July 4, 1972 N. A. ELSNER ET AL 3,674,513

METHOD FOR PACKING CARBONATED BEVERAGES INTO CONTAINERS USING ELECTROMAGNETIC ENERGY

Filed Dec. 18, 1969

FIG. 1

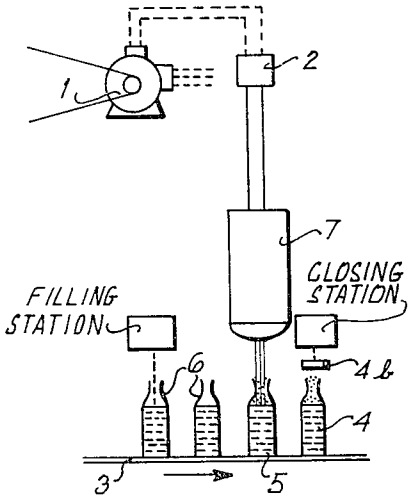


FIG. 2

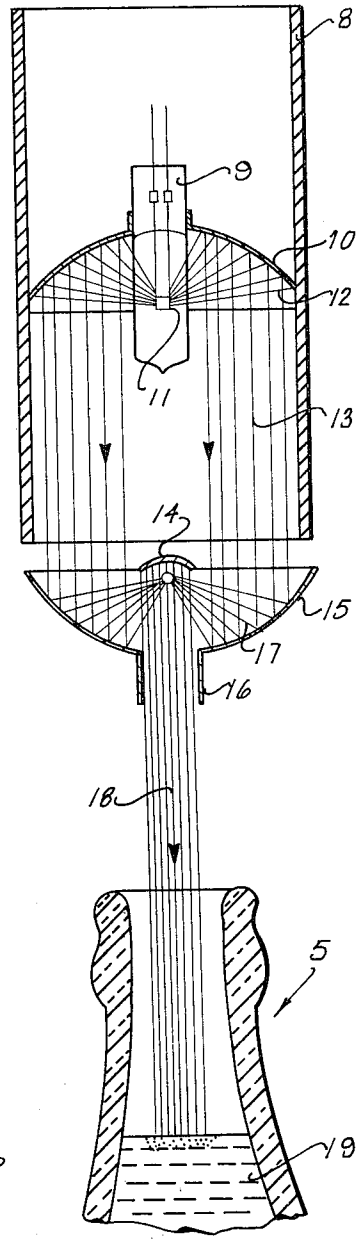
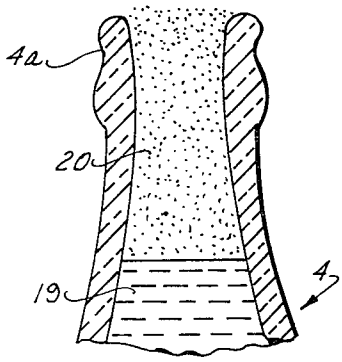


FIG. 3



INVENTOR
NILS ÅKE EGSNER
BY HANS ERIK NILSON
Richard S. Hoel
ATTORNEY

United States Patent Office 3,674,513 Patented July 4, 1972

3,674,513

METHOD FOR PACKING CARBONATED BEVERAGES INTO CONTAINERS USING ELECTROMAGNETIC ENERGY

Nils Ake Elsner, Hagersten, and Hans Erik Nilson, Stockholm, Sweden, assignors to Infrarodteknik AB, Vanersborg, Sweden

Filed Dec. 18, 1969, Ser. No. 886,106
Claims priority, application Sweden, Dec. 20, 1968, 17,558/68
Int. Cl. B65b 55/16
U.S. Cl. 99—217 1 Claim

ABSTRACT OF THE DISCLOSURE

A method for packing carbonated beverages into containers is disclosed. A container is almost but not completely filled through an inlet opening thereof with a carbonated beverage, an unfilled space remaining between the level of the beverage and the inlet opening. Infrared electromagnetic waves or microwaves are directed through the inlet opening into the beverage, thereby liberating the carbon dioxide in the carbonated beverage so that the carbon dioxide forms gas bubbles which form a layer of foam above the level of the liquid, filling the empty space in the container and expelling residual air from this empty space. Immediately thereafter the inlet opening is fluid-tightly sealed.

BACKGROUND OF THE INVENTION

The present invention relates generally to the packing of carbonated beverages into containers, and more particularly to a method for effecting such packing and to an apparatus for carrying out the method.

Conventionally the filling of containers with carbonated beverages, and the subsequent sealing of these containers, is known as "bottling" irrespective of the fact whether the container is in fact a bottle, a can or another recptacle. In the present specification the term "packing" has been used to make it unmistakably clear that the invention is applicable irrespective of the type of container, that is that it is applicable to bottles, cans and other vessels. This term, therefore, is equivalent to the expression "bottling" in the broadest sense thereof.

Carbonated beverages, such as malt beverages and the so-called "soft drinks," are produced and packed into receptacles in exceedingly large quantities. Given this large-volume production, and taking it in conjunction with existing distribution and stocking conditions, it is readily understandable that a considerable time usually elapses between the packing of the beverages into their receptacles and the opening of the receptacles for consumption purposes. Therefore, if air becomes enclosed in the receptacle when the same is sealed after filling, the presence of such air in the receptacle containing the beverage over these relatively long periods of time results in a deleterious influence on the quality of the beverage by oxidation.

Because this is evidently undesirable many attempts have been made to reduce the content of sealed-in air in the beverage receptacles to as low a factor as possible. In particular, the gas cushion above the surface of the liquid—it must be remembered that receptacles for carbonated beverages are never completely filled—must include as little air as possible. An accepted way of achieving this is to cause the beverage to foam before the receptable is sealed, in order that the foam may fill the free space above the level of the liquid in the container and thereby expell air from the same, whereupon the container is then closed. The cushion of gas then remaining in the empty space above the upper level of the liquid

in the thus-closed container is composed mostly of carbon dioxide.

Various approaches to producing the foaming have become known. Some of these are mechanical and involve the use of devices which in part knocks or taps the container. Others use ultrasonic waves and still others involve directing a jet of liquid which is preferably freed of air, or of carbon dioxide, into the free space in the container. Unfortunately, all of these approaches suffer from certain disadvantages. The mechanical devices carry with them the constant danger that the receptacle might be damaged or broken, particularly if it is a bottle of glass. Furthermore, they as well as devices using ultrasonic waves require constant readjustment during operation to produce precisely the proper quantity of foam, because too little foam would not expel the air adequately and too much foam—so-called "over foaming"—impairs the intended results and may cause what is known in the trade as "net-filling," that is some of the liquid contents of the container may be lost due to over-foaming with the foam escaping through the inlet opening of the container. It should be mentioned here that this over-foaming sometimes also occurs without any apparent reason, possibly due to defects of the filling apparatus and/or the container involved, but that it will of course be equally objectionable regardless how it is caused. Finally, the use of a fluid jet to remove air from the free space of a receptacle has also not been found entirely satisfactory, on the one hand because it makes it most difficult to maintain the contents of the container sterile and on the other hand it is almost impossible to avoid that air is being carried along and introduced into the free space by the jet.

SUMMARY OF THE INVENTION

It is, accordingly, a general object of the present invention to provide a method of packing carbonated beverages into containers which is not possessed of the aforementioned disadvantages.

More particularly it is an object of the present invention to provide a method to produce and control foaming of carbonated beverages partially filling a container, to thereby expell air from the free interior space of the container.

It is an additional object of the invention to provide an apparatus for carrying out the method.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the invention resides in a method of packing carbonated beverages into containers which, briefly stated, comprises introducing into a container through an inlet opening thereof a quantity of carbonated beverage requisite for filling most but not all of the volume of said container, so that an unfilled space remains between the level of the beverage and the inlet opening. Into the beverage we then direct electromagnetic waves. The radiation particularly suitable for this purpose consists of electromagnetic radiation within the range of the infra-red electromagnetic freqeuncy spectrum of an intensity requisite for causing foaming of the beverage to the extent that the developing foam will fill the space and thereby expell residual air from the same. Now, the inlet opening is immediatley fluid-tightly sealed to prevent the escape of liquid from the interior of the container and to prevent the entry of air thereinto.

The electromagnetic waves are supplied in form of a beam composed of waves predominantly within the range of infrared radiation. In accordance with the invention it is absolutely unnecessary that there be any connection whatever between the device producing the electromagnetic waves and the beverage, or the container in which the beverage is accommodated. Because of this no me-

chanical damage to the container is possible, and the importation of possible contaminants into the container and the beverage therein as a result of the use of such connecting means—for instance a fluid jet—is reliably precluded. In fact, the present invention brings about the additional advantage that the radiant energy employed has a sterilizing effect so that treatment in accordance with the present invention not only produces the primary intended result—namely expulsion of residual air from the package or container before the same is closed—but also assures sterility of the container and its contents.

Excess foaming or over foaming can be reliably controlled in accordance with the present invention by varying the energy of the electromagnetic waves, the duration for which the contents of a container are exposed to the waves, and the radiation intensity. In all heretofore known approaches any excessive foaming—whether it had occurred unintended and spontaneously or as a result of the operation of whatever prior-art method was being employed—was always further increased by the respective prior-art methods and could not be controlled in any way. According to the present invention, however, this control is very simple in that, as the thickness of the layer of foam above the upper surface of the beverage exceeds a predetermined value—determined by the radiation intensity—the radiation can no longer penetrate to the upper surface of the beverage and stimulate the development of further carbon dioxide bubbles. Instead, it then acts within the foam layer breaking down the bubbles in the region of the upper surface thereof and causing them to burst, whereby the excessive foaming is simply and reliably controlled.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claim. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatic side-elevation illustrating an arrangement employing the present invention;

FIG. 2 is a fragmentary sectioned partly diagrammatic detail view, on an enlarged scale, showing an arrangement according to the invention; and

FIG. 3 is a fragmentary detail view, on an enlarged scale, of the upper portion of a container in which the development of foam has been stimulated.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing firstly FIG. 1 of the drawing in detail it will be seen that reference numeral **1** identifies generally and diagrammatically a drive in an apparatus for filling carbonated beverages into containers such as cans or bottles. No representation is made that such apparatus per se is novel, and the invention can be used with many existing "bottling" machines. Reference numeral **2** in FIG. 1 identifies a relay or similar control device. Reference numeral **3** is a conveyor belt on which containers—here identified as bottles **4**, **5** and **6**—are advanced in the direction of the arrow first to a filling station which is shown diagrammatically, then to a device according to the present invention which is identified with reference numeral **7** and subsequently to a closing station which is also shown diagrammatically. Reference numeral **4** in FIG. 1 identifies a bottle which is filled with a beverage and in whose residual interior space the development of foam has been stimulated to expel residual air; this bottle **4** is ready to be closed by means of the closure device **4***b* which is applied at the closing station. Reference numeral **5** identifies a similar bottle containing beverage and being in process of having the development of foam stimulated by the device **7**. Reference numeral **6** identifies two bottles which have received beverage at the filling station and are ready to advance to the device **7**.

The device **7** is shown in more detail in FIG. 2. It is a radiation generating device comprising a cover **8** which surrounds and contains within it a radiation source **9** having a filament **11** which, when electrically energized produces electromagnetic waves or rays.

Reference numeral **10** identifies a parabolic cavity reflector, reference numeral **14** identifies an additional parabolic reflector and reference numeral **15** identifies yet a further parabolic cavity reflector having an opening **16** with which the open necks of the bottles **4**, **5**, **6** are serially brought into registry as these bottles advance on the conveyor **3**. On enerzigation of the filament **11** the rays **12** emitted thereby impinge upon the concave side of the parabolic reflector **10** and are reflected in form of a beam **13** consisting of parallel rays which are directed against the inner side of the opposite parabolic reflector **15**. This, in turn, reflects the rays of the beam **13** inwardly to the parabolic reflector **14** from where they pass as a coherent beam **18** of rays or electromagnetic waves through the opening **16** to impinge upon beverage **19** contained in whatever container—the bottle **5** in FIG. 2—is in registry with the opening **16**. This ray **18** stimulates the formation of carbon dioxide bubbles in the region of the upper level of the beverage **19** so that foaming occurs above this upper level and a foam plug **20** develops which fills the neck **4***a* of the bottle **4** shown in enlarged detail in FIG. 3 and corresponding to the bottle **4** of FIG. 1. The relay **2** cooperates with the various other components of the bottling machine to energize and de-energize the device **7** in dependence upon whatever requirements are made, for instance to energize it when a container is in registry with the opening **16** and subsequently to de-energize it until the next container has moved into such registry. Such control functions, as other components concerned with refrigeration of the beverage supply, dispensation of the beverage into the respective containers, protection of the operators against contact with the beam **18**, and the like, are well known to those skilled in the art and are not discussed in detail because they do not form a part of the present invention. Similarly, devices for controlling the duration and intensity of the radiation are not discussed in detail but are to be understood as diagrammatically represented by the device **2** of FIG. 1.

The operation of the arrangement according to the present invention is thought to be evident from the drawing and from what has been set forth herebefore. Let it be assumed that he beverage to be filled into the bottles **4**, **5** and **6** is beer, then it will be realized that filling of the bottles occurs at the filling station shown in FIG. 1. As a rule the gas cushion which forms above the surface of the beer in the respective container measures approximately 3% of the volume of the container. A large part of this cushion consists of air which it is desired to expel in accordance with the present invention. Thus, when the bottles have been filled to a desired height they are advanced by the conveyor **3** in direction indicated by the arrow towards the closing station where a closure **4***b* is to be applied. As they pass below and in registry with the opening **16** of the device **7** they are subjected to the action of the beam **18** the duration and intensity of which may be adjusted and controlled in known manner as outlined before.

The electromagnetic radiation of the beam **18** is primarily in the frequency field of infrared radiation which produces in the region of the upper surface of the carbonated beveage **19** sufficient heat to libeate the cabon dioxide contentained in the beverage **19** so that the same forms gas bubbles and the development of a foam plug **20** will result. This plug **20** fills the neck of the bottle or the space above the upper liquid level in whatever container has been used, and expels residual air from this space. The container now has the appearance illustrated in FIG. 3 and is immediately thereafter closed at the closing station so that the beer contains no more oxygen than

that which is dissolved in the beer. This quantity is small enough not to affect the desired stability of the beverage.

It has already been pointed out before that it occurs—and occurs actually quite frequently—that beer or another carbonated beverage may foam during filling at the filling station. If this foaming is not positioned to expel the residual air from the free space above the upper level of the beverage **19**, then the foaming will be completed when the respective container moves into registry with the device **7**. If, on the other hand, excessive foaming has occurred at that time—or if excessive foaming occurs as a result of the operation of the beam **18**—then the latter cannot penetrate through foam plug **20** when the same exceeds a certain thickness. Therefore, instead of continuing to stimulate the development of carbon dioxide bubbles in the region of the surface of the beverage **19**, the beam **18** now bursts and breaks down the gas bubbles in the upper region of the foam plug **20**, with the thus liberated liquid running back down into the container. The overfoaming thus ceases and the foaming becomes normal as desired. This is a very important consideration because it is known that overfoaming at times may be so abundant that the entire contents or a large portion of the contents of a container is transformed into foam and lost.

The beam **18** of course does not aspirate air into the respective containers and therefore does not contribute to contamination of the interior of the containers. It does, instead, have a sterilizing effect on the contents of the container and thus serves to preserve or increase the sterility of the contents.

In an experiment made with the apparatus according to the present invention a beer having a alcohol content of 2.8% by weight was filled into bottles under such conditions that no foam was produced in the respective bottle. The beer was thereupon submitted to radiation from a beam of infrared waves, emanating from a source of radiation such as that described herein and identified with reference numeral **7** in the drawing. The beam entered through the open neck of the respective bottles in vertically downward direction. Immediate formation of carbon dioxide foam resulted and this foam filled the entire free space in the neck of the respective bottle to the upper open end thereof. Overfoaming did not occur at any time. When radiation was directed into the respective containers for a prolonged period of time, that is for a longer period of time than is necessary in operation of the device to produce the desired quantity of foam, the tendency of the foam was to break down. No break down occurred, however, when the contents of the bottles were exposed to radiation for only a period of time sufficient to produce the condition shown in FIG. 3.

Tests carried out on the contents of the thus treated bottles, which were closed immediately subsequent to reaching the condition shown in FIG. 3, showed that the taste and other qualities of the beer were not deleteriously influenced, but that the quality was improved by the fact that the air content in the filled bottles had been used to the desired and acceptable value.

It should be understood that infrared radiation is not the only electromagnetic energy suitable for carrying out the invention. Instead, the same results can be obtained—and with beams **18** of shorter time duration—with other types of electromagnetic radiation of higher energy, for instance with microwaves. However, it is recognized that the use of microwaves would increase the operating expenses involved.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of uses differing from the types described above.

While the invention has been illustrated and described as embodied in an apparatus for packing carbonated beverages into containers, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claim:

1. A method of packing carbonated beverages into containers, comprising the steps of introducing into a container through an inlet opening thereof a quantity of carbonated beverage requisite for filling most but not all the volume of said container, so that an unfilled space remains between the level of said beverage and said inlet opening; directing into said beverage through said inlet opening electromagnetic waves within the range of infrared radiation requisite for causing foaming of said beverage and form a foam layer of predetermined maximum thickness within said space, so as to expel the residual air from the same, the intensity of said electromagnetic waves being adjusted so that said electromagnetic waves penetrate only said foam layer of predetermined maximum thickness so as to continue foaming of the beverage beneath said foam only until the same reaches said predetermined maximum thickness, said electromagnetic waves also collapsing the gas bubbles within said foam layer when the same exceeds said predetermined maximum thickness, whereby excess foaming is prevented and immediately thereafter, fluid-tightly sealing said inlet opening at a closing station.

References Cited

UNITED STATES PATENTS

3,088,831	5/1963	Fauth et al.	99—217 X
3,261,140	7/1966	Long et al.	99—182 UX
2,672,420	3/1954	Jeremiah	99—79
3,350,839	11/1967	Carter	99—182 X
3,409,447	11/1968	Jeppson	99—217 X
3,063,846	11/1962	Polin	99—1 X
2,916,266	12/1959	Pray	99—49 UX

OTHER REFERENCES

Food Processing, Packaging, Marketing, January 1953, vol. 22, pp. 4–7.

FRANK W. LUTTER, Primary Examiner

S. L. WEINSTEIN, Assistant Examiner

U.S. Cl. X.R.

53—282; 55—87; 99—49, 79, 182, 189, 171 B