

W. D. BELL

METHOD AND APPARATUS FOR SEALING CONTAINERS

Filed March 22, 1940

2 Sheets-Sheet 1

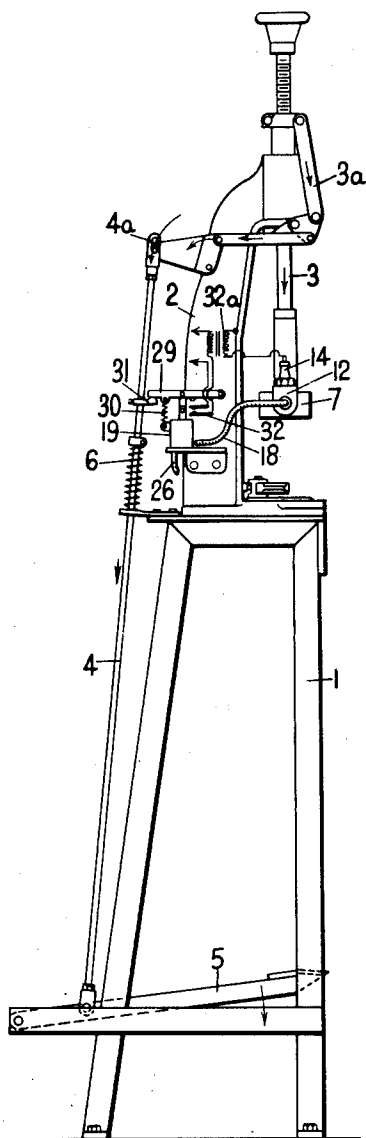


Fig. 1

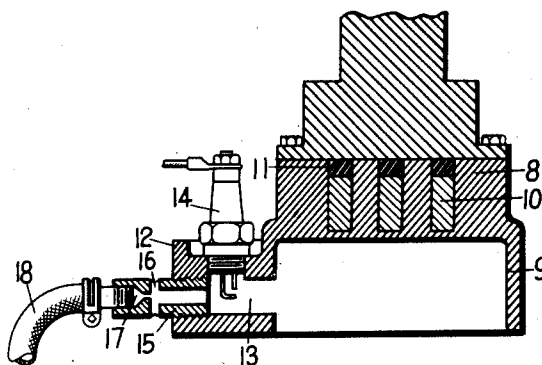


Fig. 2

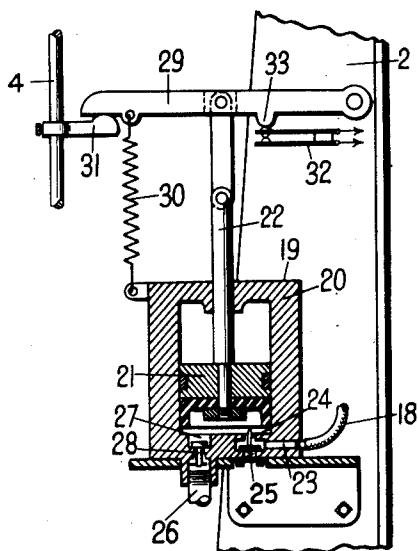


Fig. 3

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2,284,631

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Filed March 22, 1940

2 Sheets-Sheet 2

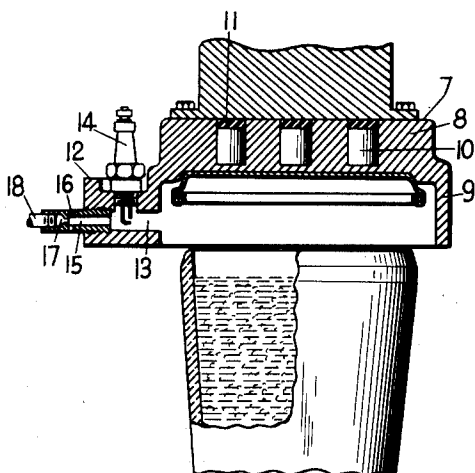


Fig. 4

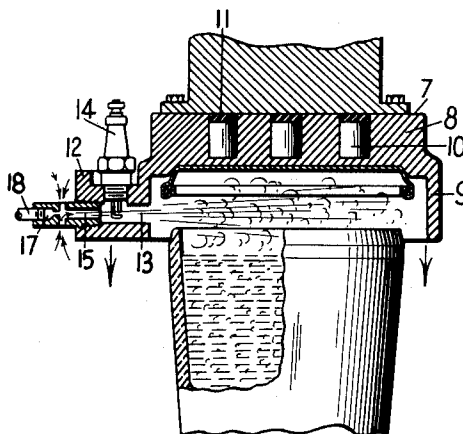


Fig. 5

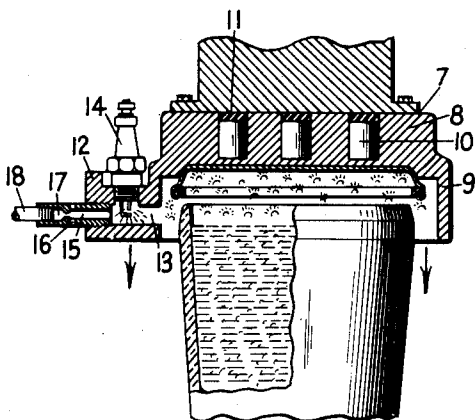


Fig. 6

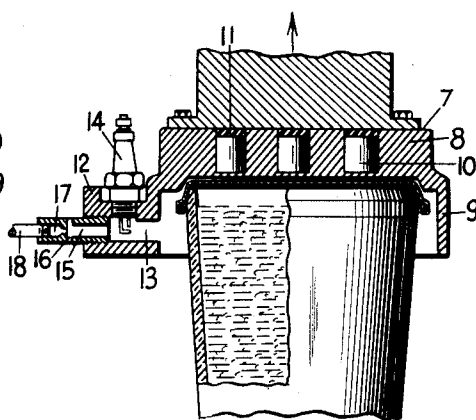


Fig. 7

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2,284,631

METHOD AND APPARATUS FOR SEALING
CONTAINERS

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Application March 22, 1940, Serial No. 325,393

12 Claims. (Cl. 226—82)

My invention relates to method and apparatus for sealing containers. It has to do, more particularly, with a method and apparatus for producing a partial vacuum in the upper ends of the containers at the same time that closures are sealed onto the containers.

One of the objects of my invention is to provide a greatly simplified method and apparatus for sealing closures on containers and for creating an effective vacuum in the space at the upper end of each container, between the closure and the contents of the container, which will aid in keeping the closure in position on the container and will also aid in preventing spoilage of the contents.

Another object of my invention is to provide a method and apparatus of the type indicated in the preceding paragraph which is of such a nature that the desired vacuum is produced without the introduction of moisture and, consequently, which will be particularly useful in sealing and vacuumizing containers filled with substances which are dry or to which moisture should not be added.

Another object of my invention is to provide a method and apparatus of the type indicated which will be self-contained and which will vacuumize and seal containers without the use of auxiliary apparatus such as boilers, vacuum pumps, and the like.

Another object of my invention is to provide a method and apparatus of the type indicated which will vacuumize and seal the containers quickly, effectively and very economically.

Another object of my invention is to provide a method and apparatus of the type indicated which is of such a nature that the closure and the upper end of the container and the head space between the contents and the closure will be sterilized during the sealing operation.

In its preferred form, my method consists of three main steps which are performed progressively but almost instantaneously. These three steps consist of (1) injecting a suitable combustible gas into the head space of a container, beneath and around a cap spaced slightly thereabove; (2) igniting the combustible gas and (3) sealing the cap on the container at the conclusion of the combustion period.

I preferably employ a hydrocarbon gas but any suitable combustible gas may be used. A predetermined volume of this gas is injected into the space between the lifted cap and the contents of the container in such a manner that it mixes with the air therein to form a combustible charge

beneath the cap, in the head space of the container, and in the zone surrounding the upper partly open mouth of the container. When this predetermined volume of gas has been supplied to the upper end of the container, the resulting explosive charge is ignited. Upon ignition combustion spreads rapidly throughout the mixture. This is accompanied by a sharp rise in temperature and a correspondingly great increase in the volume of the entire burning charge. Since the burning gases are free to expand, and the cap is sealed onto the container when the temperature of the gases is highest, the very hot product of the combustion remaining in the head space of the container is only a small fractional part of the original air content of the space. Cooling also takes place in a small fraction of a second after combustion ceases, with a resulting contraction of the gases, and an effective vacuum results.

Since the combustion of the charge not only expands and displaces the air in the head space of the container but also consumes the oxygen therein, the rarefied gases which remain in the head space of the container after sealing are inert products of combustion. They consist of very small quantities of residual atmospheric nitrogen, carbon dioxide, and water vapor, the latter due to the combination of the hydrogen of the fuel.

The flash temperature of the burning gases is very high, in some cases in the neighborhood of 4000° F., which effectively sterilizes the entire head space of the container. At the same time the temperature rise is of such short duration that no damage is done to either the cap or the contents of the container. This flame sterilization, together with the elimination of free oxygen, results in better preservation of the contents of the container than has hitherto been obtained by other processes.

The rate at which combustion spreads through the mixture differs with various gas-to-air ratios. Advantage can be taken of this well established fact to so adjust the mixture that the maximum temperature, and therefore the maximum vacuum produced, will be reached just at the instant that the seal is completed.

In the accompanying drawings, I have illustrated one form of apparatus which may be used in performing my method. However, it is to be understood that this apparatus may take various forms as long as it embodies the basic features of my invention. In the drawings similar characters of reference designate corresponding parts and:

Figure 1 is a side elevation of a sealing machine having my invention embodied therein.

Figure 2 is a vertical sectional view through the sealing head of my machine.

Figure 3 is a detail, partly in section, and partly in side elevation showing the control members for the gas injecting pump and the gas ignition device.

Figure 4 is a vertical sectional view of the sealing head showing the cap lifted from the container and before the gas is injected into the container.

Figure 5 is a similar view showing the step of injecting the gas into the container.

Figure 6 is a similar view showing the sealing head moving downwardly and the gas being ignited.

Figure 7 is a similar view with the sealing head in its lowermost position and with the cap sealed on the container.

With reference to the drawings, I have illustrated a manually operated capping machine of the single unit type in which my invention has been embodied. However, it is to be understood that my invention may be embodied in various types of machines either single or multiple unit types which are manually or automatically operated.

The machine illustrated comprises a base 1 having an upstanding standard 2 thereon which supports a vertically reciprocable sealing plunger 3. This plunger 3 is reciprocated in the usual way by means of a vertically disposed rod 4 which is connected at its lower end to a pivoted treadle 5. The upper end of rod 4 is connected by a pin and slot connection 4a to the mechanism 3a which reciprocates plunger 3. A spring 6, associated with the rod 4, normally keeps it and the plunger 3 in its uppermost position. The apparatus so far described is of a well known type.

The sealing head 7 on the lower end of the plunger 3 is of novel construction. This sealing head 7 embodies an upper disc portion 8 having a depending annular flange 9. Within the portion 8 a plurality of cylindrical sockets are formed for receiving cylindrical magnets 10. The sockets do not extend completely through portion 8 so that their lower ends are closed. Rubber inserts 11 are provided in the tops of the sockets to keep the magnets 10 in position. The head 7 is of non-magnetic material.

The sealing head 7 is provided with an extension 12 on one side thereof. This extension 12 is provided with a gas inlet passageway 13. A spark plug 14 is mounted on the extension 12 in such a manner that its points are located in the passageway 13. An inspirator member 15 is threaded into the outer end of the passageway 13. This member 15 is provided with air inlets 16 and a gas inlet 17 in the usual manner. The inlet 17 is connected to a conduit 18 which may be connected to a suitable gas injecting pump 19.

The pump may be of any suitable type but is shown as being of the cylinder and piston type. As shown best in Figure 3, this pump embodies a cylinder 20 having a vertically movable piston 21 therein which has an upstanding piston rod 22 that projects through the upper end of the cylinder. The conduit 18 is connected to the outlet passageway 23 of the pump, which is controlled by a one-way valve 24 that is normally held closed by means of a spring 25. A conduit 26 is connected to the inlet opening 27 of the pump and its opposite end is connected to any

suitable source of supply of gas. The inlet 27 is under the control of a one-way valve 28. The valve 28 permits gas to enter into cylinder 20, on the upward stroke of piston 21, through opening 27 but prevents gas from being forced through said opening, on the downward stroke of the piston. The valve 24 will be closed on the upward stroke of piston 21 but will be forced open on the downward stroke thereof.

The upper end of the piston rod 22 is pivotally connected to a horizontally disposed lever 29 which is pivoted to the vertical standard 2. A spring 30, having its upper end connected to the outer end of the lever 29 and its lower end connected to the cylinder 20, tends to swing the lever 29 downwardly and force the piston 21 downwardly. A stop 31, carried by the rod 4, normally contacts with the outer end of the lever and prevents downward movement thereof. A switch 32 is provided, adjacent the lever 29, and controls the circuit to the spark plug 14. This circuit includes a transformer 32a. Switch 32 is normally open but is closed at the proper time by means of a lug 33, on lever 29, when the lever swings downwardly to a predetermined position. The stop member 31 is adjustable vertically on the rod 4.

In the operation of this apparatus, a container with a cap thereon is positioned beneath the sealing head 7 which will be in its uppermost position. The cap will be immediately lifted from the container by the magnets 10, as indicated in Figure 4. Then if the treadle 5 is moved downwardly, the rod 4 will be pulled downwardly and the pump 19 will be actuated to force the charge of gas between the cap and the upper edge of the container, as shown in Figure 5. This is accomplished because the stop member 31 moves downwardly and permits the lever 29 to swing downwardly and force piston 21 downwardly. Actuation of pump 19 will be initiated before the sealing head 7 starts to move downwardly due to the pin and slot connection 4a. Piston 21 will force the gas, which has been previously drawn into cylinder 20, through the outlet opening 23, through conduit 18, and finally into the sealing head through the passageway 13. The switch 32 is so arranged that substantially at the instant when the piston 21 reaches its lowermost position and the flow of gas through the passageway 13 stops, the contacts thereof are moved together, causing the spark plug 14 to produce its spark. This will ignite the charge of gas within the sealing head and in the space between the cap and the contents of the container. At the instant the charge is ignited the cap will have moved downwardly almost into sealing position, as indicated in Figure 6. Almost instantaneously after ignition of the charge, the sealing head reaches its lowermost position, as indicated in Figure 7, where the cap is sealed on the container. The treadle 5 may then be released and the sealing head will move upwardly to its original position. When the rod 4 moves upwardly, the lever 29 is swung upwardly, opening switch 32 and drawing the piston 21 upwardly. This will cause another charge of gas to be drawn into the cylinder 20 through the inlet 27.

Thus, during downward movement of the rod 4, the combustible gas is first injected into the upper end of the container beneath the cap, the gas is ignited and the cap is sealed on the container. These three operations occur progressively and almost simultaneously. Ignition of the gas functions to produce an effective vac-

uum in the upper end of the container and also to sterilize the upper end of the container and the cap, as previously explained.

The duration of the flame or combustion and the heat of combustion may be controlled by regulation of the ratio of the air and gas, as previously explained. The amount of gas and air mixture injected into and around the upper end of the container may be readily controlled, such as by regulation of the stroke of the piston. Various gases may be employed but, as previously stated, I prefer to use a hydrocarbon gas. For example, I may employ natural gas.

It will be apparent from the above description that I have provided a simple and economical method for vacuumizing and sealing containers. Many advantages of this method have been discussed herein and others will be apparent.

Having thus described my invention, what I claim is:

1. A method of closing and sealing a container which comprises providing a closure member in spaced relationship to the container, supplying a charge of combustible gas into the container so that it will mix with the air therein, igniting the combustible gas and air mixture so produced, and sealing the closure member on the container.

2. A method of closing and sealing a container which comprises supplying a charge of combustible gas into the container so that it will mix with the air therein, igniting the combustible gas and air mixtures so produced and then sealing the container.

3. A method of closing and sealing a container which comprises progressively supplying a charge of combustible gas into the container so that it will mix with the air therein, igniting the combustible gas and air mixture so produced, and sealing the container with a suitable closure.

4. A method of closing and sealing a container having an open upper end which comprises associating a closure member in spaced relationship to the upper end thereof, and then progressively supplying gas between the closure member and the upper end of the container so that it will mix with the air in the space beneath the closure member, igniting the combustible gas and air mixture so produced, and sealing the closure member in position on the container.

5. A method of closing and sealing a container which comprises progressively and substantially instantaneously supplying a combustible hydrocarbon gas into the container so that it will mix with the air therein, igniting the gas and air mixture so produced, and sealing the container with a suitable closure.

6. A method of closing and sealing a container which has been almost filled with material which comprises supplying a charge of combustible gas in association with the upper end of the container so that it will mix with the air adjacent

thereto, igniting the gas and air mixture so produced, and immediately sealing the container with a suitable closure.

7. Apparatus for closing and sealing a container comprising means for supplying a charge of combustible gas into the container so that it will mix with the air therein, means for igniting the gas and air mixture so produced, and means for substantially instantaneously sealing the container with a suitable closure.

8. Apparatus for closing and sealing a container which comprises means for holding a cap in spaced relationship to the upper end of the container, means for supplying a charge of combustible gas into the container so that it will mix with the air therein, means for igniting the combustible gas and air mixture so produced, and means for forcing the cap downwardly on the upper end of the container.

9. Apparatus for closing and sealing a container comprising means for holding a cap in spaced relationship to the upper end of the container, and means for progressively forcing a charge of combustible gas between the cap and the upper end of the container so that it will mix with the air beneath the cap, igniting the air and gas mixture so produced and forcing the cap downwardly on the upper end of the container.

10. Apparatus for closing and sealing a container comprising a sealing head, means associated with said sealing head for holding a cap in spaced relationship to the upper end of said container, means associated with the sealing head for forcing a charge of gas between the cap and the upper end of the container, means associated with the sealing head for igniting said charge, and means for moving said container and said sealing head axially relative to each other to force the cap on the container.

11. Apparatus for closing and sealing a container comprising a sealing head, means associated with said sealing head for holding a cap in spaced relationship to the upper end of said container, means associated with said sealing head for supplying a charge of gas adjacent the upper end of the container, means associated with the sealing head for igniting said charge, and means for moving said container and said sealing head axially relative to each other to force the cap on the container.

12. A method of sealing and preserving packaged material which comprises charging the air within and about the open mouth of a container with a combustible gas to form a combustible mixture, igniting said combustible mixture, permitting the burning gases to expand, and sealing the container when the expansion is substantially complete.

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