

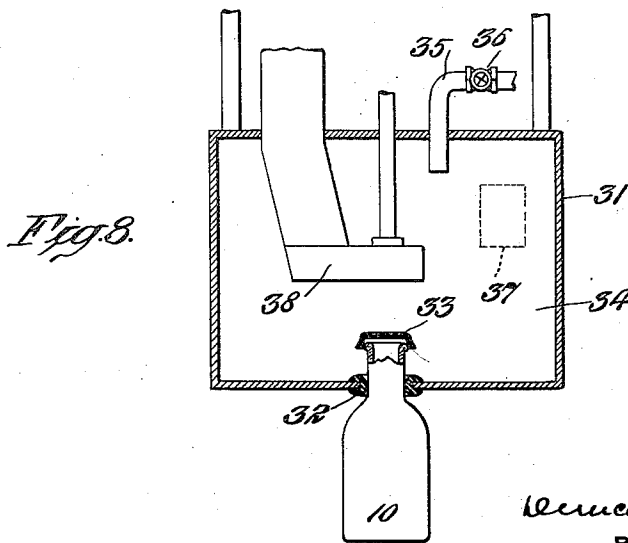
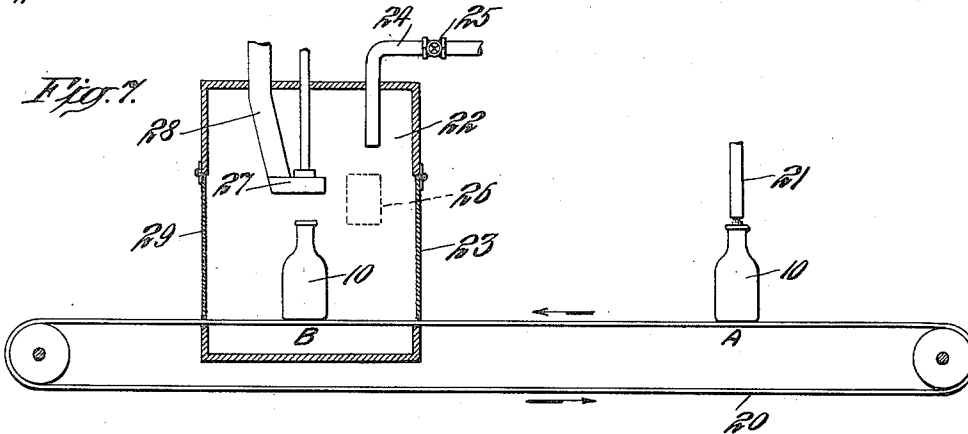
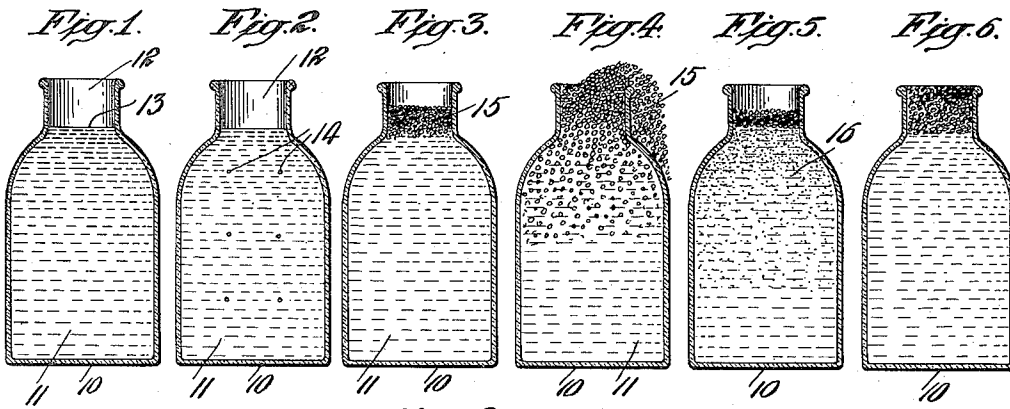
April 19, 1938.

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2,114,964

ART OF PACKAGING BEERS AND ALES

Filed Nov. 19, 1935



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UNITED STATES PATENT OFFICE

2,114,964

ART OF PACKAGING BEERS AND ALES

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Application November 19, 1935, Serial No. 50,528

14 Claims. (Cl. 226—82)

This invention relates to a method of packaging beers and ales.

In packaging beers and ales in bottles, cans or other containers it is customary to leave a head space above the level of the packaged liquid. These head spaces are practically essential if the beer or ale is to be pasteurized after filling and closing in order to allow for expansion of the liquid and gas. In any event they are usually purposely left for convenience in filling and for other reasons. These head spaces contain some air and some carbon dioxide gas and other gases which are freed from the beer or ale during filling. But whatever the relative proportions of air and gas, there is usually present an appreciable amount of air.

It has been found that the presence in closed containers of any substantial amounts of air causes a deterioration in the quality of the beer or ale. For example, the flavor is adversely affected and the appearance is apt to become cloudy. Whether the air present acts directly on the contents or indirectly in the nature of a catalyzer, it is unnecessary to discuss. The fact remains that when air is present in substantial amounts the deterioration above mentioned sooner or later takes place.

In an effort to avoid these objectionable results, various expedients have been proposed for eliminating air in head spaces of containers. For example, it has been proposed to shake or agitate the filled container to cause foaming, the theory being that the foam rising in the container would displace the air. This method, however, has not proved satisfactory. The amount of foaming cannot be controlled, with the result that there is either too little foaming, permitting most of the air to remain, or there is an excess of foaming, causing an overflow and resulting in loss of beer, decarbonation and undesirably sloppy bottling conditions. Moreover, if the foaming is too sudden or too violent at the first rush of foam, as is usually the case with this uncontrollable agitation, the foam entraps head space air so that a substantial amount of air remains in the foam in the form of bubbles and so remains in the container after closing. The results, therefore, are at best extremely uncertain and there is an undesirable lack of uniformity.

This lack of uniformity applies both to air content and to degree of decarbonation. Not only do most of the containers after closing still contain considerable air in the head spaces but the amounts of air present in the successive containers of a given run are not uniform. Even

more objectionable is the matter of decarbonation. The amount of CO₂ gas in beer to give proper foaming upon serving must be held within close limits. It follows that the containers of a given run must, to be commercially acceptable, be substantially uniform as to the degree of carbonation and considerable care is taken in bottling to attain this uniformity. But with the method of attempted air removal above referred to, this uniformity is lost. Since the foaming which results from the applied agitation cannot be controlled, not only is there usually an undesirable amount of decarbonation but the decarbonation varies in the successive containers of a given run.

It has also been proposed to squirt small quantities of beer or CO₂ into the filled containers with the same end in view, i. e. to cause foaming and displace the air. Here, again, the results have been unsatisfactory for substantially the same reasons.

It has also been proposed to remove the air from the empty bottle and substitute CO₂ gas before the bottle is filled with the beer or ale. Whether this expedient is for the purpose of avoiding ultimate head space air or for other purposes, it is not necessary to discuss. Whatever benefits may accrue in other respects, the fact remains that this method does not avoid head space air and bottles so packaged are found to contain a considerable and varying quantity of air in the head spaces. This air presumably is drawn into the bottle as the filling nozzle is withdrawn or it may enter in other ways. In any event, the results, as far as the problem of head space air is concerned, are unsatisfactory.

It is an object of the present invention to provide a novel, simple and effective method of packaging beers and ales such that the undesirable effects of air in the head spaces of closed containers are avoided, or substantially so, whereby the original flavor, appearance and other characteristics of the beer are preserved.

It is a further object of the invention to provide a method of effectively removing the air content of container head spaces without wasting any beer or ale; without substantial change in the degree of carbonation; and without other deleterious effects on the packaged product or on packaging conditions.

In the drawing,—

Figures 1-4 are vertical sectional views of a bottle of beer or ale, showing schematically and in a somewhat exaggerated manner, the formation of foam and its overflow;

Figure 5 is a similar view showing similarly the clearing of beer after filling;

Figure 6 is a similar view illustrating similarly the removal of head space air in accordance with the present invention;

Figure 7 is a diagrammatic view of apparatus suitable for carrying out the invention, and

Figure 8 is a similar view of a modified form of apparatus.

For convenience, the invention is here described, for the most part, as related to beer packaged in ordinary glass bottles. But it is to be understood that the invention is applicable to beers and ales in general and to bottles, cans, kegs and any other containers suitable for beers and ales. In this connection it is noted that the above mentioned disadvantages resulting from the presence of head space air and the objections to the attempted methods of air removal are equally applicable to beer packaged in cans. Moreover, the more air present, the stronger must the cans be made because of the considerable increase in air pressure under pasteurizing temperatures. It follows that the invention is of particular value in connection with packaging beer in cans because in addition to preserving the original characteristics of the beer, expense can be saved in the manufacture of the cans.

In carrying out the invention in its entirety, bottles are charged with beer in any suitable manner. The filling operation should be so conducted as to cause as little foaming as possible. Some types of fillers cause less foam than others. For example, it is common practice to fill the bottle under a counter-pressure higher than atmospheric pressure to reduce foaming. This, or other types of low-foaming fillers are preferable for reasons that will hereinafter appear.

The quantity of the charge is such that when the inflowing beer finds its liquid level there remains a head space of desired or necessary extent. Subsequently, but under conditions later referred to, the contents of the bottle are subjected to a vacuum to remove the head space air.

It would naturally be assumed that the application of a vacuum to a carbonated liquid such as beer would result in a considerable loss of CO₂ or even in drawing the beer itself out of the container. After long experimentation I have discovered, however, that a vacuum may be applied to beer under such conditions and in such manner as to cause removal of all or most of the head space air without loss of beer and without any substantial decarbonation.

Beer supersaturated with CO₂ gas, as most beers are, is unstable. Because of this unstable condition, when such beer is agitated there is a tendency of the CO₂ gas to escape from the solution. It follows that when a beer that is supersaturated with CO₂ gas is agitated, foam is created. In packaging beer, foam may be caused by the agitation resulting from the inrush or cascading of the beer during filling or by the release of the counter-pressure in the bottle or both. Foam may also be caused by agitation, such as shaking the bottle or otherwise, after filling.

For explanatory and exemplifying purposes, the drawing illustrates schematically the formation of foam in a bottle. Figure 1 shows a bottle 10 filled to normal height with beer 11 and having a head space 12. It is assumed that there is no agitation and, as appears, there is

no foam and the surface 13 of the beer is smooth and unbroken. If there are any internal bubbles these are so insubstantial in size and number as not to be discernible. This condition is termed "black beer" in the art to indicate absence of foam and bubbles. The beer in this condition may be said to be practically if not absolutely quiescent.

If the bottle is slightly agitated, as by tapping or jiggling, bubbles start to rise, such bubbles being indicated at 14 in Figure 2. Parenthetically, it is to be understood that the showings in this and similar views are exaggerated for convenience of illustration.

If the agitation is increased and continued, the force of the rising and accumulating bubbles overcomes the surface tension of the liquid level, the bubbles break through and free foam is formed. The former liquid surface ceases to exist as such and there is an indefinite, uneven dividing line between foam and liquid. This line is not necessarily at the original liquid level and it tends to descend in the container the greater the amount of foam formed. This condition is illustrated in Figure 3, the foam being indicated at 15. Agitation being continued, the whole body of free foam attains a certain amount of motion, presumably from the force of the rising bubbles and formation of additional foam, until the foam rises in the container and overflows (Figure 4). This, of course, results in a loss of beer and in decarbonation. The rise of foam, once started, is usually fairly sudden and cannot, as a rule, be controlled by controlling or even by stopping the agitation.

When a bottle is filled with beer, particularly with machine filling, the swirl of the liquid causes such agitation that the bulk of the beer has more or less of a milk appearance, resulting from the internal foam or bubbles, and there is usually some free foam. If the beer is packaged under counter-pressure, the release of such counter-pressure may add to or prolong this foaming condition. After such release, and after the nozzle, if any, has been removed, if the beer is allowed to remain in a state of rest, without agitation or the like, the liquid soon finds its level and the milky condition of the body of the beer clears fairly rapidly.

During this clearing, there is some internal motion in the beer because of the rise of the bubbles. There is, however, no creation of new foam. The internal bubbles become largely dissipated although there may remain some accumulation, for a time, below the surface. If the rising bubbles break through the surface they do so with too little force or motion to create foam. Figure 5 illustrates this clearing. At the bottom of the bottle is a layer of cleared beer 11. Above that, is a layer of milky beer 16. It will be understood that the beer clears from the bottom upwardly and that the line dividing the cleared and milky layers is rising rapidly. After a short interval, usually a matter of seconds, the internal motion ceases and the beer is entirely cleared, except, possibly, for a slight accumulation of bubbles which may remain for a time adjacent the surface.

In this condition, the contents of the bottle may be said to be in a substantially quiescent state as distinguished from a state in which the beer is under agitation with free foam being formed or is under internal motion. While the beer in this state may not be precisely the "black beer" of Figure 1, it is substantially in the same

condition, at least for the purposes here involved. There is no agitation to cause the creation of new foam. If there is any accumulation of bubbles below the surface, these bubbles are in a state of substantial rest. If there is any free foam above the surface, such foam is in a static state or slowly subsiding.

While the vacuum may be applied under various conditions and while the manner of its application may vary, in carrying out the invention to what is now considered the best advantage, the vacuum is applied in such manner and under such conditions that a major or considerable portion of the head space air is removed without any substantial foaming and thereafter a delayed and controlled rise of foam is utilized to eject the remaining and rarefied air. To this end, the vacuum is preferably applied to the contents of the container when the contents are in a substantially quiescent state. The "black beer" condition of Figure 1 may be considered as the theoretical ideal. This ideal condition, however, is by no means essential and it is sufficient if the beer is substantially quiescent.

I have found that if vacuum is applied when the contents are under agitation or too soon after the cessation of agitation, the tendency of the beer to foam is severely accentuated. This is the case both when the beer is already freely foaming and when, though not freely foaming, it has a substantial amount of internal foam or motion. In either case, the beer is so ready to foam that the application of even a small amount of vacuum causes a sudden and severe foaming. Under such conditions it is difficult, if not impossible, to attain a sufficient removal of air or to control the foaming. As a result of this lack of control, the beer foams out and overflows. This causes the undesirable results above mentioned, namely, entrapped air, decarbonation, loss of beer and unclean bottling conditions. It follows that when vacuum is applied under the conditions just referred to, the results are substantially as objectionable as in the attempted methods of air removal previously described.

According to the invention in its entirety, after the bottles are filled I permit the contents to gain or regain a substantially quiescent state. This does not necessarily mean that the containers themselves must be in a state of rest. What is desired is a sufficient lapse of time, without agitation, to permit the beer to attain the quiescent state above referred to. This lapse of time may, if desired, be the period involved in the transfer of the containers from a filling station to a vacuumizing station, since with modern conveying mechanisms, movement of the container may be effected without any substantial agitation or internal motion of the contents.

For the theoretically ideal conditions above referred to, the beer would be permitted to remain in a state of rest until it attained the "black beer" condition of Figure 1. But this condition is not essential and its attainment would ordinarily require too much delay for practical purposes since some free static foam is apt to remain except after long periods of rest. For practical purposes, and particularly when the filling machine is of the low foaming type, and when the beer is at proper temperatures, I have found that a period of a few seconds after the completion of the filling operation will suffice to put the beer in the substantially quiescent state desired.

When vacuum is applied to a container having its contents in the substantially quiescent state

above referred to, the entire operation can be so controlled as to remove all or most of the air without any substantial loss of beer and without any substantial decarbonation.

Upon application of vacuum under the conditions described, a certain amount of head space air is removed without any rise of foam, the relative amount removed depending on the degree of vacuum. While it is desirable to remove as much air as possible at this stage, it is not necessary to use excessively high vacuums to attain the practical benefits of the invention.

In carrying out the invention in its entirety, the vacuum application is so regulated as to cause a delayed rise of foam, thereby to expel all or most of the remaining air, the foam being so controlled as to prevent overflow. This foam may be the surface foam remaining after the period of rest; or it may be new foam created as later described; or it may be a combination of both.

Considering first the "black beer" condition of Figure 1. When the vacuum is first applied, a certain amount of head space air is removed, depending on the degree of vacuum. Then, vacuum being maintained, bubbles start to rise and some free foam is formed. Finally, the foam starts to rise toward the mouth of the bottle. It is my belief that the action of the vacuum causes the foam bubbles to expand, whereby the foam as an entirety rises in the bottle. Whether this rise of foam is the result of such bubble expansion or otherwise, the fact remains that a rising movement of foam does take place.

Under proper conditions of beer temperature and the like, by regulating the vacuum the rising movement of the foam can be so accurately controlled that it may be caused to rise to any desired point in the bottle neck and no further. Moreover, the speed of the foam movement may be more or less controlled by regulation of the vacuum. Since the rise of foam is delayed, i. e. occurs after the initial application of the vacuum so that the air that remains in the head space is rarefied air only, and since, even then, its rise is not sudden and violent, there is practically no air entrapped by the foam. Since the rise of the foam may be controlled and stopped at any desired point, there is no overflow and substantially no decarbonation. As a result, the displacement of the air is certain and uniform throughout a given run. The amount of residual air displaced by the foam depends on the extent of foam rise. Consequently, the rise of the foam to the bottle mouth indicates a maximum displacement of air for a given bottle or series of bottles. By so controlling the vacuum that the delayed foam rises to and only to the bottle mouth, as illustrated in Figure 6, all or most of the head space air is removed without any beer overflow and its consequent disadvantages. And since substantially no air is entrapped by the foam, practically no air remains in the head space after the bottle is capped.

To indicate how accurately the foam thus created can be controlled, I have found that simply by increasing or decreasing the degree of vacuum, the foam may be brought up to the mouth of the container or to any other point short of the mouth, caused to fall back to any given point, and moved up and down or stopped at any given point as desired.

If the beer is not in the precise "black beer" condition of Figure 1 but already has some free foam following its period of rest, the operation

is substantially the same except that the rise of the foam to the bottle mouth occurs somewhat more quickly because some foam is already in existence. If there is not enough free foam

5 present to rise to the mouth or other desired point, the vacuum is so regulated as to cause formation of some new foam as above described. The degree of vacuum applied and the duration of the application may be varied to suit the

10 circumstances. I have found, for example, that with beer in substantially the "black beer" condition of Figure 1 and at chilled temperatures, a vacuum of about 22 inches will draw a delayed foam to the lip of an ordinary beer bottle in a

15 few seconds. The further the condition of the beer is from "black beer", the lower is the degree of vacuum or the less is the duration of application required to cause a rise of foam to the same point. The warmer the beer the more

20 easily it tends to foam and the faster the foam moves once it is started. Consequently, the warmer the beer the lower the vacuum or the shorter the period of application or both. The above applies to beers having the usual degree

25 of carbonation. For less highly carbonated beers and ales a greater degree of vacuum is necessary, other conditions being equal.

In causing and controlling the rise of foam it is not necessary to treat each bottle as a

30 separate problem. For a given lot of beer and for a given filling machine, successive filled bottles will have a substantially uniform condition. Consequently, once the necessary period of time for attaining a substantially quiescent state and

35 once the necessary degree and duration of vacuum to cause the controlled rise of foam to the bottle mouth or other point have been determined by observation, successive containers under the existing conditions may be treated automatically, so to speak. There may be deviations from

40 normal in any run of containers that will result in deviation in the results of the air removal treatment. But such deviations will not be material compared to the advantageous results attained in the complete run.

As regards determination of the proper vacuum by observation, it will be apparent that the conditions in bottles or other glass containers are readily observable. In the case of cans or

50 other metal containers, it can be observed when the foam reaches the outlet. If more careful or detailed observation is desired, one or more dummies of glass of the same size as the cans may be used for observation and test purposes.

55 It is to be understood that the invention is not limited to the controlled rise of foam. Even if the vacuum is so limited that there is no rise of foam, a considerable amount of the head space air will be removed. The above described procedure, however, involving displacement of residual air by delayed and controlled foaming, removes more air and so attains, more completely, and more conveniently, the ends in view.

While the invention is not limited to any particular beer temperature, since warm beer is more susceptible to foaming and since the foam is more difficult to control when the beer is warm, in carrying out the invention to what is now considered the best advantage the beer will be pack-

70 aged at a temperature of about 32° to 40° F.

According to the invention in its entirety, the bottles are closed without permitting the re-entrance of any substantial amount of air and without permitting the foam to overflow. While

75 this may be accomplished in various ways, in

carrying out the invention to what is now considered the best advantage, the bottle is closed substantially at the instant the rising foam reaches the bottle mouth and without reducing the degree of vacuum. This may be accomplished, for example, by delivering the filled bottle to a vacuum chamber, regulating one or more of the controlling factors hereinafter mentioned and applying the closure in such chamber. Theoretically, the application of the closure could

10 be regulated to suit the rise of foam. But in machine packaging the time of the operation of the capper is more conveniently fixed, i. e. it is arranged to take place as and when a bottle reaches a given capping position. Consequently,

15 it is more convenient to regulate one or more of the factors that control the rise of foam.

For a given run of beer and assuming absence of agitation, the instant at which the foam reaches the bottle mouth or other predetermined point depends on three factors, namely, the temperature of the beer, the degree of vacuum and the duration of vacuum application. With machine packaging of the automatic type mentioned, the last named factor becomes the

25 period of time that elapses between the entrance of the bottle into the vacuum chamber and the application of the bottle closure. While any one or more of the above factors can be regulated, in machine packaging the time element is more conveniently fixed and the temperature is presumably substantially constant. Consequently, it is more convenient to regulate the degree of vacuum alone in having the foam reach the predetermined point at the instant the cap is ap-

35 plied.

If, for any reason, it is not desired to apply the closure at the instant the foam reaches the mouth of the container, overflow of foam may be prevented by causing the vacuum to be slightly

40 reduced, say by $\frac{1}{2}$ inch of pressure, as soon as the foam reaches the predetermined point. This will ordinarily be sufficient to arrest foaming or to cause the foam to fall back slightly. Thereafter, the closure may be applied. Even if a

45 small quantity of rarefied air should be drawn back into the bottle as the foam recedes, it would be so insubstantial as not to affect materially the desired results.

The drawing shows diagrammatically or schematically the operation of two types of packaging machinery suitable for carrying out the invention. Referring to Figure 7, the bottles

50 are carried by an endless conveyor 20 having a step-by-step or intermittent movement. At station A the bottle is filled from a nozzle 21 which is lowered adjacent to or into the bottle mouth. After filling, the chain movement carries the bottle into a vacuum chamber 22 having a vacuum retaining trap door or inlet valve 23. The

60 chamber 22 is connected with a source of vacuum (not shown) by a pipe 24 having a control valve 25. In one wall of the chamber is an observation window 26.

Once the time interval necessary for the contents to become quiescent has been established for a given beer, a given filler and conveyor and a given type of bottle, the distance traveled by the bottle and the speed of travel can be so regulated that the desired period has elapsed by the

70 time the bottle reaches the vacuum chamber.

The apparatus here illustrated as an example is so organized that as soon as a bottle reaches capping station B, a closure is automatically applied by a reciprocating capping head 27. A

75

chute 28 delivers successive closures to the capping head.

If the closure is to be applied at the instant the foam reaches a predetermined point, e. g. the mouth of the bottle, these two events may be synchronized, as above pointed out, by controlling the speed of the conveyor, thereby to control the time it takes the container to move from the entrance door to station B; by controlling the temperature of the beer; or by controlling the degree of vacuum. Since the conveyor speed is more conveniently constant, and since the beer temperature can be made substantially constant, it is more convenient to control by regulation of the degree of vacuum alone. Once the proper degree of vacuum for a given run has been ascertained, it may ordinarily remain fixed for that run. Should the temperature vary, because of local or temporary conditions, the degree of vacuum may be adjusted accordingly.

In any event, the bottle is closed while subjected to the same degree of vacuum as is used for the air removal and so there is no substantial re-entrance of air. Nor is there any overflow.

If it is not desired to synchronize the capping and foam movement, the vacuum may be so regulated that the foam reaches the predetermined point before the bottle reaches capping position or the capper may be operated independently of the time the bottle reaches such position. In either event, as soon as the foam reaches the desired point, e. g. the bottle mouth, the vacuum is reduced slightly, say by $\frac{1}{2}$ inch of pressure, by means of valve 25. This checks the rise of foam and prevents overflow but is not sufficient to cause the re-entrance of any substantial amount of air. Then the bottle is closed while maintaining vacuum at the slightly reduced degree.

After capping, the conveyor movement carries the bottle out of the vacuum chamber through a door 29 similar to door 23.

In the modified form of apparatus shown in Figure 8, a sealing hood 31 is lowered over the filled bottle, a seal being effected by a gasket 32. A closure 33 is previously loosely mounted on the bottle mouth and temporarily anchored in any suitable manner. The hood 31 has a chamber 34 connected with a source of vacuum (not shown) by a pipe 35 having a control valve 36. In the hood is an observation window 37.

After the bottle mouth has been sealed in the hood, the vacuum is applied by opening valve 36. As soon as the foam reaches the bottle mouth or other desired point, the closure may be applied by a reciprocating capping head 38, the operation of the latter being timed, if desired, to occur at the end of a predetermined period following opening of valve 36. Or, if it is not desired to synchronize the closure application and the rise of foam, as soon as the foam reaches a predetermined point the vacuum may be reduced slightly to check the rise of foam and the closure thereafter applied. In either case, the bottle is closed without any overflow of foam and without entrance of any substantial amount of air, as above described.

With this Figure 8 type of apparatus the bottle may be completely packaged at a single station. After filling, the filling nozzle (not shown) is removed and hood 31 is placed over the bottle and the vacuum is turned on. If this interchange does not involve sufficient time to permit the bottle contents to become substantially quiescent,

turning on of the vacuum may be delayed until such quiescent state is attained.

In the case of large containers, such as kegs and barrels, a vacuum hood provided with means whereby a bung is applied while vacuum is maintained may be utilized.

With the process described, substantially all the air may be removed from container head spaces without any loss of beer, without creating undesirable bottling conditions and without any substantial loss of CO₂. For example, I have found that beers bottled under present methods of filling may contain 10 to 12 cc. of air in the head spaces, measured at atmospheric pressure and at 70° F. This air content may readily be removed down to 1 to 2 cc. or even less. Moreover, this end may be accomplished, even with a relatively high degree of vacuum, with the loss of only a negligible amount of CO₂. As a result, the deleterious effects of head space air are entirely or largely avoided and the high quality of the product is definitely preserved. Furthermore, since the air removal can be accurately controlled and since there is substantially no decarbonation, the final packaged product of a given run has a high degree of uniformity both as to carbonation and as to air removal.

What is claimed is:

1. The process of packaging beers and ales which comprises charging a container with a quantity of the beer or ale sufficient to leave a given head space, permitting the contents of the filled container to remain substantially free from agitation until any creation of free foam has substantially ceased and until the bulk of the beer or ale is substantially clear of internal bubbles or foam, then subjecting the contents to a vacuum, thereby to remove air from the head space, regulating the vacuum so as to prevent any substantial overflow of foam and closing the container while vacuum is maintained on the contents.

2. The process of packaging beers and ales which comprises charging a container with a quantity of the beer or ale sufficient to leave a given head space, permitting the contents of the container to become substantially quiescent, then subjecting such contents, while substantially quiescent, to a vacuum, thereby to remove air from the head space, regulating the vacuum so as to prevent any substantial overflow of foam and closing the container while vacuum is maintained on the contents.

3. The process of packaging beers and ales which comprises charging a container with a quantity of beer or ale sufficient to leave a given head space, permitting the contents of the container to become substantially quiescent, subjecting the contents, while in such substantially quiescent state, to a vacuum, regulating the vacuum to cause foam to rise toward the container mouth but without any substantial overflow, and closing the container without permitting the re-entrance of any substantial amount of air.

4. The process of packaging beers and ales which comprises charging a container with a quantity of the beer or ale sufficient to leave a given head space, permitting the contents of the container to become substantially quiescent, subjecting the contents, while in such substantially quiescent state, to a vacuum of such degree and duration as first to cause a removal of a considerable amount of the head space air and then to cause a rise of foam toward the mouth of the container, thereby to displace all or most of the

remaining air from the head space, and closing the container without permitting any substantial overflow of foam or the re-entrance of any substantial amount of air.

5 5. The process of packaging beers and ales which comprises charging a container with a quantity of the beer or ale sufficient to leave a given head space, permitting the contents of the container to become substantially quiescent, sub-
10 jecting the contents, while in such substantially quiescent state, to a vacuum of such degree and duration as first to cause a removal of a considerable amount of the head space air and then to cause a rise of foam to a predetermined point
15 in the container, and closing the container as soon as the foam reaches such point and while maintaining substantially the same degree of vacuum.

6. The process of packaging beers and ales
20 which comprises charging a container with a quantity of the beer or ale sufficient to leave a given head space, permitting the contents of the container to become substantially quiescent, sub-
25 jecting the contents, while in such substantially quiescent state, to a vacuum of such degree and duration as first to cause a removal of a considerable amount of the head space air and then to cause a rise of foam, thereby to displace more
30 air from the head space, and closing the container at substantially the instant when the foam reaches the container mouth and while maintaining substantially the same degree of vacuum.

7. The process of packaging beers and ales which comprises charging a container with a
35 quantity of the beer or ale sufficient to leave a given head space, subjecting the contents of the container to a vacuum to remove air from said head space without causing any substantial rise of foam, thereafter further subjecting the con-
40 tents to a vacuum to cause a rise of foam, and closing the container while maintaining vacuum and before such foam overflows.

8. The process of packaging beers and ales which comprises charging a container with a
45 quantity of the beer or ale sufficient to leave a given head space, inserting at least the mouth of the container, with the contents in a substantially quiescent state, in a chamber under vacuum, closing said container after it has been
50 in such chamber a predetermined length of time, and regulating the degree of vacuum to cause foam to rise in the container and to reach a predetermined point at substantially the instant the container is closed.

9. The process of packaging beers and ales which comprises charging a container with a
55 quantity of the beer or ale sufficient to leave a predetermined head space, permitting the contents of the container to become substantially quiescent following any agitation, transporting the container into a chamber under vacuum and to a predetermined position in said chamber, closing the container as soon as it reaches such
60 position, and regulating the relation between the hereinafter named factors to cause foam to rise to a predetermined extent in the container, such factors being the time interval during which the container is in the vacuum chamber before reach-
65 ing the closing position, the temperature of the beer or ale, and the degree of vacuum.

10. The process of packaging a succession of substantially uniform containers filled under substantially uniform conditions, which com-
prises inserting successive containers in a cham-
ber under vacuum, while the container contents
5 are in a substantially quiescent state, closing the successive containers after they have remained in said chamber substantially uniform periods of time, and regulating the degree of vacuum to
10 cause a foam to rise in the containers and to reach a predetermined point at substantially the instant the containers are closed, the degree of vacuum being maintained substantially constant as long as the temperature of the beer or ale re-
15 mains constant and being adjusted as such temperature varies.

11. The process of packaging beers and ales which comprises charging a container with a
quantity of the beer or ale sufficient to leave a
predetermined head space, permitting the con-
20 tents of the container to become substantially quiescent, subjecting the contents, while so quiescent, to the action of a vacuum, so regulating the vacuum as to control the existence or extent
25 of foam, and closing the container without permitting any overflow of foam or the reentrance of any substantial amount of air.

12. The process of packaging beers and ales which comprises charging a container with a
30 quantity of the beer or ale sufficient to leave a predetermined head space, permitting the contents of the container to become substantially quiescent, placing the container, while the contents are in such substantially quiescent state,
35 in communication with a source of vacuum closing the container after a predetermined lapse of time following the establishment of said communication, and so regulating the degree of vacuum as to prevent any substantial overflow of
40 foam.

13. The process of packaging beers and ales which comprises charging a container with a
45 quantity of the beer or ale sufficient to leave a predetermined head space, permitting the contents of the container to become substantially quiescent, placing the container, while the contents are in such substantially quiescent state,
50 in communication with a source of vacuum, closing the container after a predetermined lapse of time following the establishment of said communication, and regulating the relation between the hereinafter named factors, thereby to control the rise of foam in the container, such factors being the predetermined time interval afore-
55 said, the temperature of the beer or ale, and the degree of vacuum.

14. The process of packaging beers and ales which comprises cooling the beer or ale to a
temperature between 32° F. and 40° F., charging a container with a quantity of the beer or
60 ale sufficient to leave a given head space, permitting the contents of the container to become substantially quiescent, then subjecting such contents, while substantially quiescent and while substantially at said temperature, to a vacuum,
65 thereby to remove air from the head space, and closing the container without permitting any substantial overflow of foam or the re-entrance of any substantial amount of air.

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