(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 008 886**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 79301622.1

(22) Date of filing: 10.08.79

(51) Int. Cl.³: B 67 C 3/22
B 65 B 31/04

(30) Priority: 17.08.78 GB 3370878

(43) Date of publication of application: 19.03.80 Bulletin 80/6

(84) Designated Contracting States: BE DE FR GB IT NL

(71) Applicant: ARTHUR GUINNESS SON & COMPANY (DUBLIN) LIMITED
St. James's Gate Brewery St. James's Gate
Dublin 4(IE)

(72) Inventor: Hildebrand, Peter Cedric Roy
4 Orchard Grove
Newcastle, Co. Dublin(IE)

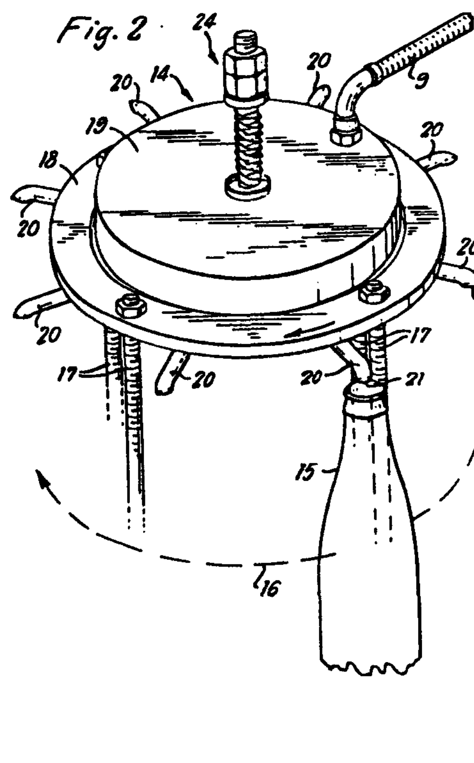
(72) Inventor: Hildebrand, Seward Harold
Estoril Sol Rooske Road
Dunboyne, Co. Meath(IE)

(74) Representative: Walters, Frederick James et al,
URQUHART-DYKES & LORD 11th Floor St. Martin's
House 140 Tottenham Court Road
London W1P 0JN(GB)

(54) **Method and apparatus for manufacturing packaged beverages and packages manufactured by such method.**

(57) A method of and apparatus for manufacturing a beverage package such as a bottle, carton or can containing beer, lager, ale, or stout. To alleviate contamination of the beverage in the sealed package by oxygen, the headspace of the container is filled prior to sealing of the container, with a froth or foam formed remotely from the container by the (or a different) beverage and carbon dioxide and/or an inert gas such as nitrogen. The froth or foam is fed into the headspace of the containers (15) between the beverage filling and sealing stations by way of outlets (21) forming part of a rotary valve (14). The containers (15) are moved sequentially along a circular path (16) by a star wheel; a plate (19) of the valve (14) is carried on struts (17) by, and to rotate in unison with, the starwheel and relative to a fixed plate (19) of the valve. Relative rotation between the plates (18) and (19) controls the valve to determine the flow of preformed froth or foam from a supply conduit (9) to the outlets (21) which are carried by and rotate with the plate (18). Preferably the valve is arranged so that the froth or foam is delivered to the containers (15) only while such containers are located on the starwheel below the respective outlets (21).

Fig. 2



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DESCRIPTION

This invention relates to a method of, and apparatus for, packaging a beverage package (as hereinafter defined).

By the term "beverage package" as used throughout this Specification is meant a container such as a bottle, a can, or a carton in which a relatively small quantity of a beverage is sealed from atmosphere (as compared with a bulk quantity beverage container such as a beer keg) and by which the beverage may be transported, shelf stored and dispensed into a drinking vessel by manual pouring directly from the container.

In the conventional packaging of a beverage package the container is charged with a metered quantity of the beverage and to alleviate wastage of the beverage by spillage from the container it is usual to provide a headspace. A headspace is also desirable to permit expansion of the beverage in the sealed container, for example, during pasteurisation of beer, where the lack of a headspace can result in bursting or deformation of the container. It is also desirable to provide headspaces to accommodate different volumes of the beverage due to inaccuracies in filling machines. Prior to sealing of the container it is usual for the headspace to be open to atmosphere so that when the container is sealed the headspace can contain oxygen present in the atmosphere. For many types of beverages and especially in the case of fermented liquor such as beer, lager, ale or stout any oxygen present in the headspace can react with the beverage in the sealed package.to provide off-flavouring which, when the beverage is consumed, may be readily discernible to the educated palate.

In an attempt to alleviate the aforementioned difficulty of oxygen contamination it has been proposed to purge the headspace prior to sealing of the container with carbon dioxide (see for example, U.K. Patent No. 538,376) or an inert gas such as nitrogen but this presents the difficulty of ensuring that complete purging of the headspace is being effected. In the case of fermented liquors such as beer, lager, ale or stout, which are capable of forming a head of froth or foam, it has also been proposed to appropriately excite the beverage in the package sufficiently to cause a head of froth or foam to develop in the headspace and thereby expel the air from the container prior to sealing (see, for example, U.K. Patent No. 715,586). This latter technique however can be disadvantageous for many fermented liquors where the frothing or foaming can lead to a serious loss of certain dissolved gases in the beverage (particularly nitrogen in the case of nitrogenated beverages) prior to sealing. By use of these previously proposed techniques it will be apparent that the physical characteristics and possibly the flavouring of the beverage can be adversely affected when the beverage is eventually presented for consumption.

It is an object of the present invention to provide a method of, and apparatus for, packaging a beverage package and which will alleviate the problem previously discussed of contamination of the beverage by oxygen in the headspace and which will also alleviate the aforementioned disadvantages associated with the previously discussed proposals for overcoming this problem.

According to the present invention there is provided a method of packaging a beverage package (as hereinbefore defined) which comprises charging the container with the beverage to provide a headspace and charging the container with a pre-formed froth or foam substantially to fill the headspace, said froth or foam comprising carbon dioxide and/or an inert gas (as hereinafter defined) and the, or a further, beverage, and sealing the container.

Although for some beverages, for example, non-gasified beverages such as fruit juice, the container can be charged with the froth or foam prior to, or simultaneously with, the container being charged with the beverage, it is preferred, for example in the case of gasified beverages, that the container is first charged with the beverage to form the headspace and thereafter the headspace is charged with the froth or foam. Further according to the present invention therefore, there is provided a method of packaging a beverage package (as hereinbefore defined) which comprises charging the container with the beverage to provide a headspace; pre-forming a froth or foam with the, or a further, beverage and carbon dioxide and/or an inert gas (as hereinafter defined) at a position remote from the container; charging the headspace of the container with said froth or foam so that the headspace is substantially filled with said froth or foam and sealing the container.

Still further according to the present invention there is provided a beverage package when packaged by the method as specified in either of the two immediately preceding paragraphs.

The invention also provides apparatus for packaging a beverage package (as hereinbefore defined) which comprises beverage charging means by which the container of the package is charged with the beverage to provide a headspace therein; froth or foam charging means by which froth or foam formed of the, or a further beverage, and carbon dioxide and/or an inert gas (as hereinafter defined) remotely from the container is fed into the container for substantially filling the headspace, and sealing means for sealing the container with the beverage and froth or foam contents.

By the preferred method of the present invention, following the metering in of a measured quantity of beverage into the container, the air in the headspace of the container is displaced by the froth or foam which is injected or otherwise fed into the headspace prior to the sealing of the package. To ensure that substantially the whole of the atmospheric oxygen is removed from the headspace prior to the package being sealed it is preferred that the headspace is slightly over-filled with the froth or foam.

The present invention was primarily developed for use in the packaging of a beverage package containing a fermented liquor such as the aforementioned beer, lager, ale or stout and in such cases the froth or foam (also known as "fob") will usually be pre-formed from the same beverage as that with which the container of the package is charged. The invention is however also applicable to the packaging of beverage packages containing non-fermented beverages such as soft drinks.

If required the headspace of the container can be purged with a froth or foam which is pre-formed from a beverage which is different to that with which the container is charged. With this in mind the froth or foam can be formed from a beverage which is intended to provide a particular flavouring or physical (such as colouring) characteristic to the contents of the package when the latter is presented for consumption; for example, to produce a shandy-type beverage, the beverage in the container can be primed with such flavouring agents as are required from the liquid from which the foam or froth is formed.

By the term "inert gas" as used throughout the Specification is meant a gas with the following properties:

(1) It does not itself react chemically with the beverage;

(2) When applied to, or dissolved in, the beverage it does not promote or develop bacteriological reactions;

(3) It is not harmful to the consumer;

(4) It does not impair the normal taste of the beverage.

Preferably the inert gas is nitrogen which has the advantage that it is readily obtainable, generally inexpensive and is non-inflammable. An example of another gas which may be considered suitable for the purposes of the present invention is argon. As previously mentioned, the invention was primarily developed for the packaging of a beverage package of beer, lager, ale or stout and in such case it is preferred that the froth or foam is formed of carbon dioxide and/or an inert gas of which the latter has the following properties (which are additional to those which are previously mentioned) that, as compared with carbon dioxide,

(a) It is relatively insoluble in fermented liquor, for example in the order of less than 5% by volume as compared with 100% for carbon dioxide gas at 15°C.

(b) It does not have a large effect on the size of head of froth or foam for a given pressure change of dissolved gases ("size of head" being the volume of froth or foam initially present on the top of the beverage in an open topped vessel after the beverage has been dispensed into the vessel and the head has been formed).

For packages containing nitrogenated beverage it is preferred, particularly with fermented liquors, that the froth or foam which is applied to purge the headspace of the beverage package is formed of nitrogen.

The presence of a particular gas in solution influences, to a certain extent, the flavour charactertistic of the beverage when dispensed. This is particularly true of stout where there is a major difference in quality between stout with a carbon dioxide content above 2.0 vols./vol. which is dispensed from a sealed package such as a can or bottle (where the head is predominantly formed by release of carbon dioxide) and similar stout containing dissolved nitrogen and with a carbon dioxide content in the range of 0.8 to 1.8 vols./vol. of beer which is dispensed in draught form from a keg pressurised with nitrogen and carbon dioxide (where the head formation is assisted and greatly improved in smoothness of texture by nitrogen release). For the avoidance of doubt the units "vols./vol." are the number of volumes of gas which are dissolved in a unit volume of beverage at a pressure of 760 millimetres of mercury and at a temperature of 15.6°C. The aforementioned difference in quality is particularly discernible in the case of the froth or foam which develops on the beverage.

In recently developed beverage packages of fermented liquor, particularly stout, the beverage contains both carbon dioxide and nitrogen with the former present to considerably lesser extent than that normally encountered in wholly carbonated bottles or canned stout and typically in the aforementioned range of 0.8 to 1.8 vols./vol. By this development of providing stout in a beverage package with a low carbon dioxide and nitrogen content such stout dispensed from the package may be expected to have substantially the same flavour and appearance characteristics as if that beverage had been dispensed in draught form from bulk containers by use of carbon dioxide and/or nitrogen under pressure. With such a package however it is necessary, after opening of the container, to subject the stout to an excitation medium or means (such as ultrasonic vibration) in order to stimulate the liquor to cause the excess dissolved nitrogen and excess dissolved carbon dioxide to be liberated and provide a desirable head of froth or foam on the stout. The stout in such a beverage package is likely to be subjected to oxidised off-flavouring in the event that the headspace in the package is not purged of oxygen prior to the package being sealed and this purging of the headspace will usually be carried out by use of froth or foam which is produced from similar stout and nitrogen gas. It is advisable however to ensure that the carbon dioxide content in the froth or foam in the headspace of the package is low, say, in the order of, or less than, 0.1 vols./vol.; this is because dissolved carbon dioxide in the liquid fraction rapidly diffuses into the gaseous fraction of the froth or foam and thus reduces the partial pressure of the gaseous nitrogen of the foam upon sealing of the package and this would result in low nitrogen levels for example, less than 0.02 vols./vol., upon eventual dispensing of the beverage from the package (and consequently an undesirable variation in the physical and flavour characteristics of the stout). To alleviate this it is desirable to ensure that the froth or foam is formed with a high concentration of nitrogen - thereby reducing release of dissolved nitrogen from the beverage to the headspace as the contents of the package come into equilibrium after sealing; this can be achieved by preparing the froth or foam from stout having a low carbon dioxide concentration. Consequently, it may be desirable to subject the stout which is used in the formation of the froth or foam to decarbonation, such decarbonation can be achieved for example, by subjecting the stout to high shear forces to liberate the carbon dioxide while mixing it with appropriate quantities of gaseous nitrogen. From the aforegoing it will be realised that in addition to the general advantage of substantially eliminating air from the headspace of a beverage package prior to sealing of the package, the invention can provide the additional advantages for packages containing gasified beverages: firstly it can be ensured that the headspace is filled, substantially, with a froth or foam formed by a gas of a known and desired nature (particularly nitrogen in the case of a nitrogenated beer or stout), and secondly after sealing of the package and when the contents come into equilibrium and the froth or foam settles, the size of the headspace will be reduced which will cause a reduction in the loss of dissolved gases (particularly nitrogen in a nitrogenated beverage as aforementioned) into the headspace.

The present invention can be applied to conventional apparatus for charging containers with predetermined quantities of the beverage by incorporating with such apparatus a froth or foam charging device by which a dollop or stream of froth or foam is fed into the container, preferably to fill a pre-formed headspace, prior to the container passing through the apparatus for appropriate sealing. For mass production purposes the froth or foam charging device can include a multi foam outlet or manifold which is sited over an array of packages previously charged with the beverage so that the headspaces of such containers in the array are simultaneously filled with froth or foam dispensed from the manifold. In the event that the containers are moved continuously on a conveyor then the manifold dispenser can be arranged to move in sequence therewith to ensure that the headspace of each package is adequately charged.

One embodiment of the present invention will now be described, by way of example only, with reference to the accompanying illustrative drawings, in which:-

Figure 1 diagrammatically illustrates apparatus for producing froth or foam for purging the headspace in a container of a beverage package;

Figure 2 diagrammatically illustrates a perspective view of a froth or foam charging device by which foam is dispensed into the headspace of beverage package containers;

Figure 3 is a side view of the device shown in Figure 2;

Figure 4 is a perspective view of a base plate of the device in Figure 2;

Figure 5 is a perspective view of a valve plate of the device in Figure 2, and

Figure 6 diagrammatically illustrates further apparatus for producing froth or foam and which is available as an alternative froth or foam forming means to that shown in Figure 1.

The present example will be considered as applied to the packaging of beverage packages in the form of bottles containing stout having in solution therewith a mixture of nitrogen and carbon dioxide, the former being present typically in the range 0.015 to 0.055 vols./vol., and the carbon dioxide being present typically in the range of 0.8 to 1.8 vols./vol. Such stout is passed through conventional bottle filling apparatus (not shown) to charge each bottle with an appropriately metered quantity of the stout. After charging of the bottles a headspace remains which headspace is open to atmosphere and which is to be purged with a froth or foam prepared from the beverage remotely from the bottle and by use of nitrogen gas.

The purging froth or foam is derived from stout which is the same as that with which the bottles are charged. However, in view of the particular characteristics of the stout in the charged bottles it has been found desirable, for reasons which have previously been discussed, to subject the stout used in the formation of the froth or foam to a decarbonation process since the presence of carbon dioxide in the froth or foam in the headspace of the container dilutes the concentration of nitrogen in the froth or foam which can result in low nitrogen levels (say less than 2% by volume) when the stout is eventually at equilibrium and presented for consumption (so that the physical and flavour characteristics of the stout may be adversely affected). To demonstrate this, assume that a 290 mls. bottle is to be charged with stout and foam so that, after settling, the bottle contains 284 mls. and a 6 ml. headspace and that the stout with which the bottle is charged originally contains 3.5% nitrogen and 130% carbon dioxide (by volume). If the headspace is charged with foam formed from carbonated stout then it can be assumed that, using stout at 15.5°C with a dissolved carbon dioxide content of 1 vol./vol. and sufficient nitrogen to produce a foam of 67% liquid, each 1 ml. of foam would consist of 0.667 mls. stout (containing 0.004 mls of dissolved nitrogen), 0.111 mls. of gaseous nitrogen and 0.222 mls. of gaseous carbon dioxide. When the headspace has been filled with such foam and the container sealed, then after the contents come into equilibrium at 10°C it will be found that the stout in the bottle will contain approximately 1.96% (by volume) of nitrogen. In comparison with this if the headspace is charged with foam formed from decarbonated stout then it can be assumed that, using stout at 15.5°C with a dissolved carbon dioxide content of 0.1 vols./vol. and sufficient gaseous nitrogen to produce a foam of 67% liquid, each 1 ml. of foam would consist of 0.667 mls. stout (containing 0.011 mls. of dissolved nitrogen), 0.311 mls. of gaseous nitrogen and 0.022 mls. of gaseous carbon dioxide. When, alternatively, the aforementioned headspace has been filled with this latter foam and the container sealed, then after the contents come into equilibrium at 10°C it will be found that the stout in the bottle will contain approximately 2.60%(by volume) of nitrogen.

As an example of decarbonating the stout which is intended for use in the formation of the purging froth or foam, five barrels of the stout (one barrel being approximately 5.8 cubic feet) containing approximately one volume of carbon dioxide was circulated through a mixer at a rate of approximately forty barrels per hour for twenty minutes. Within the mixer the stout was subjected to high shear forces and to this was added and mixed approximately ten barrels of gaseous nitrogen to form a fob of froth or foam constituted by a bubble size of less than two millimetres diameter. The fob resulting from this process filled a twenty barrel tank which was maintained at atmospheric pressure. When the fob had subsided (after an appropriate delay of a few hours) the process was repeated and following a further delay after such repetition and when the fob had subsided the decarbonated stout 1 was stored in a keg 2 (see Figure 1). By subjecting the stout to decarbonation its carbon dioxide level was reduced to approximately 0.1 vols./vol. while its nitrogen content was approximately 0.018 vols./vol. The keg 2 of decarbonated stout 1 was then fitted to the froth or foam charging system of the beverage package manufacturing apparatus. In such system a cap 3 is in sealed engagement with the outlet of the keg 2 and communicates with a branch pipe 4 of a feed pipe 5. The pipe 5 is intended to communicate with a source of gaseous nitrogen at approximately 45 lbs per square inch (3170 gramms per square centimetre) (Absolute). Such gaseous nitrogen is fed through the pipes 5 and 4 and the cap 3 into the headspace 6 within the keg 2 to expel the decarbonated stout 1 through a riser pipe 7 which extends upwardly from the keg through the cap 3 to communicate with pipes 8 and 9 of which the former communicates with, and is effectively an extension of, the nitrogen feed pipe 5 and the latter provides a source of froth or foam. Adjustable pressure or flow control valves 10, 11 and 12 are respectively provided in the pipes 7, 8 and 9 and a pressure gauge 13 is provided to indicate the pressure in the piping between the valves 11 and 12. The valve 11 is of the needle type and nitrogen from the pipe 5 passes through this valve into a mixing region or chamber formed within the pipes 7, 8 and 9 between the aforementioned three valves. Within this mixing region pressure is maintained at approximately 33 lbs per square inch (2325 gramms per square centimetre) (Absolute) by valve 12. Stout 1 is displaced upwardly through the riser pipe 7 and enters the mixing region by way of valve 10 to encounter the nitrogen from pipe 5 and in so doing a froth with bubbles of relatively large diameter is formed in the mixing region by admixture of the stout with the nitrogen. The pipe 9 is open to atmospheric pressure and consequently the stout in passing through valve 12 is subjected to a pressure drop of approximately 18 lbs per square inch (1268 gramms per square centimetre) which causes a reduction in the diameter of the nitrogen bubbles which develop the froth or foam in the mixing region. This latter reduction in bubble diameter results from the shear forces to which the froth is subjected in passing through the valve 12 and possibly a cavitation effect on the stout in the valve 12. By adjusting the valves 10, 11 and 12 it is possible to control the volume of the froth or foam which is produced per second and also to control the stout to nitrogen ratio (that is the nitrogen which is derived from the pipe 8) from, for example, approximately 30% stout to approaching 100% stout (a ratio of approximately 60% stout to 40% nitrogen has been found most convenient to provide a suitable purging froth or foam).

The froth or foam derived from the pipe 9 is fed through that pipe to a froth charging device shown at 14 in Figure 2. The charging device 14 is located in the stout bottling line at a position between a first station where the bottles 15 are charged sequentially with a metered quantity of stout to provide the headspace and a bottle capping or sealing station. More particularly, in passing between the aforementioned stations by conventional transfer means (such as rotors or endless conveyors) the bottles 15 are moved along a horizontal and part circular path indicated at 16 by a star wheel (not shown) which rotates about a vertical axis to convey the bottles in a predetermined spaced array through a second station. Located at this second station is the froth charging device 14 which is carried by, and above, the star wheel on struts 17. The struts 17 communicate between the star wheel and a base plate in the form of a stainless steel disc 18 of the device 14 so that such disc rotates in unison with the star wheel. Mounted above the disc 18 to be concentric and in face-to-face abutment therewith is a circular valve plate 19 which is to be retained stationary and relative to which the disc 18 is to rotate. To facilitate relative sliding movement between the abutting faces of the plates 18 and 19, the plate 19 is preferably formed of polytetrafluoroethylene. As shown in Figures 3 and 4 the disc 18 carries a peripherally spaced array of radially extending foam discharge pipes 20, the outer ends 21 of which provide foam outlets while the inner ends 22 communicate with the upper surface of the disc 18 in a circumferentially spaced array which is concentric with the disc 18. The surface of the valve plate 19 which is in sliding abutment with the upper surface of the disc 18 is provided with a channel 23 which is of part annular shape in the plane of the plate 19 and is concentric with the disc 18. In particular the channel 23 is located in the plate 19 so that it overlies the circular path along which the inner ends 22 of the pipes 20 move during relative rotation between the disc 18 and the plate 19. The channel 23 communicates with the pipe 9 which pipe conveniently serves to secure the plate 19 stationary relative to the rotating disc 18. The co-operating disc 18 and plate 19 constitute a valve whereby as the inner ends 22 move into communication with the channel 23 during relative rotation between the aforementioned disc and plate, froth which is fed through the pipe 9 into the channel 23 can pass through the discharge pipes 20 for so long as the inner ends 22 of these discharge pipes communicate with the channel 23. As the inner ends 22 of the discharge pipes move out of communication with the channel 23 then froth discharge is shut off. Consequently by phasing the transfer of the bottles 15 to synchronise with the rotational movements of the outer ends 21 of the delivery pipes 20 so that the mouth of a bottle is located under each outer end 21 of a pipe 20 while the inner end of that pipe communicates with the channel 23, froth or foam will be delivered into the headspace of the bottle. To avoid wastage of the froth it is preferred that the mouth of each bottle will move on to the star wheel into a position beneath the outer end of a pipe 20 before the inner end of that pipe moves into communication with the channel 23 and that the inner end of the pipe 20 will move out of communication with the channel 23 before the bottle is removed from below the outer end 21 of that delivery pipe; it will of course be realised that the rate of delivery of the froth or foam to the discharge pipes 20 and the period of such delivery are arranged to just fill, or slightly over-fill, the headspace of the bottles.

To provide sealing between the sliding faces of the disc 18 and plate 19 the latter is spring loaded as shown at 24 into abutment with the disc 18 (it is possible however that some stout will leak between the abutting surfaces but this will conveniently serve as a lubricant.

Following purging of the headspaces in the bottles 15 by the froth or foam dispensed through the pipes 20 the bottles are passed to a sealing station where they are crowned in conventional manner.

As mentioned above there is a reduction in the diameter of the bubbles which develop the froth or foam as the stout passes through the valve 12 and a relatively small bubble diameter is desirable to alleviate the likelihood of the bubbles in the froth or foam prematurely obturating the mouths of the bottle necks as the froth or foam is dispensed into the headspaces.

With the alternative form of froth or foam forming means shown in Figure 6 the decarbonated stout 1 prepared as previously described is stored in a tank or receiver (not shown) from which it is fed at approximately 30 lbs per square inch (2100 gramms per square centimetre) (Absolute) by way of a passage 25 and an adjustable flow valve 26 to a venturi device 27 where the decarbonated stout entrains and mixes with nitrogen gas to form the required foam or fob. Low pressure nitrogen gas is fed to the venturi device 27 by way of a passage 28 from an inlet 29. The foam or fob passes from the venturi device 27 through a passage 30 and by way of a second adjustable flow valve 31 to be fed to the charging device 14 through pipe 9 as shown in Figure 2.

The flow control valve 26 controls the overall flow of decarbonated stout to the froth or foam forming means and thereby the rate or volume per second at which foam or fob is produced. The second flow control valve 31 serves two functions: a) to develop a back pressure and thereby reduce the venturi generated suction on the nitrogen gas supply; by progressively closing the valve 31 it is possible to increase the percentage of stout in the foam or fob typically from 40% to approaching 100% (a foam or fob with a ratio of approximately 60% stout to 40% nitrogen has been found most convenient to provide suitable purging of, and reduction of the volume of, the headspace) and b) to provide a pressure drop to the foam or fob in passing through the valve 31 which acts to reduce the size of the bubbles produced in the fob which latter aids smooth filling of the bottle headspace.

With this alternative froth or foam forming means it will be usual for an excess of nitrogen gas to be supplied through inlet 29, the venturi device 27 however will only use the amount of such gas as is required by fob flow rate and the gas to stout ratio (which is determined by the control valve 31 and the stout flow control valve 26) and excess nitrogen gas passes from the inlet 29 by way of an open ended branch pipe 32 to bubble through water 33 in a transparent container 34. The water and container 34 provides a convenient means of accurately controlling the nitrogen pressure irrespective of varying flow demands. It also acts as a visual method from which the nitrogen flow from its supply can be assessed and on which basis such flow can be adjusted as required.

If required the control valve 31 can be left at a predetermined setting while only the stout flow control valve 26 is adjusted as necessary by an operator during bottling to achieve complete filling of the bottle headspace with fob. It has been found that changing the flow rate of stout into the venturi device 27 by the valve 26 by even a factor of three has very little effect on the ratio of stout to gas in the froth or foam which is derived from pipe 9.

CLAIMS

1. A method of packaging a beverage package (as herein defined) which comprises charging the container with the beverage to provide a headspace and charging the container with a preformed froth or foam substantially to fill the headspace, said froth or foam comprising carbon dioxide and/or an inert gas (as herein defined) and the, or a further, beverage and sealing the container.

2. A method as claimed in claim 1 which comprises charging the container with said froth or foam prior to the completion of the charging of the container with the beverage.

3. A method of packaging a beverage package (as herein defined) which comprises charging the container with the beverage to provide a headspace; pre-forming a froth or foam with the, or a further, beverage and carbon dioxide and/or an inert gas (as herein defined) at a position remote from the container; charging the headspace of the container with said froth or foam so that the headspace is substantially filled with said froth or foam and sealing the container.

4. A method as claimed in claim 3 in which the beverage is a fermented liquor.

5. A method as claimed in either claim 3 or claim 4 in which the beverage is nitrogenated and the froth or foam with which the headspace is charged is pre-formed with nitrogen gas and beverage which has been subjected to a decarbonation process.

6. A method as claimed in any one of claims 3 to 5 in which the beverage with which the container is charged has in solution therewith a mixture of nitrogen and carbon dioxide, the former being present in the range 0.015 to 0.055 vols./vol. and the latter being present in the range 0.8 to 1.8 vols./vol.

7. Apparatus for packaging a beverage package (as herein defined) which comprises beverage charging means by which the container of the package is charged with the beverage to provide a headspace therein; froth or foam charging means by which froth or foam formed of the, or a further, beverage, and carbon dioxide and/or an inert gas (as herein defined) remotely from the container is fed into the container for substantially filling the headspace, and sealing means for sealing the container with the beverage and froth or foam contents.

8. Apparatus as claimed in claim 7 in which transfer means is provided whereby the container is moved sequentially from a first station in which it is charged with a metered quantity of the beverage, to a second station in which the headspace of the container is charged with the froth or foam, and to a third station in which the container is sealed.

9. Apparatus as claimed in claim 8 in which the container is moved continuously through the second station and an outlet is provided through which the froth or foam is fed into the headspace, and wherein

said outlet is moved in sequence with the container during the froth or foam charging operation.

10. Apparatus as claimed in claim 9 in which the transfer means conveys a plurality of containers sequentially and continuously through the second station and a plurality of outlets are provided which move in sequence one with each of said containers and wherein valve means is provided for controlling the flow of froth or foam to the respective outlets to effect charging of the headspace during the period for which the respective outlets move in sequence with the containers which are respectively associated therewith.

11. Apparatus as claimed in any one of claims 8 to 10 in which the containers are conveyed through the second station along a part circular path by a star wheel which rotates about a substantially vertical axis and rotation of said star wheel controls rotary valve means which is coupled thereto, and wherein rotation of part of said valve means by the star wheel determines the flow of the froth or foam to outlets through which the froth or foam is fed into the headspaces of the containers and which outlets are mounted to rotate in unison with the star wheel.

12. Apparatus as claimed in any one of claims 7 to 11 having froth or foam forming means which comprises a beverage reservoir from which beverage is displaced and subjected to carbon dioxide gas and/or an inert gas (as herein defined) under pressure prior to the froth or foam formed thereby being fed into the container.

13. Apparatus as claimed in Claim 12, in which the beverage is displaced from the reservoir to be fed to the headspace by the said carbon dioxide gas and/or inert gas under pressure.

14. Apparatus as claimed in any one of Claims 7 to 11 having froth and foam forming means which comprises venturi means through which beverage is displaced to entrain carbon dioxide gas and/or an inert gas (as herein defined) prior to the froth or foam formed thereby being fed into the container.

15. A beverage package when packaged by the method as claimed in any one of the preceding Claims 1 to 6.

Fig.1

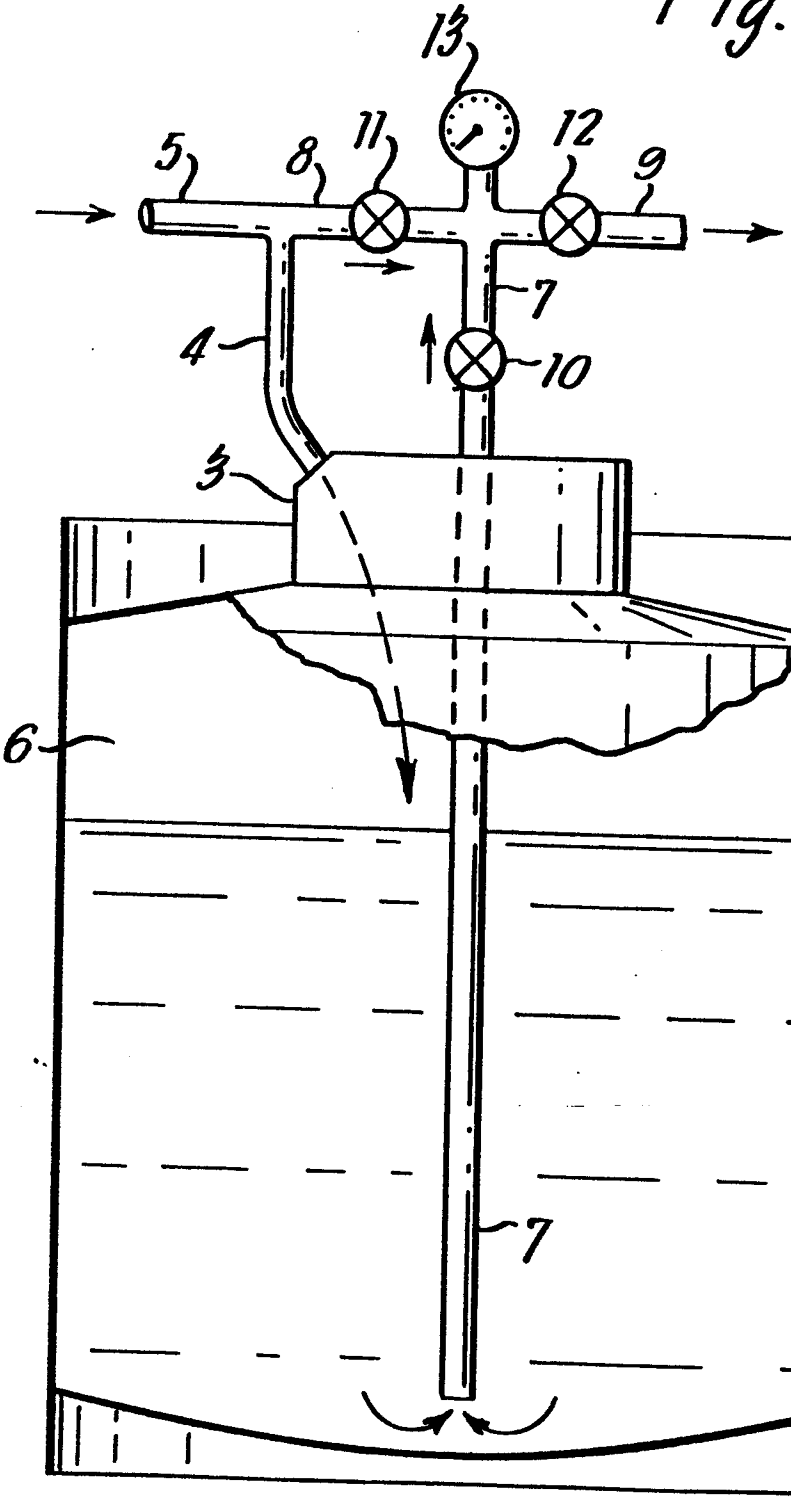


Fig. 2

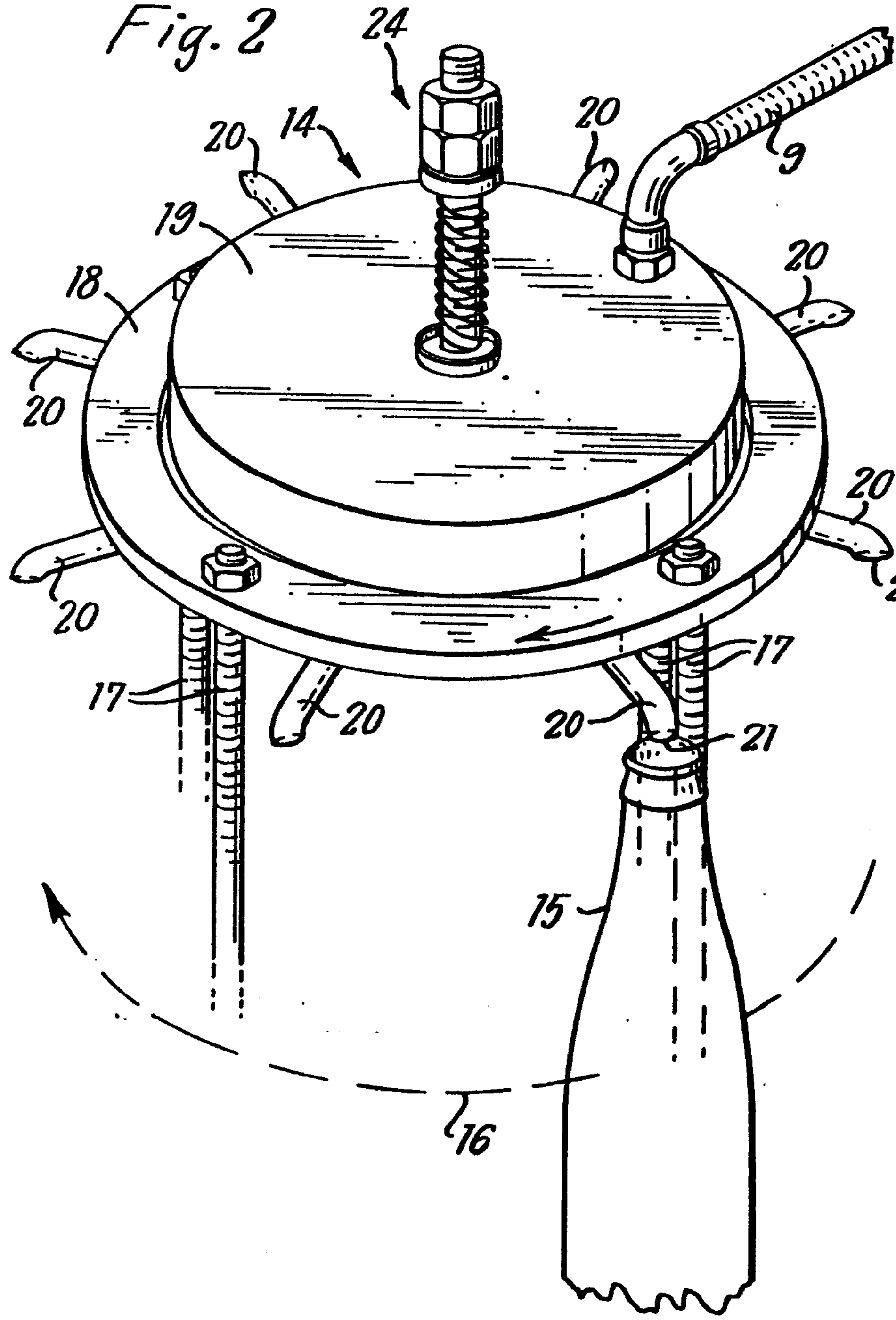


Fig. 3

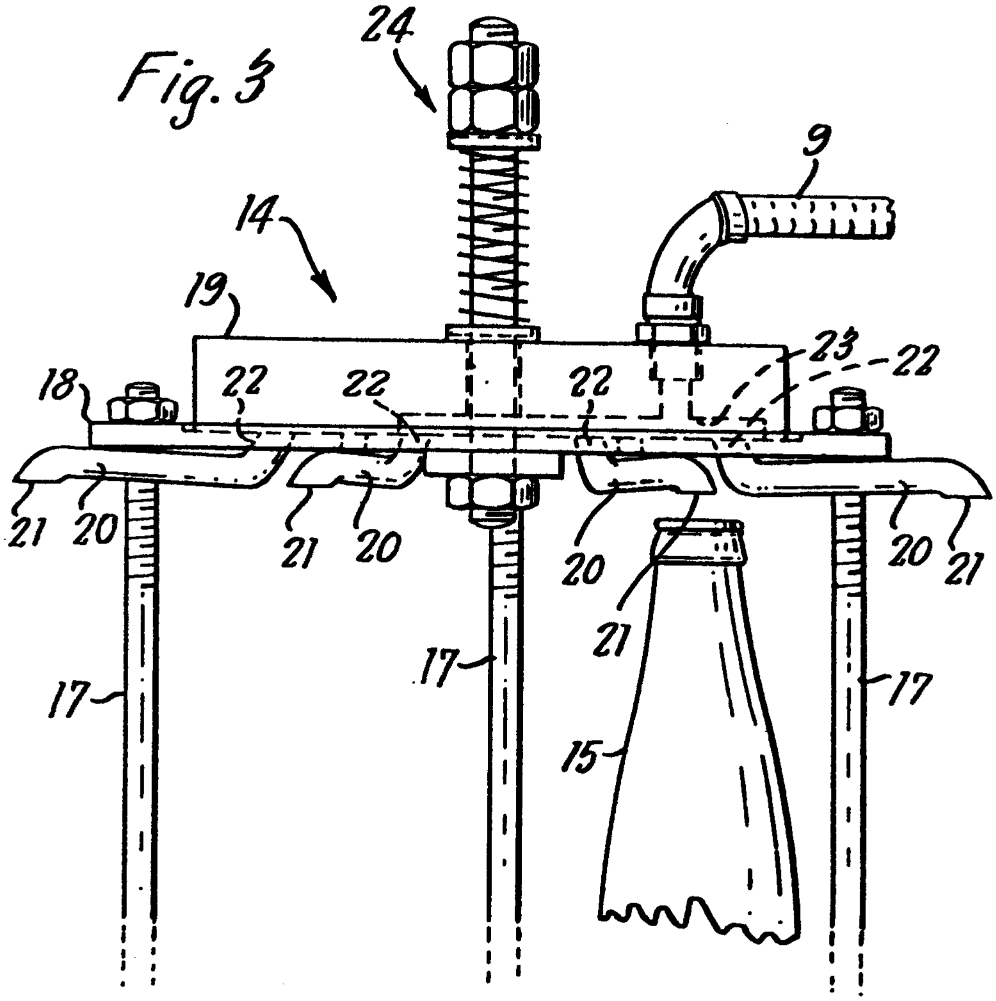


Fig. 4

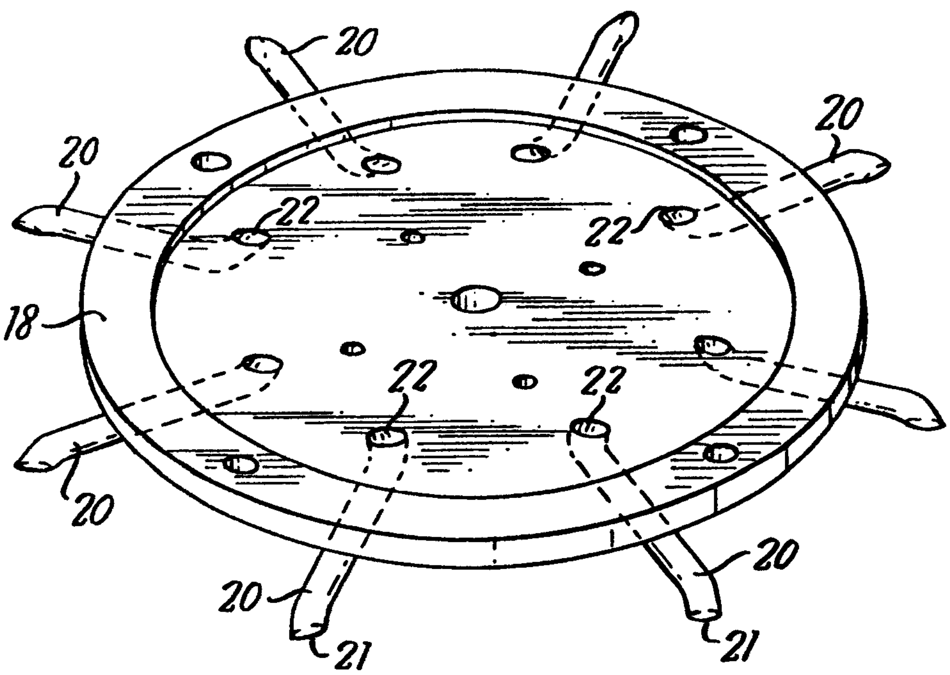
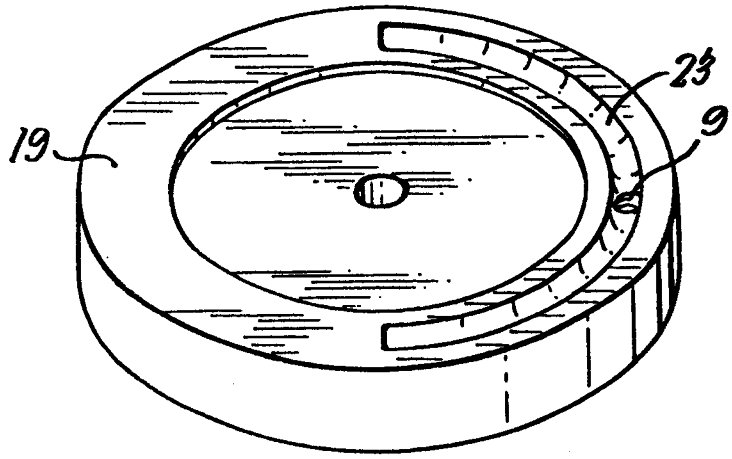


Fig. 5



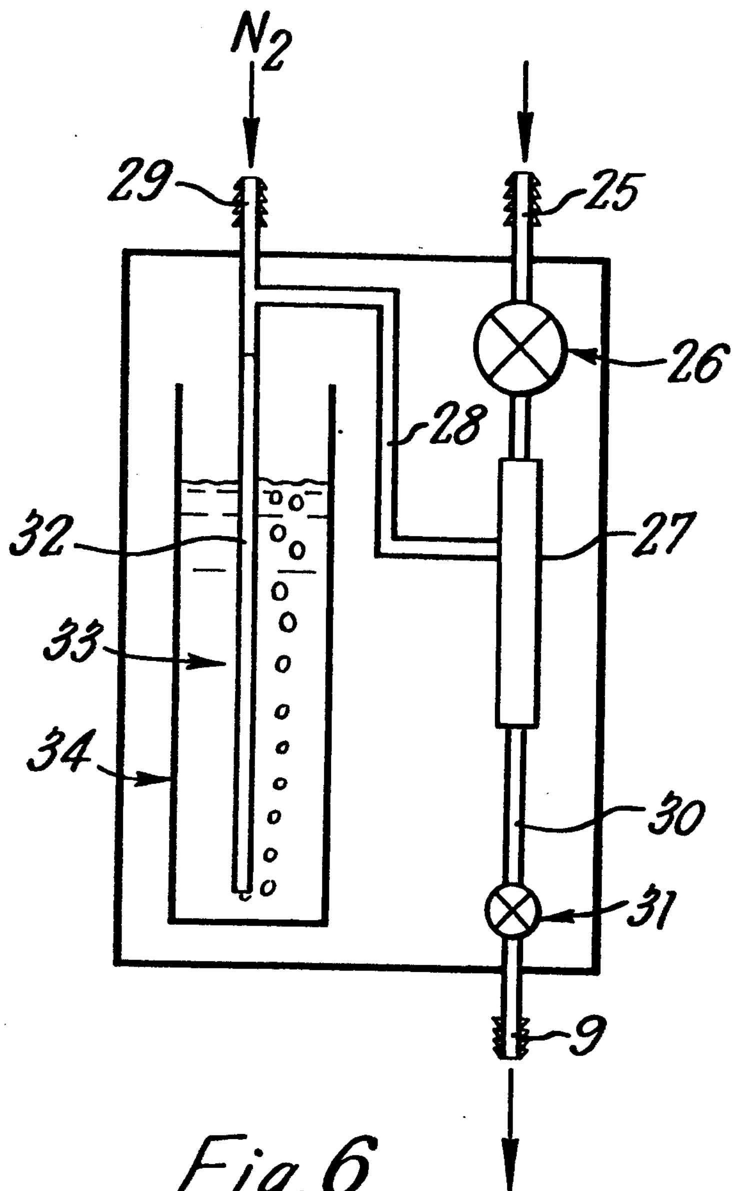


Fig.6

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European Patent Office

Application number EP 79 30 1622

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. [3])
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	US - A - 2 897 851 (N.F.S.) * Column 1, lines 15-21; column 2, line 12 - column 5, line 23; column 6, lines 25-30; figures 1-6 * --	1,3,7 8,9,10 12,13 15	B 67 C 3/22 B 65 B 31/04
	FR - A - 2 289 392 (COPRAL) * Page 2, lines 10-33; figures 1,2 * --	1,3	
			TECHNICAL FIELDS SEARCHED (Int.Cl. [3])
	US - A - 3 406 080 (HUNT) * Column 1, lines 18-21; column 2, line 62 - column 4, line 46; figures * --	1,3	B 67 C B 65 B
	US - A - 2 433 071 (C.C. COMP.) * Column 1, lines 14-19; column 2, line 24 - column 3, line 37; figures * --	1,3,12	
			CATEGORY OF CITED DOCUMENTS
	US - A - 2 267 744 (A.C. COMP.) * Page 2, column 2, line 3 - page 2, column 1, line 68; figures 1-3 * ----	11	X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
X	The present search report has been drawn up for all claims		&: member of the same patent family, corresponding document

Place of search	Date of completion of the search	Examiner
The Hague	13-11-1979	VROMMAN