Jan. 25, 1955 V. C. HALL 2,700,497

BOTTLE STOPPERING MACHINE

Filed Feb. 2, 195(3 Sheets-Sheet 1

Fig. 1.

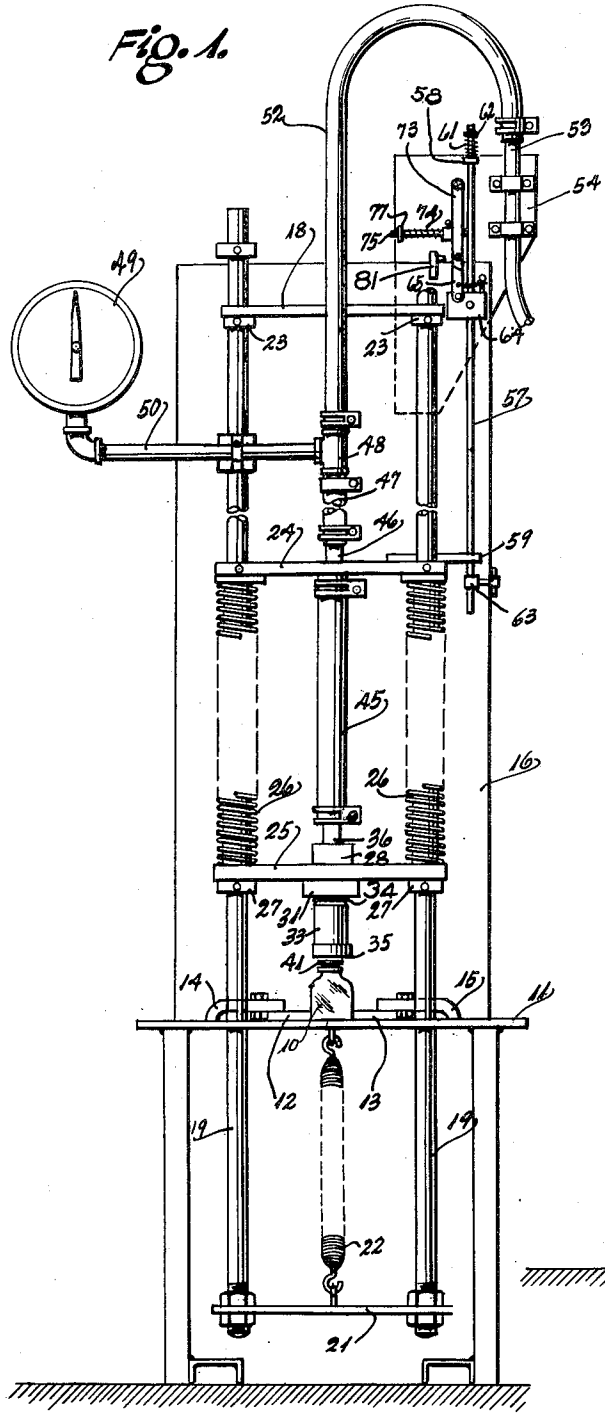
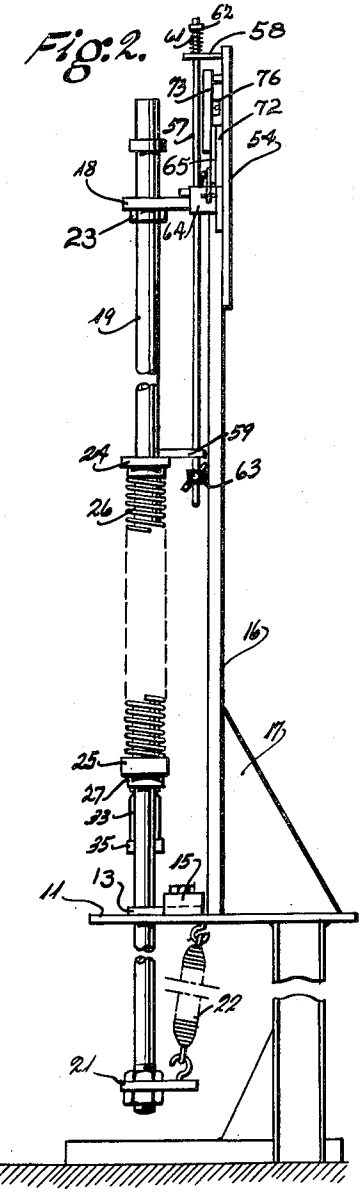


Fig. 2.



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BOTTLE STOPPERING MACHINE

Filed Feb. 2, 1950 3 Sheets-Sheet 2

Fig. 3a.

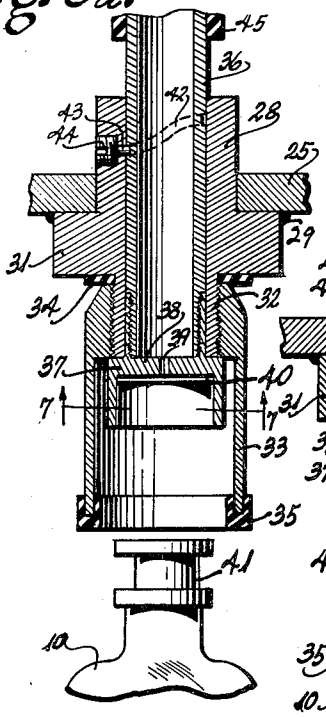


Fig. 4a.

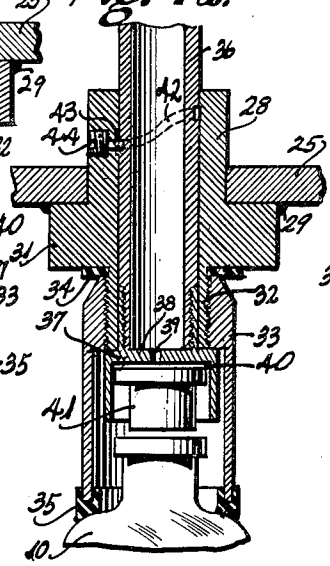


Fig. 7

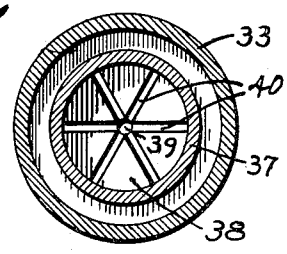


Fig. 5a.

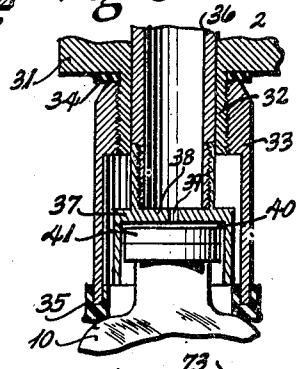


Fig. 3b.

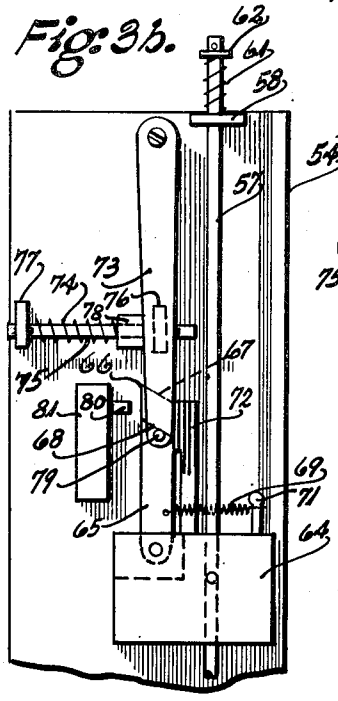


Fig. 4b.

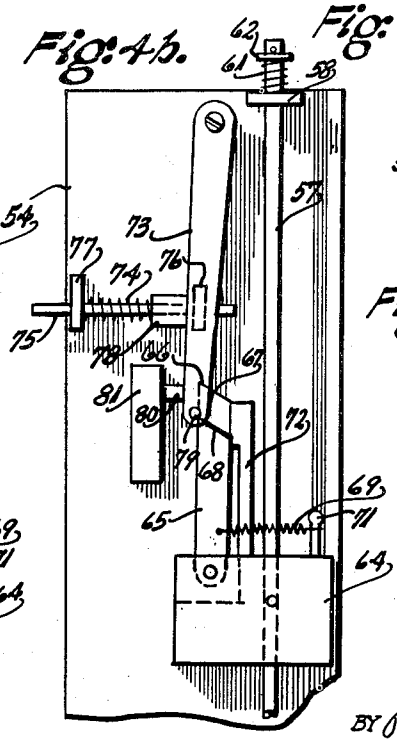


Fig. 5b

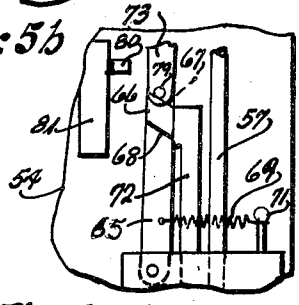
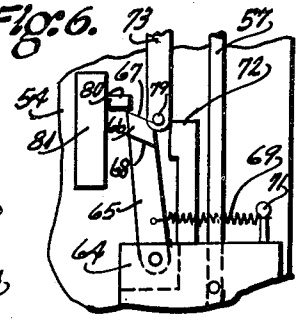


Fig. 6.



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BOTTLE STOPPERING MACHINE

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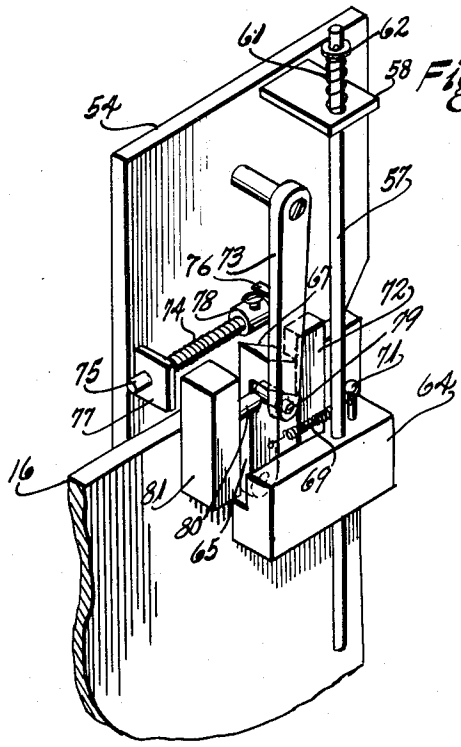

Fig. 8.

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2,700,497

BOTTLE STOPPERING MACHINE

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Application February 2, 1950, Serial No. 142,055

3 Claims. (Cl. 226—82)

This invention relates to a machine for stoppering bottles, and more particularly to an apparatus of this character which will insert a stopper into the mouth of a bottle after the bottle has been subjected to a vacuum.

In many instances such, for example, as the bottling of biological material, it is necessary that the air be withdrawn from the bottle and that a rubber stopper be inserted while the bottle remains under the vacuum, these steps being accomplished under dry conditions. If water or other lubricant can be present on the stopper, the stopper can be readily inserted in the bottle. In many situations, such as is involved in the present invention, both the bottle and the stopper must be dry. This is important because the entrapment of moisture or other liquid within the bottle may bring about deterioration or other undesirable change in the contents of the bottle.

In the instances in which the stoppering is performed in the presence of steam for sterilization purposes, the insertion of the stopper into the bottle may be readily accomplished. However, under the dry conditions with which the present invention is concerned, considerable difficulty is experienced in inserting the dry stopper into the bottle. This is especially true if the stopper is made of rubber or similar plastic material which has a high coefficient of friction. An attempt to force such a stopper into the bottle in a direct manner meets with considerable resistance and this often results in tilting of the stopper so that it cannot be inserted at all.

In accordance with the present invention, a machine is provided which readily accomplishes the insertion of a stopper into a bottle under dry conditions. In general, it may be here stated that this is accomplished due to mechanism which imparts a rotary motion to the stopper as it is being inserted into the mouth of the bottle. The air is first evacuated from the bottle and while this vacuum is maintained, the stopper is inserted into the mouth with a rotary motion.

A preferred embodiment of the invention is illustrated in the accompanying drawings in which

Figure 1 is a front elevational view of the apparatus.

Figure 2 is a side elevational view of Figure 1.

Figure 3*a* is an enlarged view of the stopper applying portion of the machine, with the parts in their initial position.

Figure 3*b* is an enlarged view showing the vacuum controlling mechanism in the position corresponding to Figure 3*a*.

Figure 4*a* is similar to 3*a* but shows the parts in the position at the time vacuum is applied to the bottle but before the stopper is inserted.

Figure 4*b* is similar to 4*a* but shows the vacuum control mechanism in the position corresponding to Figure 4*a*.

Figure 5*a* is similar to 3*a* but shows the parts in the position in which the stopper has been inserted into the bottle.

Figure 5*b* is similar to Figure 3*b* but shows the vacuum controlling mechanism in the position corresponding to Figure 5*a*.

Figure 6 shows the vacuum controlling mechanism in the position after the stopper has been inserted and when the vacuum is released.

Figure 7 is a sectional view on the line 7—7 of Figure 3*a*.

Figure 8 is a perspective view of Figure 3*b*.

The bottle **10** which is to be stoppered is placed upon a table top or base plate **11** which is supported in any desired manner above the floor. To fix the placing of

the bottle in the desired location relative to the stoppering machine, positioning plates **12** and **13** are adjustably secured to the base plate **11**. This may conveniently be done, for example, by means of the clamping brackets **14** and **15** which may be bolted downwardly against the positioning plates **12** and **13**. To accommodate bottles of different sizes, it is merely necessary to loosen the clamping brackets **14** and **15** and reposition the plates **12** and **13**, so that they form a socket for the bottle.

The mechanism for applying the stopper into the bottle is supported by an upstanding back plate **16**. This is attached to the base plate **11** in any desired manner, as by welding, and its upright position is reenforced by means of the web plate **17**.

Attached to the back plate **16** at the upper portion thereof is a forwardly projecting guide plate **18**. Passing through the guide plate **18** and the base plate **11** are two vertically moveable rods **19**. The guide plate **18** and the base plate **11** serve as bearings so that the rods **19** will be guided in their up and down movements. Connecting the lower ends of the rods **19** is a step plate **21**.

A spring **22** is attached to the step plate **21** and to the base plate **11** to urge the rods **19** upwardly. Their upper movement under the influence of this spring **22** is limited by means of the adjustable collars **23** which are attached to the rods **19** near their upper ends. These collars are so positioned upon the rods **19** that they will strike the guide plate **18** and arrest the upward movement of the rods **19**. The rods **19** are moved downwardly by pressure of the operator's foot upon the step plate **21**.

A cross plate **24** is attached to the rods **19** at points below the collars **23** so that this plate moves with the rods. Slidably mounted upon the rods **19** below the cross plate **24** is a transverse plate **25**. Springs **26** are located upon the rods **19** between the cross plate **24** and the transverse plate **25** so as to yieldingly urge the transverse plate **25** downwardly away from the cross plate **24**.

To limit the downward movement of the transverse plate **25** along the rods **19**, collars **27** are adjustably affixed to the rods **19** in any desired manner, such as by set screws, for example. It is desired that the springs **26** be under some degree of compression when the transverse plate **25** is resting upon the collars **27**. It should be observed here that the transverse plate **25** can move upwardly along the rods **19** toward the cross plate **24** against the pressure exerted by the springs **26**.

The transverse plate **25** carries the parts which make a vacuum tight connection with the bottle, and the parts which insert the stopper into the bottle while this vacuum is maintained. These parts include a sleeve **28** which is mounted within an opening through the transverse plate **25** midway between the two rods **19**. The sleeve **28** is attached to the transverse plate **25** in any suitable manner such as by the welding shown at **29**, or it may be a press fit.

The sleeve **28** is diametrically enlarged at **31** below the transverse plate **25** so that it will provide a shoulder which bears against the under side of the transverse plate **25** so that downward movement of the transverse plate **25** will carry with it and apply downward pressure upon the sleeve **28**. Below the enlarged portion **31** the sleeve **28** is of reduced diameter, as shown at **32**.

Mounted upon the reduced portion **32** is an inverted cup-shaped member **33**. The cup-shaped member **33** should fit quite tightly upon the reduced portion **32** so that a substantially air tight contact will be established. To prevent any air leakage, it is desirable that a packing ring **34** be disposed between the cup-shaped member **33** and the enlarged portion **31**. This packing ring **34** may, for example, be made of rubber.

The interior of the cup-shaped member **33** is sufficiently large to pass over the neck of the bottle. At the lower end of the cup-shaped member **33** is a sealing gasket **35**, attached thereto in any desired manner as by means of a groove in the gasket, as shown. This gasket **35** may, for example, be made of rubber or soft plastic so that when it contacts the shoulder of the bottle below the neck it will form an air tight seal. This relationship is best illustrated in Figure 4*a*.

Within the sleeve **28** is a tube **36**. This tube **36** should closely fit the interior of the sleeve **28** so that there will

be no or a negligible amount of air leakage along the exterior of the tube **36**. The tube **36** is reciprocatable within the sleeve **28**.

At the lowermost end of the tube **36** is an enlarged portion **37** which has a cavity therein to serve as the stopper receiving and retaining recess. It will be observed that the enlarged portion **37** at the lower end of the tube **36** provides a shoulder which bears upwardly against the lower edge of the reduced portion **32** of the sleeve **28** to limit the upward movement of the tube **36**.

At the junction between the enlarged portion **37** and the tube **36** is a partition **38** which is apertured at **39**. The under side of the partition **38** is provided with radial ridges **40**, as is shown in Figure 7. These ridges **40** serve to hold the stopper away from the partition **38** and away from the aperture **39** so that passageways will be established around the stopper and into the aperture **39**. It is apparent that other hold-off or spacing means than the ridges **40** may be employed so that the stopper will not bear against the partition **38** and obstruct the flow of air around the stopper and up through the aperture **39**.

It may be observed at this point that when a vacuum is applied to the bottle when the parts are shown in the position of Figure 4*a*, the outward rush of the air from the bottle will carry the stopper **41** upwardly into the recess within the under side of the enlarged portion **37**. This recess will therefore serve to position the stopper **41** in axial alignment with the bottle opening so that the stopper can then be pushed down directly into the bottle.

It has been mentioned that a feature of the invention is the provision of means for giving the stopper **41** a rotary motion as it is being urged downwardly into the bottle. This rotary motion is brought about by the formation of a cam groove **42** in the outer surface of the tube **36**. The cam groove **42** has a helical shape generally analogous to that of a screw thread but has a steep pitch. A pin **43** extends into the cam groove **42** and this pin **43** may for convenience be carried by a set screw **44** which is threaded into the sleeve **28**.

It will be observed that upon axial movement of the tube **36** through the sleeve **28**, the engagement of the pin **43** within the groove **42** will serve to rotate the tube **36**. The means by which the necessary relative longitudinal movement between the sleeve **28** and the tube **36** is brought about to cause a rotary movement of the tube **36** will be explained later.

Attached to the upper end of the tube **36** is a flexible hose **45**. The upper end of the hose **45** is attached to a rigid conduit **46** which passes through an opening in the cross plate **24**. The top edge of the hose **45** should bear against the cross plate **24** so that downward movement of the cross plate **24** will also force the flexible hose **45** downwardly. This is important because the cross plate **24** is affixed to the rods **19** and upon downward movement of the rods **19** the flexible hose **45** will also be forceably moved downwardly. It will be apparent, however, that it will not be necessary for the hose **45** to seat against the cross plate **24** if the hose is tightly secured to the conduit **46** and if conduit **46** is fixed to the cross plate **24**.

The upper end of the rigid conduit **46** is attached through a hose **47** to a pipe **T 48**. The side opening of the **T 48** is connected to a vacuum gauge **49** through a conduit **50**. Conduit **50** is preferably supported by attachment to one of the rods **19**.

The other opening of the **T 48** is connected by a flexible hose **52** to a rigid conduit **53**. This rigid conduit **53** is attached to a plate **54** which in turn is secured to the upper end of the back plate **16**. The flexible hose **52** permits upward and downward movement of the cross plate **24** which carries with it the **T 48**.

The apparatus includes means for applying a vacuum to the bottle to be stoppered just prior to the time that the stopper is to be inserted. This involves a source of the vacuum which is not illustrated here as it forms no part of the present invention. It may be sufficient to point out that the conduit **53** is connected to such a vacuum source and that interposed in this conduit is a valve which is not shown. It is desirable that this vacuum control valve be electrically operated so that upon the supply of electrical energy to it, the valve will be opened and the stopper apparatus will be in communication with the vacuum source.

The vacuum controlling mechanism is carried upon the plate **54** which, as has been noted, is attached to the back plate **16**. This mechanism includes an actuating rod **57**, the upper end of which is slidably guided in a bearing lug **58** attached to the plate **54**. The lower end of the rod **57** passes through a bracket **59** which is attached to the cross bar **24**.

A spring **61** encircles the topmost part and is interposed between the lug **58** and a washer **62** attached to the top of rod **57**. This spring **61** serves to yieldingly support the rod **57** in an upward position. Downward movement of the rod **57** in opposition to the pressure exerted by spring **61** is caused by engagement of the bracket **59** against an adjustable collar **63** attached to the lower end of rod **57**.

It will be noted that in an initial position, in which the cross bar **24** is in an uppermost position under the influence of spring **22**, the collar **63** is spaced below the bracket **59**. This space is not closed until the cross bar **24** has been moved downwardly such a distance that the sealing gasket **35** has contacted the upper surface of the bottle. This is important to make certain that the vacuum is not applied to the bottle until after engagement of the sealing gasket **35** has been made with the bottle.

A block **64** is attached to the rod **57** at a point between its ends, and this attachment should be adjustable so that the position of the block **64** may be varied. An upright cam latch **65** is pivotally attached to the block **64**. At the upper end of the cam latch **65** is an offset head **66** and the upper surface **67** and the lower surface **68** of this offset head **66** are at an acute angle so that they constitute cam surfaces. As here shown, these cam surfaces **67** and **68** are parallel, although this is not a necessary relationship, but they should have the general slope illustrated.

A tension spring **69** is attached to the cam latch **65** at one end and to an upright pin **71** at its other end, this pin **71** being supported by the block **64**. To limit the movement of the cam latch **65** under the influence of spring **69** and normally retain the cam latch **65** in an upright position, the stop post **72** is provided. This stop post **72** is attached to the block **64**.

Pivotally attached to the plate **54** is a depending lever **73**. This lever **73** is urged toward the stop post **72** by means of a compression spring **74**. Spring **74** is disposed upon a slide rod **75** which passes at one end through a lug **76** carried by the lever **73**, and at its opposite end through a guide lug **77** attached to the plate **54**. A collar **78** is attached to the rod **75** and the spring **74** bears against this collar **78** to urge the lever **73** against the stop post **72**.

At the lower end of the lever **73** is a laterally projecting pin **79**. In the initial position of the apparatus this projecting pin **79** underlies the cam surface **68** of the cam latch **65**. Because of this relationship, downward movement of the cam latch **65** will cause the surface **68** to exert a camming effect upon the pin **79** and swing the lower end of the lever **73** to the left as viewed in the drawings. When the lever **73** has been moved in this manner sufficiently far, it will strike the actuating pin **80** of the microswitch **81**. The switch **81** should be of the type which will thereupon close an electrical circuit which will supply electrical energy through wires (not shown) to the aforementioned valve disposed in the conduit **53**. Upon the occurrence of this event, the source of vacuum will be in communication with the tube **36** so that the air contents of the bottle will be evacuated.

The operation of the machine is as follows:

A stopper **41** is first loosely inserted into a bottle **10**, and this bottle is then disposed between the positioning plates **12** and **13**. The pedal plate **21** is then depressed by the foot and this moves the cross plate **24** downwardly. The transverse plate **25** is also moved downwardly through the action of the compression springs **26** and this brings the inverted cup-shaped member **33** downwardly over the neck of the bottle so that the sealing gasket **35** bears upon the surface of the bottle to make an air tight contact therewith. At this moment the bracket **59** will have just contacted the collar **63** so that the rod **57** will thereafter be moved downwardly.

Further downward movement of the pedal plate **21** will cause the cross bar **24** to move downwardly, but the cross bar **25** cannot move down further because it will be held upwardly by reason of the contact of sealing gasket **35** against the bottle. The initial downward move-

ment of cross bar **24** beyond this point will carry with it the rod **57** and will also cause downward movement of the cam latch **65**. This will serve, as has been explained above, to swing the lever **73** so that the microswitch **81** will be actuated. This position is illustrated in Figure *4a* and Figure *4b*.

The vacuum which is now applied through tube **36** will withdraw air from the bottle and will carry the stopper upwardly into the recess of the enlarged part **37**, as shown in Figure *4a*.

At this time the operator observes the gauge **49** and as soon as the indicating needle comes to rest, it is known that static vacuum conditions have been established in the system. Thereupon the operator depresses the pedal plate **21** further downwardly and this continues to move the cross plate **24** downwardly. The transverse plate **25** remains at rest during this further downward movement of the cross plate **24** but through the action of the flexible hose **45** the tube **36** is forced downwardly through the stationary transverse plate **25**. It will be apparent that the tube **36** is urged longitudinally through the sleeve **28** and that this relative movement will impart rotary movement to the tube **36** due to the action of the cam groove **42** and the pin **43**. This rotary movement of the tube **36** is permitted by the hose **45** which can assume the slight necessary twist.

As the stopper **41** is pushed downwardly into the bottle, therefore, the stopper will be given a rotary movement. This is important because the stopper will enter more freely into the bottle and its tendency to twist out of position is eliminated. The pedal plate **21** is depressed until the stopper is entirely in position, as shown in Figure *5a*.

In the position of Figure *5a*, the vacuum control mechanism is in the position shown in Figure *5b*. From this it will be observed that the pin **79** will have passed beyond the top of the cam latch **65** and will have swung to a position above the cam surface **67**. Pin **80** is now released and the vacuum connection is broken.

When the foot pressure is now released from the pedal plate **21**, the spring **22** will serve to restore all of the parts to their initial upward position. During the consequent upward movement of the block **64**, the cam surface **67** will strike against the pin **79** and this will serve to cam the latch **65** out of the way of the passage of the pin **79**, as is shown in Figure 6. Continued upward movement of the cam latch **65** will move its offset head **66** above the pin **79** so that the pin **79** can resume its initial position shown in Figure *3b*.

The evacuated and stoppered bottle **10** is now removed and a new bottle is positioned in its place for a repetition of these same steps. Because of the simplicity of the apparatus, it will be apparent that it may be operated both effectively and efficiently for its intended purpose.

It is believed that the equivalent structures will be obvious. For example, instead of having the microswitch **81** establish a circuit when its pin **80** is depressed, depresssion of pin **80** can break a circuit in the microswitch, if the vacuum control valve is of the type which is normally open but is closed under the action of an electric current. In like manner, instead of employing a microswitch and electric circuit, the microswitch **81** can be replaced by the vacuum control valve, and the actuating pin **80** can be the actuating stem of the valve so that when this stem is moved by lever **73** the valve will be directly opened.

Variations in the relative positioning or proportioning of the parts to accommodate bottles of different shapes and sizes will be obvious. For example, the positioning plates **12** and **13** will be readjusted to properly locate the bottle, and the parts **33** and **37** may be of the appropriate shapes.

What I claim is:

1. A bottle vacuumizing and stoppering machine comprising a bottle support to receive a bottle having a prepositioned stopper therein, an upright sleeve having an inverted cup-shaped element at its lower end to establish a vacuum tight engagement about the mouth of the bottle, a tubular member fitting within said sleeve and both rotatable and moveable longitudinally therein, said member having a recessed portion at its lower end to receive a stopper therein, cam means including a spiral cam and a follower between said sleeve and said member for imparting a rotary movement to said member upon their relative longitudinal movement, said member having a passageway therethrough and around a stopper in its recessed portion for applying a suction to thereby withdraw the stopper from the bottle and into the recess and also evacuate air from the bottle, and means for bringing the cup-shaped element and the bottle into engagement so that said inverted cup-shaped element is in engagement with the bottle and thereafter further urging the member longitudinally of the sleeve and toward the bottle to thereby rotate the stopper during its insertion in the bottle.

2. A bottle vacuumizing and stoppering machine comprising a bottle support to receive a bottle having a prepositioned stopper therein, an upright sleeve having an inverted cup-shaped element at its lower end to establish a vacuum tight engagement about the mouth of the bottle, a tubular member fitting within said sleeve and both rotatable and moveable longitudinally therein, said member having a recessed portion at its lower end to receive a stopper therein, spring means for biasing said member so its lower end is urged upwardly away from the lower end of the sleeve, cam means including a spiral cam and a follower between said sleeve and said member for imparting a rotary movement to said member upon their relative longitudinal movement, said member having a passageway therethrough and around a stopper in its recessed portion for applying a suction to thereby withdraw the stopper from the bottle and into the recess and also evacuate air from the bottle, and means for bringing the cup-shaped element and the bottle into engagement so that said inverted cup-shaped element is in engagement with the bottle and thereafter further urging the member longitudinally of the sleeve against the action of said spring means and toward the bottle to thereby rotate the stopper during its insertion in the bottle.

3. A bottle vacuumizing and stoppering machine comprising a bottle support to receive a bottle having a prepositioned stopper therein, an upright sleeve mounted for movement downwardly toward the bottle and having an inverted cup-shaped element at its lower end to establish a vacuum tight engagement about the mouth of the bottle, a tubular member fitting within said sleeve and both rotatable and moveable longitudinally therein, said member having a recessed portion at its lower end to receive a stopper therein, spring means for biasing said member so its lower end is urged upwardly away from the lower end of the sleeve, cam means including a spiral cam and a follower between said sleeve and said member for imparting a rotary movement to said member upon their relative longitudinal movement, said member having a passageway therethrough and around a stopper in its recessed portion for applying a suction to thereby withdraw the stopper from the bottle and into the recess and also evacuate air from the bottle, means for moving the cup-shaped element and the member downwardly until the sleeve seals against the bottle and thereafter further urging the member downwardly and longitudinally through the sleeve against the action of said spring means to thereby rotate the stopper during its insertion in the bottle, and vacuum control means for applying a vacuum to the bottle after said cup-shaped element has established a seal with the neck of the bottle.

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