of said receptacles when said unit is moved to its down position to form oversized individual shrink-film closure pieces covering the respective open tops of the receptacles, and means for heating the oversized portion of each said closure piece to shrink the same into shrink-fit engagement with its associated receptacle.

**12.** Apparatus according to claim **11** wherein said unit includes means for heating its said bottom wall, and means attaching each said knife element to said bottom wall whereby the knife element is heated by conduction.

**13.** Apparatus for simultaneously applying individual shrink-film type closures to the respective mouth rims of a plurality of open-topped receptacles, said apparatus comprising a frame, a heated air chamber unit carrying a plurality of downwardly facing capping heads for applying said closures to the respective receptacles, pantograph linkage means mounting said chamber unit for substantially vertical movement on said frame between an up position spaced away from said receptacles and a down position wherein said capping heads engage said receptacles, and blower means for blowing heated air from said chamber unit into all of said capping heads when said chamber unit is in its said down position, said pantograph linkage means comprising a pair of parallel and vertically spaced apart arms, each arm being pivotally attached to said frame at respective frame pivot points, and said chamber unit being pivotally attached to each said arm at respective pivot points which are spaced an equal distance from the respective of said frame pivot points.

**14.** Apparatus according to claim **13** wherein said pantograph linkage means further includes bias means for pivoting the same to normally bias said chamber unit in its said up position.

**15.** Apparatus according to claim **14** wherein said bias means comprises a counterweight attached to at least one of said pantograph linkage arms.

**16.** Apparatus according to claim **13** wherein said frame includes a pair of parallel and spaced apart rollers for centerless mounting of a roll of shrink-film material, said rollers being disposed horizontally for feeding the shrink-film material under said chamber unit.

**17.** Apparatus according to claim **16** wherein said rollers extend transversely of the plane of movement of said arms of the pantograph linkage means.

**18.** The method of simultaneously applying an individual shrink-film type closure to the open top end of each of a plurality of receptacles comprising the steps of arranging said plurality of open-topped receptacles in substantially equally spaced apart grouped relation, placing a unitary and common web of shrink-film material on all of said receptacles to cover their open top ends, said common web being oversized with relation to all of said receptacles to provide a laterally projecting oversized portion thereof extending peripherally about all of said grouped receptacles and having width substantially equal to one-half the distance of said equal spacing between each of said receptacles, and thereafter in substantially immediate sequence first applying downward pressure on the upper surface of said web at the location of each receptacle to firmly hold the web against said open top ends of all of the receptacles, then completely severing said web along lines of cut extending midway of said spacings between all of said receptacles to provide an individual closure piece having a peripherally extending and laterally projecting oversized portion atop each of the same, pushing downwardly on the peripheral edges of said oversized portion of each of said individual closure pieces to initiate a downward turning thereof, blowing heated air in radially inward direction about the respective peripheries of all of said receptacles at respective locations immediately below said open top ends thereof to shrink said oversized portions of the closure pieces into surrounding shrink fit relation with the respective receptacles, continuing said blowing of heated air for only about three seconds and then terminating said blowing of heated air, and thereafter releasing said downward pressure.

**19.** The method of simultaneously applying an individual shrink-film type closure to the end of each of a plurality of receptacles comprising the steps of arranging said plurality of receptacles in substantially equally spaced apart grouped relation, disposing a unitary and common web of shrink-film material over all of said receptacles to cover their said ends, said common web being oversized with relation to all of said receptacles to provide a laterally projecting oversized portion thereof extending peripherally about all of said grouped receptacles, the width of said oversized portion along each of at least three sides of the receptacle group being substantially equal to one-half the distance of said equal spacing between each of said receptacles, and thereafter in substantially immediate sequence first holding said web at the location of each receptacle against said ends of all of the receptacles, then cutting said web along lines of cut extending substantially midway of said spacings between all of said receptacles while maintaining said holding of the web material against said receptacle ends to provide an individual fully severed closure piece having peripherally extending and laterally projecting oversized portions on each of said receptacle ends, and thereafter applying heat to said oversized portions of all of said closure pieces to shrink the same into surrounding shrink fit relation with the respective receptacles while holding said closure pieces against the respective of said receptacle ends.

**20.** In apparatus for applying a shrink-film type closure from a substantially continuous length of shrink-film material to the mouth rim of a receptacle, the improvement comprising a capping head for heat-shrinking a portion of said shrink-film material which is oversized with respect to said receptacle mouth rim into capped relation on the mouth of said receptacle, said capping head having an open end, plunger means associated with said open end of the capping head, said plunger means comprising a clamper portion in alignment with said open end and having peripheral size and shape conforming to that of said receptacle mouth rim for engaging and holding said portion of shrink-film material against the latter, said capping head open end having size and shape corresponding to said peripheral size and shape of said plunger means clamper portion for slidably receiving the latter therethrough, means mounting said clamper portion for slidable movement between first and second positions thereof, with respect to said capping head open end, said first position being outside of said open end and said second position being within said capping head, said clamper portion being normally biased to its said first position, and said mounting means providing said movement of the clamper portion from its said first position and against its said bias to its said second position responsive to said engagement of the clamper portion with said receptacle mouth rim, means for supporting said continuous length of shrink-film material whereby said portion thereof may be fed to a position aligned with, but outside of said capping head and adjacent its said associated plunger means, and means on said capping head for severing said film portion, when so positioned, from said continuous length thereof during said movement of said plunger means from its said first position to its said second position.

**21.** The method according to claim **19** wherein said step of disposing said unitary and common web of shrink-film material over all of said receptacles comprises moving the leading edge of a web supply of said material over said receptacles from the fourth side of said re-

ceptacle group to the opposite side thereof, said web supply of the material feeding to said fourth side of said receptacle group, and said cutting step further comprises cutting said unitary and common web of said material from said web supply thereof.

22. The method of applying a shrink-film type closure from a substantially continuous web supply of shrink-film material to the open end of a receptacle comprising the steps of moving the leading edge of said substantially continuous web supply of shrink-film material across said receptacle open end from one side of the latter to a position beyond the opposite side thereof to provide a substantially outward projecting area of said material at said opposite side, said web supply being spaced away from said one side of the receptacle open end to provide a substantial area of material extending between said web supply and said one side of the receptacle open end, and the width of said web supply being substantially greater than said receptacle open end to provide substantially outward projecting areas of said material at the respective other sides of said receptacle open end when said leading edge of the material is in said position, and thereafter in substantially immediate sequence first clamping said material against said receptacle open end using clamper means acting directly against said mouth rim of the receptacle and whereby said outward projecting areas of said material remain free of applied clamping pressure, then cutting an oversized closure-forming blank from said material while so positioned and clamped, said closure-forming blank being then completely severed from said web supply of material and having a substantially outward projecting oversized peripheral portion extending about said receptacle open end, and thereafter applying heat at substantially all locations along said peripheral portion to shrink the same into shrink-fit closure relation with said receptacle open end while maintaining said clamping of the closure blank against said receptacle open end.

23. The method according to claim 21 wherein said cutting step comprises cutting said material from said web supply along a line of cut which is substantially parallel to said leading edge when so positioned and which is spaced outwardly from said one side of the receptacle open end a distance which is substantially equal to the extent of project of said outwardly projecting area at any of the other sides of said receptacle open end.

24. The method according to claim 21 wherein, during said substantially immediate sequence of steps, said shrink-film material is pierced within the area overlying said receptacle open end.

25. In apparatus for applying shrink-film type enclosure to the mouth rim of a receptacle, the improvement comprising means defining a capping head opening for receiving said receptacle mouth rim from one side of the opening, film clamper means for engaging and holding shrink-film material against said receptacle mouth rim, said film clamper means having needle means for piercing said shrink-film material within the area thereof spanning said receptacle mouth rim, and said film clamper means being normally biased into a first position thereof at said one side of said opening and being movable through said opening responsive to engagement with said receptacle mouth rim and against its said bias to a second position thereof spaced away from the opposite side of said opening, and means for applying heat substantially adjacent the periphery of said opening within the spacing therefrom as determined by said second position of the film clamper means.

26. The improvement according to claim 25 wherein said film clamper means comprises apertured disc means movable between said first and second positions, said needle means being substantially concealed within the aperture of said disc means when in its said first position, and means providing projection of said needle means outwardly from said aperture when said disc means is in its said second position.

27. The improvement according to claim 25 wherein said needle means comprises an elongated needle body of angular cross-section and having a pointed end.

28. The improvement according to claim 25 wherein said film clamper means is biased by its weight into its said first position.

29. The improvement according to claim 25 wherein said film clamper means is spring biased into its said first position.

30. Apparatus for simultaneously applying shrink-film type closures to the respective mouth rims of a plurality of receptacles comprising means for positioning said receptacles in upright and spaced apart relation with respect to each other, and a capping head unit including bottom wall means spaced above said receptacle positioning means, means defining a plurality of spaced apart receptacle openings in said bottom wall means for receiving the respective mouth rims of said plurality of receptacles, plunger means comprising a clamper portion in alignment with each of the respective of said receptacle openings for holding shrink-film material against the mouth rim of the receptacle with which the receptacle opening is to be associated, each said clamper portion being movable through its associated receptacle opening between first and second positions of said clamper portion with respect to said bottom wall means, said first position being below said bottom wall means and said second position being above said bottom wall means, each said clamper portion being normally disposed in its said first position, film severing means below said bottom wall means but above said first position of said clamper portions and arranged within the spacing between the respective of said receptacle openings for severing a common web of shrink-film material into individual and oversized receptacle closure blanks, movement means for bringing said clamper portions and said receptacles into engagement when the latter are so positioned on said positioning means and for thereby urging said clamper portions to their said second positions, and means for applying heat adjacent the respective peripheries of said receptacle openings whereby, when said clamper portions are in their said second positions and engaging the respective of said receptacles with said closure blanks respectively therebetween, said closure blanks shrink into shrink-fit closure relation with the respective of said receptacle mouth rims.

31. Apparatus according to claim 30, wherein each said clamper portion is movable independently of any other of said clamper portions.

32. Apparatus according to claim 30, wherein said movement means comprises pantograph linkage means mounting said capping head unit for movement between an up position spaced away from said receptacle positioning means and a down position wherein said clamper portions so engage said receptacles when the latter are so positioned on said positioning means, bias means normally biasing said capping head unit in its said up position, and handle means for moving said capping head unit to its said down position against the bias of said bias means.

33. Apparatus according to claim 30 wherein said capping head unit comprises an air heating chamber, divider means including air passage means therethrough and dividing the interior of said chamber unit into an air preheat section and an air distribution section, said air distribution section including said bottom wall means, heater means within said air preheat section, and blower means for purging air contained in said air preheat section through said divider means and said air distribution section to said receptacle openings in said bottom wall means.

34. Apparatus according to claim 33, wherein said movement means comprises means mounting said capping head unit for movement between an up position spaced away from said receptacle positioning means and a down

position wherein said clamper portion so engage said receptacles when the latter are so positioned on said positioning means, said mounting means being connected to said divider means.

**35.** Apparatus according to claim **9**, wherein said open end of each sealing tube projects a distance below said bottom wall of the chamber unit, said distance of projection of said sealing tube bottom ends being less than said distance of projection of said knife elements.

**36.** Apparatus according to claim **13** wherein said blower means comprises an air blower mounted on said chamber unit, said blower having an air discharge opening attached to said chamber unit and an air intake opening, a spring biased butterfly valve normally closing said air intake opening when said chamber unit is in its said up position, means providing continuous operation of said blower, and chain connection means between said butterfly valve and said frame whereby said butterfly valve is moved against its said spring bias to open said air intake opening when said chamber unit is moved to its said down position.




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# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,354,604 November 28, 1967

Stephen W. Amberg et al.

**It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.**

Column 2, line 9, for "withiout" read -- without --; column 3, line 43, after "fall" insert -- by --; column 6, line 49, after "chamber" insert -- unit --; column 11, line 59, after "web" insert -- 28 --; column 12, line 22, for "receptacles" read -- receptacle --; line 29, for "blown" read -- blow --; column 13, line 2, for "said", second occurrence, read -- end --; column 17, lines 39 and 48, for the claim reference numeral "21", each occurrence, read -- 22 --; same column 17, line 45, for "project" read -- projection --; column 20, list of References Cited, under "UNITED STATES PATENTS" insert the following references:

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| 2,920,431 | 1/1960 | Izumi | 53-141 |
| 2,976,655 | 3/1961 | Dreyfus et al. | 53-42 |
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| 3,120,728 | 2/1964 | Snow, Jr. et al. | 53-42 |

same column 20, list of References Cited, under "FOREIGN PATENTS" insert the following references:

| | | |
|---|---|---|
| 827,246 | 2/1960 | Great Britain |
| 922,338 | 3/1963 | Great Britain |

Signed and sealed this 24th day of December 1968.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
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