United States Patent [19]

Muto

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[45] **Jan. 21, 1975**

[54] **METHOD AND EQUIPMENT FOR SEALING THE CAP OF BOTTLES**

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[52] **U.S. Cl.** **53/167,** 53/129, 53/292, 53/329

[51] **Int. Cl.** **B67b 5/02,** B67b 5/00

[58] **Field of Search** 53/291, 292, 295, 129, 53/167, 184, 329

[56] **References Cited**

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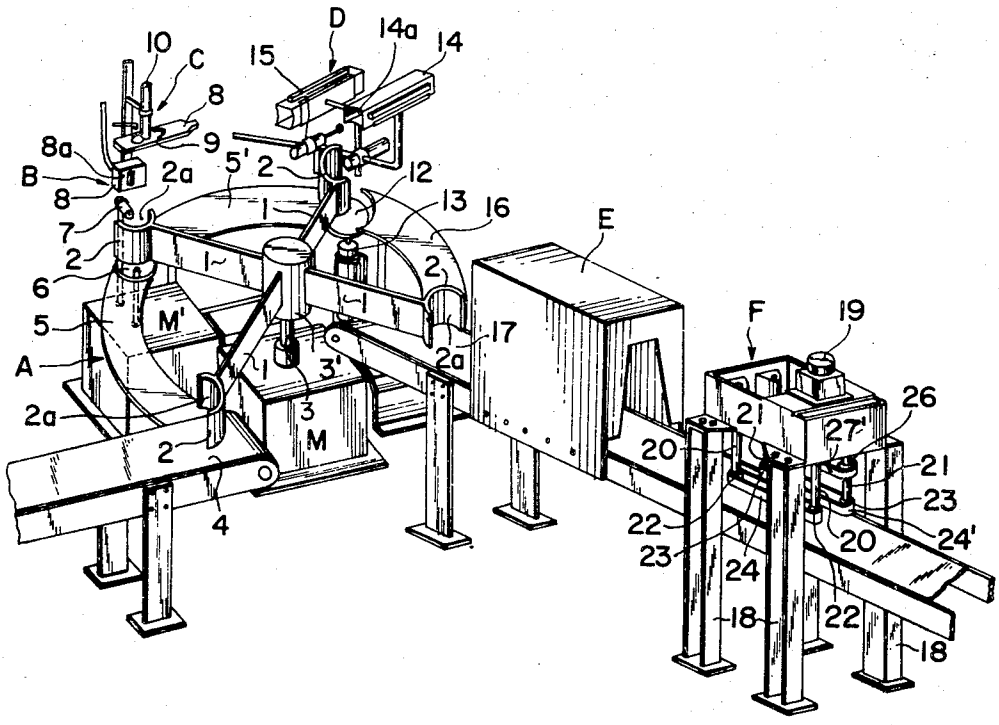
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Primary Examiner—Travis S. McGehee
Assistant Examiner—Horace M. Culver
Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

A method and apparatus for cap-sealing the necks of bottles. Bottles are supplied intermittently one by one to a bottle receiver at the end of an arm bar, and the arm bar is intermittently turned through a certain angle to carry the bottle in the bottle receiver onto a turntable positioned in the path of the turning bottle receiver. A bonding agent is uniformly applied to the circumference of the neck of the turning bottle by a bonding agent applying mechanism located above the turntable, the operation of said bonding agent applying mechanism being synchronous with the operation of a top plate feeding mechanism that automatically feeds a dust-excluding top plate onto the top of the neck of the bottle. The bottle is carried to a cap-sealing material feeding mechanism by a next intermittent motion of the arm bar. A suction opening mechanism which operates synchronously with the operation of the cap-sealing material feeding mechanism removes from a material housing a flat tubular cap-sealing material made of heat-contracting synthetic resin, and opens it to an almost cylindrical shape as it is taken out of the housing, and it puts the cylindrically opened tubular material onto the neck of the bottle. The bottle is placed, by the next intermittent motion of said arm bar, onto a conveyor running through a heating furnace in which said tubular material is thermally contracted. A twisting mechanism tightly adheres the bonding-agent-containing part of the cap-sealing material under pressure and by a twisting motion.

3 Claims, 16 Drawing Figures



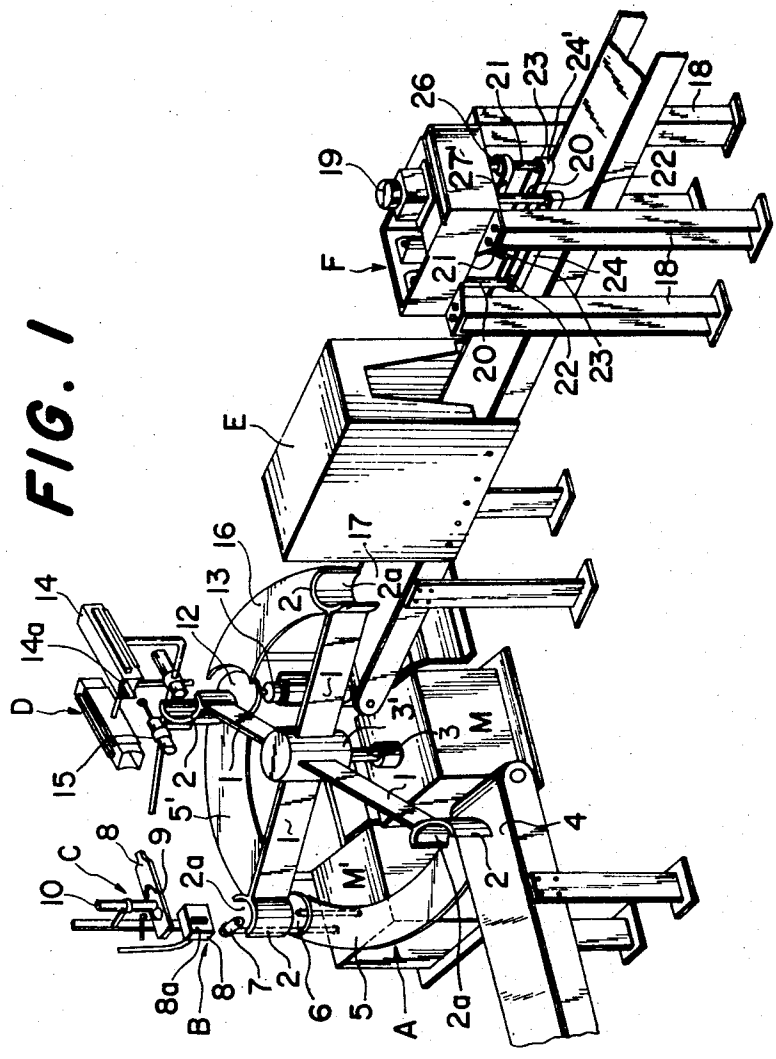

A
B
C
D
E
F
M
M'
1
2
2a
3
3'
4
5
5'
6
7
8
8a
9
10
12
13
14
14a
15
16
17
18
19
20
21
22
23
24
24'
26
27

FIG. 1

FIG. 2

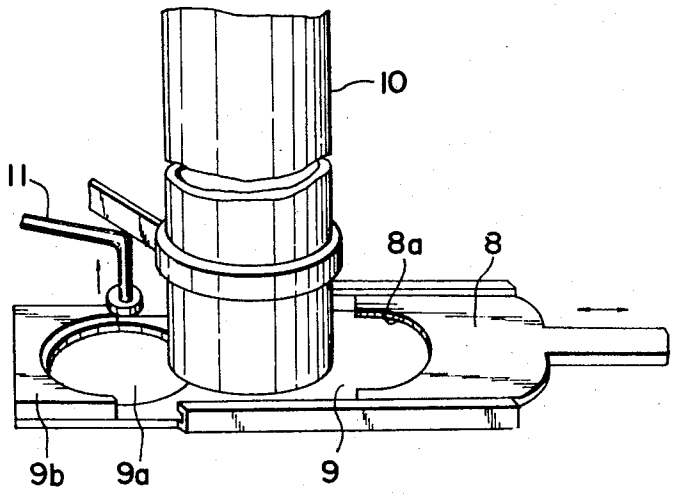

10
11
8a
8
9b
9a
9

FIG. 3

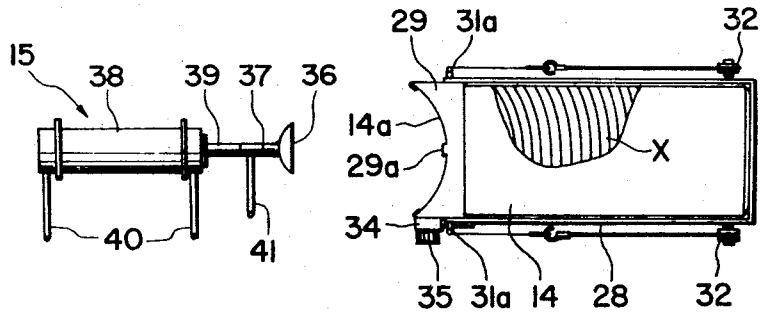

15
38
39
37
36
40
41
29
31a
32
14a
29a
X
34
35
31a
14
28
32

FIG. 4

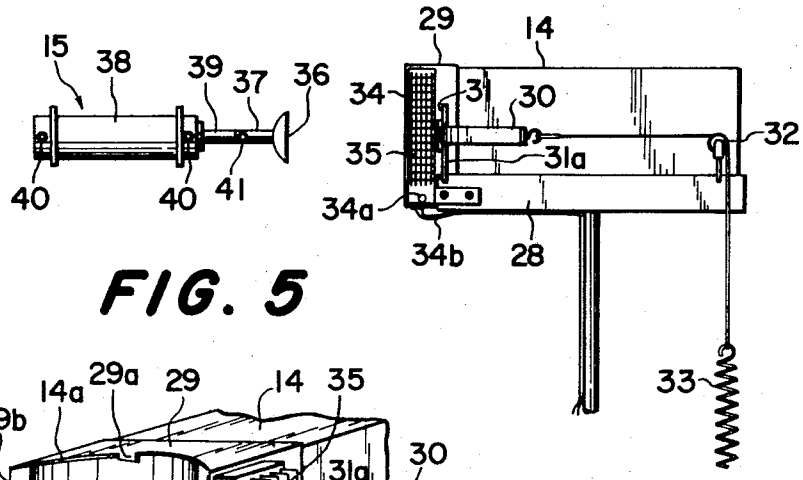


FIG. 5

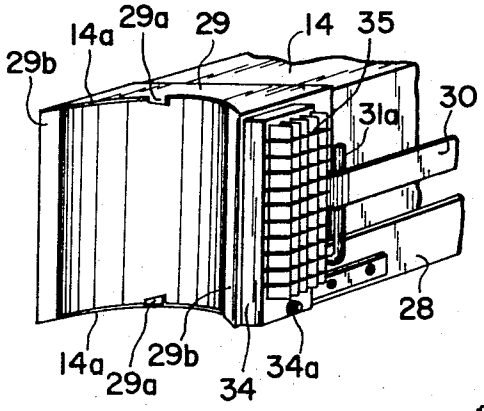


FIG. 7

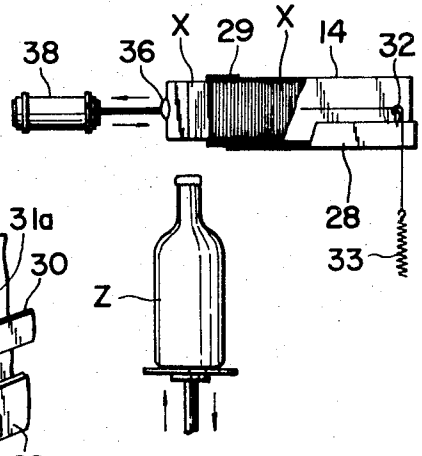


FIG. 6

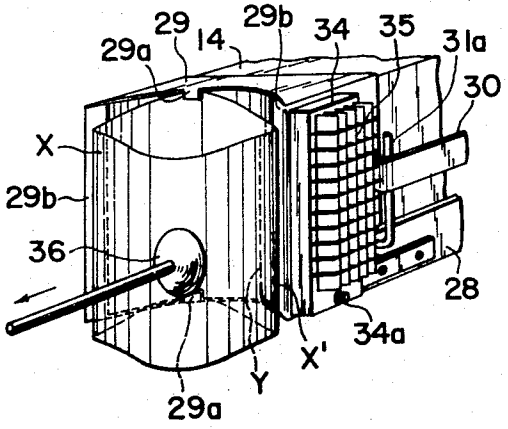
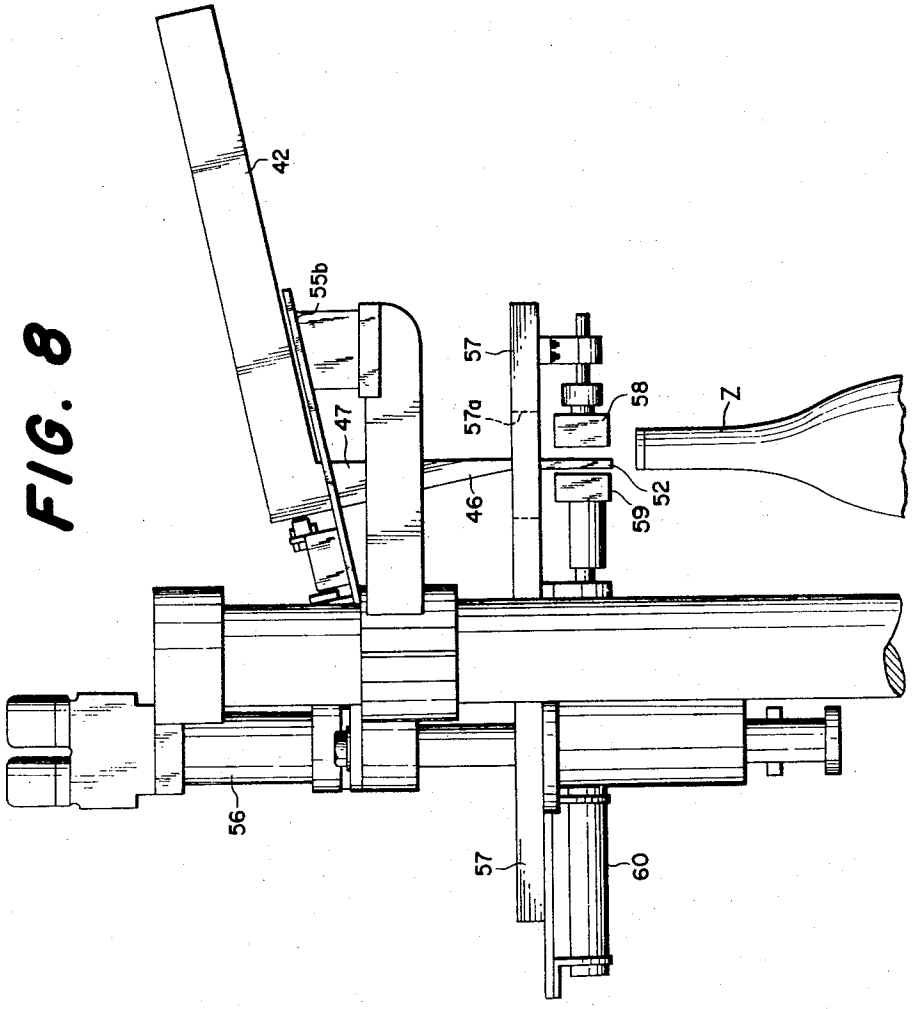


FIG. 8



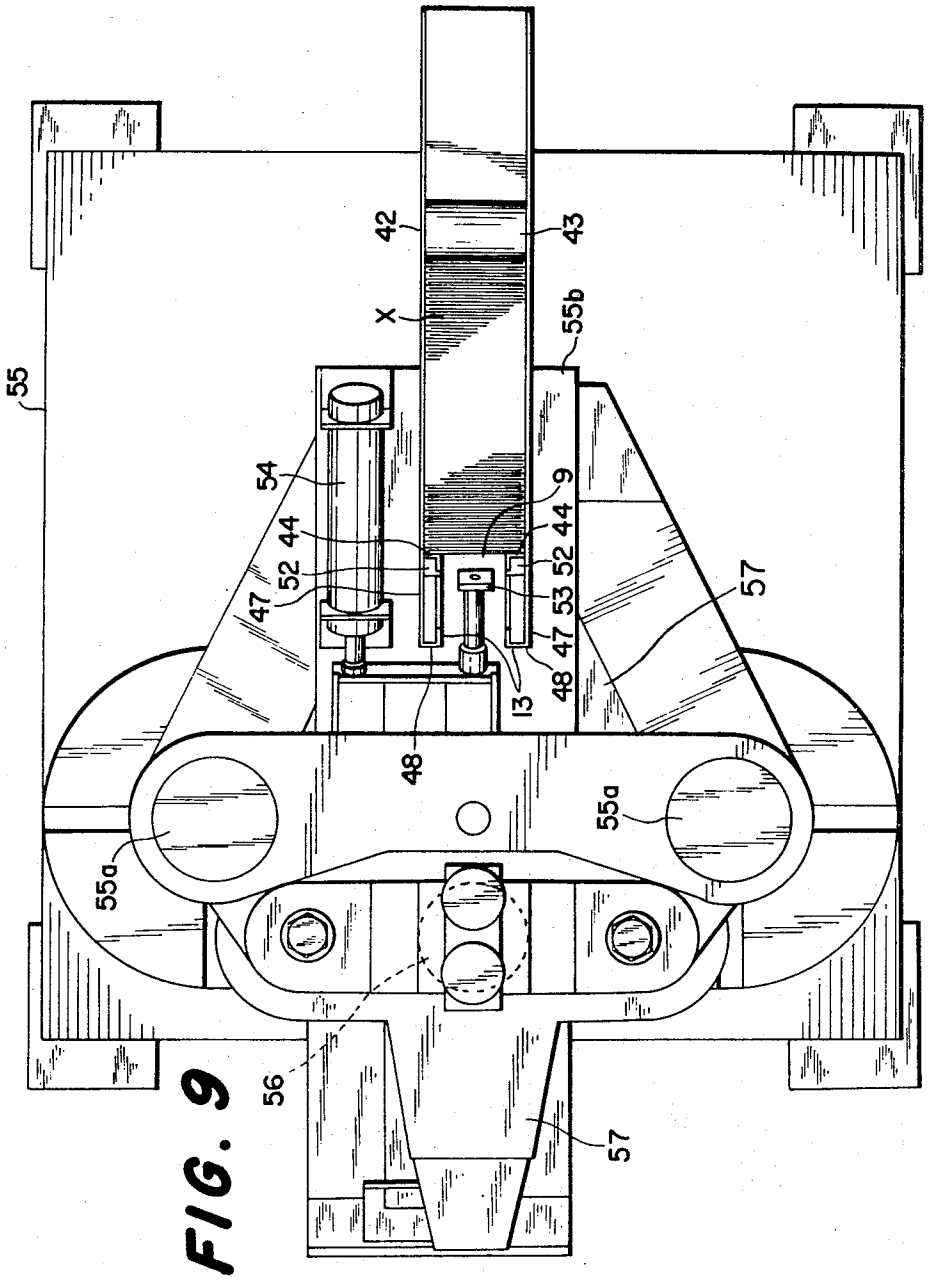


FIG. 9

FIG. 10

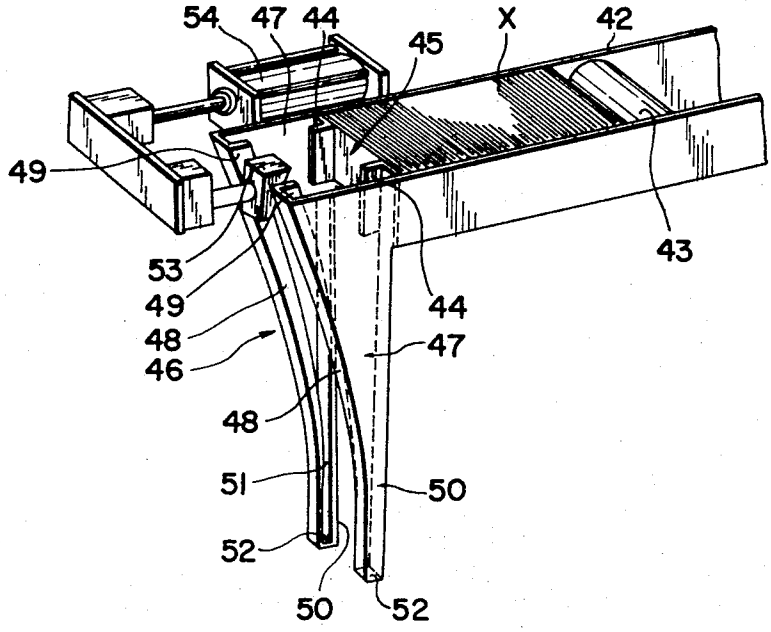


FIG. 11

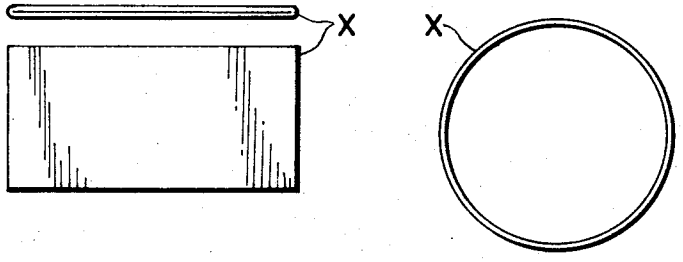


FIG. 12

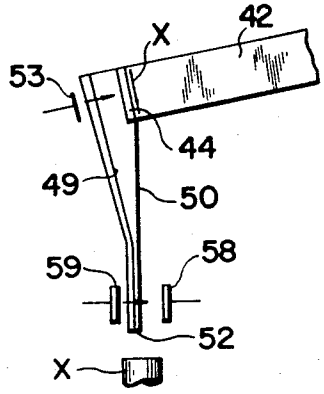


FIG. 15

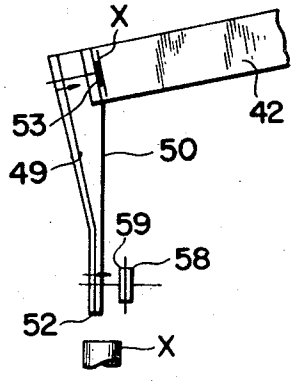


FIG. 13

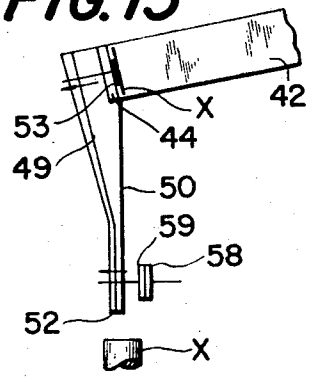


FIG. 16

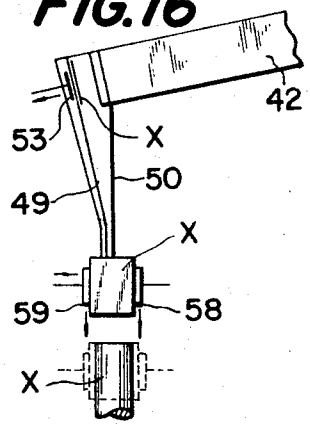
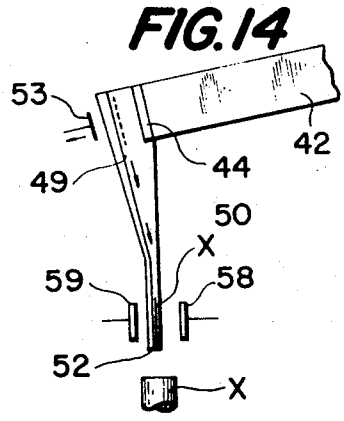


FIG. 14



METHOD AND EQUIPMENT FOR SEALING THE CAP OF BOTTLES

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to the method and the equipment for continuously and accurately sealing the cap of bottles.

More specifically, the present invention relates to the method and the equipment for continuously and accurately putting on the necks of bottles a heat-contracting synthetic resin cap-sealing material, without preforming the material, and for heat-sealing the material.

The cap-sealing of bottles has been conventionally carried out in recent years for reasons of sanitation, safety, quality guarantee of the contents of bottles and appearance, mostly by putting on the neck of a bottle a heat-contracting synthetic resin tubular material, cut short to a certain length, and then sealing it through thermal contraction.

Heat-contracting synthetic resin tubes are generally pressed flat as they are rolled up in production processes, and since the said tubular material is not exempted in conventional practice from being pressed flat poor workability and inefficiency result when said tubular material is fitted on the neck of a bottle.

Therefore, to facilitate the fitting of the said short, flat tubular material onto the necks of bottles, conventional practices usually employ a preformation of the said material. This preformation is mostly carried out by manual operations.

It is a well-known fact that in recent years automation and mechanization have been promoted in the cap-sealing industry for saving labor and improving efficiency, with varieties of devices contrived and put to actual use.

However, these devices are mechanically complicated, require much expense in equipment since they are often very large, and are not directly applicable to the cap-sealing of short tubular materials as mentioned above.

In view of the above facts, the inventor invented a method for automatically cap-sealing such short tubular material as mentioned above by directly putting the material around the necks of bottles, without preforming the material, and by using a series of equipment components arranged in rational order. He also invented the device of simple mechanical construction that is used for the said method.

In accordance with the invention, the said method provides for a bottle receiver at the end of an arm bar, to receive bottles intermittently supplied one by one, said arm bar also being intermittently turned through a certain angle to carry the bottle in the bottle receiver onto a turntable installed in the orbit of the turning bottle receiver; a bonding agent applying mechanism located above the said turntable to uniformly apply a bonding agent to the circumference of the neck of the said turning bottle, the operation of said bonding agent applying mechanism being synchronized with the operation of a top plate feeding mechanism which automatically feeds a dust-preventing top plate onto the top of the neck of said bottle; means for carrying said bottle to a cap-sealing-material feeding mechanism by the next intermittent motion of said arm bar; a suction opening mechanism which operates synchronously with the operation of said cap-sealing material feeding

mechanism for taking out of a material housing unit a flat tubular cap-sealing material made of heat-contracting synthetic resin, for opening said material to an almost cylindrical shape as taken out of the housing, and for putting the cylindrically-opened tubular material around the neck of said bottle; then, at the next intermittent motion of said arm bar, a conveyor to carry said bottle through a heating furnace where said tubular material is thermally contracted; and a twisting mechanism for adhering under pressure and with a twisting motion the bonding-agent-applied part of the cap-sealing material.

A preferred embodiment of the device to in the above-described method of the present invention will now be described by reference to the accompanying drawing, but the description given below will be shown simply by way of example and the scope of the invention will not be limited by the description.

FIG. **1** is a general view of the entire device comprising a bottle supplying mechanism A, a bonding agent applying mechanism B, a top plate feeding mechanism C, a cap-sealing material feeding mechanism D, a heating furnace E and a twisting mechanism F, each arranged in an operating position.

FIG. **2** is a view illustrating the top plate feeding mechanism.

FIGS. **3, 4, 5, 6** and **7** are views illustrating the parts of the cap-sealing material feeding mechanism.

FIGS. **8, 9, 10, 11 12, 13, 14, 15** and **16** are views illustrating another example of the construction of the cap-sealing material feeding mechanism.

The bottle supplying mechanism A illustrated by way of example in FIG. **1** has the following construction. A shaft **3'** having four crossed arm bars **1** of the same length is coupled tightly to a rotary shaft **3** connected with a driving device M, and the end of each arm bar **1** is fitted with a bottle receiver **2** having a semi-circular concave surface **2***a* open in the direction of rotation. The arm bar **1** is so controlled that it can intermittently turn one-fourth (90°) of a circle at each stroke; the bottle receiver **2** of the arm bar **1** receives a bottle (not illustrated in FIG. **1**) by its body, supplied intermittently on a conveyor belt **4**, and travels on a circular travelling path **5** at a stroke.

The bonding agent applying mechanism B comprises a turntable **6** and a bonding agent applying machine **8** installed above the turntable; it may include a photoelectric device **7**.

The turntable **6** is rotated by an auxiliary driving device M' and is flush with the surface of the travelling path **5** at the stop position of the arm bar **1** after the first stroke. The bonding agent applying machine **8**, installed above the turntable **6**, has an elastic material **8***a* which oozes out bonding liquid from its inside, and uniformly applies bonding agent, by contacting the elastic material **8***a*, to the outside of the neck of a bottle, carried in by the first stroke of the arm bar and turning on the turntable **6**.

The photoelectric device, when installed optionally, is installed in a position corresponding to the body of bottles and will be effective for bottles with a label attached beforehand to their body. That is to say, when the label on a bottle is in a position confronting with the photoelectric device **7**, the turntable **6** is rotated by the signal of the photoelectric device **7** through the medium of the auxiliary driving device M', the bottle on the turntable is also turned, then the auxiliary driving

device M' and, therefore, the turntable **6** are stopped as the edge of the label touches the radiation from the photoelectric device **7.** Thus the position of the label can be set almost correspondent to the lettering of a cap-sealing material to be applied in the following process.

The top plate feeding mechanism C has the following construction as shown in FIG. **2**: at the bottom of this device is a feeder nail **8** having a semi-circular notched end **8***a*, the diameter of the semi-circle being approximately same as that of top plates, and the feeder nail slides on the bed **9**; a cylinder **10** containing stacked-up top plates hangs above the bed **9** with a slight clearance between the cylinder **10** and the bed **9** equivalent to the thickness of a top plate; and the feeder nail **8** pushes a top plate lying on the bed **9** within the said clearance towards a circular hole **9***a* in the bed **9** through which said top plate will fall. The circular hole **9***a* is located directly above the turntable **6** so that a dropped top plate will fall onto the cap of a bottle standing below on the turntable **6.** A stopper **9***b* is provided to prevent a top plate from sliding over the circular hole **9***a*, and a dropper nail **11** is provided for to force through the hole **9***a* any top plate that would not easily drop because its edge was pressed by or stuck to the notches **8***a* of the feeder nail **8.**

The bottle, after treatment on the turntable **6** as shown in FIG. **1** and as hereinbefore described, is transferred, while sliding on a travelling path **5'** flush with the said travelling path **5** by the second stroke of the arm bar **1** to the cap-sealing material feeding mechanism D.

The cap-sealing material feeding mechanism D has the following construction (detailed description will be given later).

A disk **12** flush with the surface of the travelling path **5'** is installed at the end of the travelling path **5'** and is moved up or down intermittently by an air cylinder **13** located below the disk **12.** A material housing unit **14** having a curved opening **14***a* at its end is provided above the disk **12,** with the end opening **14***a* directly above the central part of the disk **12.** The material housing unit **14** contains numbers of flat tubular cap-sealing material pieces made of heat-contracting synthetic resin, curved to the same shape as the curved end opening **14***a* and packed in order. The material housing unit **14***a* is of special construction in which the said material pieces are constantly pushed towards the end opening **14***a* by means of a spring. In front of the material housing unit **14** is arranged a suction device **15** which takes out by suction one of the cap-sealing material pieces opened in an almost cylindrical shape, and the neck of a bottle lifted by the corresponding lifting motion of the disk **12** is inserted into the cylindrically-opened cap-sealing material piece.

The component part numbered **16** is an arc-shaped travelling path formed concentrically with the travelling paths **5** and **5'** and installed at a level not flush with the travelling paths **5** and **5'**, but flush with the disk **12** risen to its extreme height. In other words, the bottom of the bottle receiver **2** travels over, and very close to, the surface of the travelling path **16.**

The numbered **17** is a conveyor belt for carrying bottles; it runs flush with the arc-shaped path **16** and through a heating furnace E.

Located beyond the heating furnace E is a twisting mechanism F which has the following construction.

The main body of the twisting mechanism F is supported with supporting legs **18** and **18,** and has a motor **19.** Below the motor **19,** there are two pairs of protruded rotary shafts **20, 20** and **21, 21** driven by the motor **19,** the speed of revolution of the one pair of the rotary shafts **20, 20** being different from that of the other rotary shafts **21, 21.** The rotary shafts are fitted with rolls **22, 22** and **23, 23,** and endless belts **24** and **24'** running between these rolls and parallel to the conveyor belt **17** in such a manner that the inside surface of the endless belts **24** and **24'** runs in the same direction as the running direction of the conveyor belt **17.** The endless belts **24** and **24'** are set to have a distance between them equivalent to the outside diameter of the body of bottles. The rotary shafts **20** and **21** are also fitted at their top with rolls **25, 25** and **26, 26** having a larger diameter than the lower rolls **22, 22** and **23, 23,** and the necks of bottles under conveyance are held between endless belts **27** and **27'** running between these rolls with a larger diameter **25, 25** and **26, 26.** The running speed of the endless belt **27** is so differed from that of the endless belt **27'** that the neck of bottles is rolled and twisted to provide a better cooling effect for the cap-sealing material and a better adhesive effect for the cap-sealing material to the bonding agent.

FIG. **3** through FIG. **7** show by way of example preferred embodiments of the cap-sealing material feeding mechanism D, especially the device to open flat, short tubes outlined by reference to FIG. **1** above.

The material housing unit **14** mentioned above is shown in a top view in FIG. **3** and contains flattened short tubular cap-sealing material pieces X made of heat-contracting synthetic resin, curved and packed in layers.

The material housing unit **14** is held on a support **28** and is made with a mouth piece **29.** The mouth piece **29** has a curved end opening **14***a*, a protrusion **29***a* at its top and bottom, respectively, and a folded stopper **29***b* along its left-side edge and right-side edge, respectively, so that the foremost material piece X can not go out freely. Both sides and the rear side of the packed-in-layer short tubular material pieces X in the material housing **14** are surrounded with a strong tape **30** which, after drawn out through a hole drilled in either side of the mouth piece **29,** is passed over a guide bar **31***a*, is extended over a pulley **32** and is constantly pulled with a spring **33,** so that the bundle of the tubular material pieces X is constantly pressed forward.

A heating plate **34** as shown in FIG. **6** is attached to one side of the mouth piece **29** and is fixed to the support **28** with screws. The eating plate **34** has inside a built-in heating unit (not illustrated) equipped with a temperature regulator such as a thermostat, for example a built-in heat-resisting cloth containing heating wire, and has on its outside a radiator fin **35.** The purpose of said heating plate **34** is to heat that part of a machined seam Y produced beforehand near the crease X' one side of a tubular material piece to facilitate removal of cap seal. The working temperature of the heating plate **34** is a temperature necessary for softening the synthetic resin, generally within a range between 40°C and 60°C, at which the tubular material pieces will be easily drawn out of the material housing **14** by a sucker **36,** with the crease X' rounded to some extent. A temperature controlling knob **34***a* and a lead wire **34***b* are also shown on these views.

As shown in FIG. 3, a suction device 15 comprises a sucker 36 made of rubber or soft synthetic resin, and air pipe 37, a cylinder 38, a piston rod 39, an air pipe for the cylinder 40 and a suction pipe 41 connected with the sucker 36. The piston rod 39 is moved forward, the sucker 36 attaches by suction to one side of a tubular material piece X and, as the piston rod 39 is moved backward, the sucker 36 pulls the tubular material piece X to open the piece X to an almost cylindrical shape so that the opened tubular material piece X can accept the entrance of the neck of a bottle Z (FIG. 7) raised up from below.

FIG. 8 through FIG. 12 show another preferred embodiment by way of example of a mechanism for opening tubular material pieces.

As obvious from FIGS. 8, 9 and 10, a holder 42 is set slopewise, has a trough-like sectional shape, and contains tubular material pieces having openings top and bottom.

A heavy metal roller 43 is provided behind the last piece of the tubular material pieces X in the holder 42, and all the tubular material pieces X are constantly pressed toward the gate of the holder 42 by the weight of the metal roller 43 on a slope.

The front opening of the holder 42 is provided with a gate 45 (FIG. 10) having a pair of L-walls 44 and 44 which support the edges of both sides of a tubular material piece X. The outside of the gate 45 is directly connected with a vertical chute 46 comprising, an illustrated in FIG. 10, a pair of parallel side walls 47 and 47 whose width is narrowed as they extend downwards, a pair of front walls 48 and 48 and a pair of inside walls 49 and 49 formed with the side wall edges bent inward to a groove shape, the width of the inside walls 49 and 49 being tapered to nothing as they extend downwards, a pair of rear walls 50 and 50 formed with the side wall rear edges bent inward, and a pair of guide grooves 51 and 51 formed with the side walls 47 and 47, the front walls 48 and 48 and the rear walls 50 and 50. A pair of bottoms 52 and 52 are provided for the purpose of stopping dropped material pieces.

The above-described construction of the chute 46 keeps the chance of the contacting of tubular material pieces with the component parts of the chute 46 as low as possible so as to prevent tubular material pieces, even if charged with static electricity, from ticking to the component parts of the chute.

In FIG. 10, a suction head 53, a means to take out tubular material pieces one after another from the holder 42, is moved to and from the gate 45 through the inside space of the chute 46 by the operation of a cylinder 54.

The mechanism for opening to a cylindrical shape a flat tubular material piece that has dropped through the chute 46 and the combination of the mechanism with the chute 46 and the cylinder 54 are illustrated in FIG. 8 and FIG. 9. A lift 57 is raised by a cylinder 56 supported with two poles 55*a* and 55*a* standing on a base 55. A rest 55*b* fixed to the poles 55*a* and 55*a* is located above the lift 57, and the holder 42 and the cylinder 54 are mounted on the rest 55*b*.

The lift 57 has a hole 57*a* through which the chute 46 can be raised and lowered. Near the hole 57*a* under the lift 57 are provided a fixed head 58 and a confronting movable head 59 which is moved by a cylinder 60.

The operation of cap-sealing the tubular material pieces X by the above-described mechanism will now be described in the following.

FIGS. 12, 13, 14, 15, and 16 show this operation sequence. In FIG. 12, the suction head 53 in a back position is moved forward, and the movable head 59 is also moved toward the fixed head 58 when the lift 57 is in its elevated position. As shown in FIGS. 13 and 15, the suction head 53 holds the foremost flat tubular material piece X in contact with the gate 45, while the movable head 59 moves forward through the space at the bottom of the chute 46, takes hold of one side of the preceding material piece that has already dropped through the chute 46 and that stands on the bottom 52 of the chute 46, and, while movable head 59 is maintaining the attachment, contact with the tubular material piece is made by the fixed head 58 which immediately takes hold. Thus, both sides of the tubular material piece are held by the two heads 58 and 59. Next, as the suction head 53 is retracted from the gate 45, the tubular material piece held by the head 53 is pulled from the remaining tubular material pieces slipping off the hold from the L-walls 44 and 44 on either side of the gate 45 by virtue of the flexibility of the material piece. Synchronously with this procedure, the suction force of he suction head 53 is released and the tubular material piece surely drops through the chute 46 as shown in FIGS. 13 and 14. Prior to the fall of this tubular material piece, and simultaneously with the retreat of the suction head 53, the movable head 59 also retracts to open the tubular material piece held between the movable head 59 and the fixed head 58 to a cylindrical shape as illustrated in FIG. 16. Then, as the lift 57 is lowered, the tubular material piece, now in a cylindrical shape, is lowered as shown by dotted line in FIG. 16 to cover the neck of a bottle Z that stands in this position whereto it has just been carried, and the suction force of the two heads 58 and 59 is released.

The above-described cap-sealing material opening mechanism can employ a means to hold and open a tubular material piece using an inserting four or more openable and closable nails into a material piece opened in such a manner as described above. In other words, the mechanism described above by reference to the accompanying drawing is nothing but a preferred embodiment.

According to the present invention, such treatments as the application a bonding agent to the necks of bottles, placement of top plates, capping of a bottle neck with a flattened tubular sealing material piece, cap-sealing by means of heating and tight adhesion of bonding agent to the cap-sealing material can be automatically and easily carried out with a simple apparatus.

Also, according to the present invention, a simple apparatus or device to carry out said treatments can be provided.

What is claimed is:

1. An apparatus for cap-sealing the necks of bottles, comprising:

a bottle moving device for moving and guiding bottles to be cap-sealed;

a bottle sliding surface over which the bottles to be moved and guided by said bottle moving device can slide and operatively positioned therefor;

a bonding agent applying device for applying bonding agent to the necks of the bottles, and a top plate placing device for placing top plates one by one onto the tops of the bottles, said bonding agent applying device and said top plate placing device

being located at a first position along said bottle sliding surface;

a cap-sealing material feeding device positioned at a second position along said bottle sliding surface for furnishing to and covering, one by one, the necks of the bottles, to which bonding agent has been applied and onto which the top plate has been placed, a flattened tubular cap-sealing material made of heat-contracting synthetic resin;

a conveyor at the end of said bottle sliding surface;

a furnace located at a first position along said conveyor for thermally contracting the cap-sealing material covering the neck of the bottles; and

a twisting device located at a second position along said conveyor for twisting and rolling under pressure the necks of the bottles cap-sealed by heat contraction.

2. An apparatus as claimed in claim **1** further comprising a device for aligning the label of the body of the bottle with the letter-bearing surface of the cap seal, said device being a photoelectric mechanism installed beside said bonding agent applying device.

3. An apparatus for cap-sealing the necks of bottles comprising, in combination:

carrying means for supporting the bottles in their movement through the apparatus;

transferring means for individually receiving and transferring said bottles, said transferring means comprising an arm bar having a bottle receiver at one end thereof, said arm bar being operatively positioned above said carrying means and intermittently turnable through successive determined angles to receive and transfer bottles along said carrying means;

application means for uniformly applying a bonding agent to the circumference of the necks of the bottles and for applying a top plate to the tops of the bottles, said application means positioned at the end of the first successive turn of the transferring means and comprised of a turntable along said carrying means positioned so as to receive bottles delivered by said transfer means, a bonding agent applying mechanism located above said turntable, a top-plate feeding mechanism for automatically feeding a dust preventing top plate onto the top of the necks of the bottles, also located above the turntable, said bonding agent applying mechanism and said top plate feeding mechanism operating is synchronized motions;

feeding means positioned at the end of the second successive turn of the transferring means for taking out of a cap-sealing material housing-unit flat tubular cap-sealing material made of heat contracting synthetic resin, said feeding means comprised of a lifting mechanism along and level with said carrying means for raising said bottles, and a suction opening mechanism above said lifting mechanism for opening said flat tubular material to an almost cylindrical shape while being removed from said housing unit and for holding said opened tubular material while said opened tubular material is fitted onto the bottles raised to the suction opening mechanism by the lifting mechanism;

conveyor means located at the third successive turn of the transferring means and at the end of said carrying means, said conveyor means comprised of a conveyor for further moving said bottles;

heating means positioned at a first position along said conveyor means for thermally contracting said cylindrical tubular material about the necks of said bottles, said heating means comprised of a furnace with said conveyor means running therethrough; and

adhering means located at a second position along said conveyor means and spaced from said heating means for tightly adhering the bonding agent to the cap-sealing material, said adhering means comprised of a twisting mechanism for engaging said bottles coming from said heating means on said conveyor means wherein the bottles and the cap-sealing material are twisted and adherence of the cap-sealing material to the bonding agent surrounding the neck of the bottle occurs under pressure with a twisting motion.

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