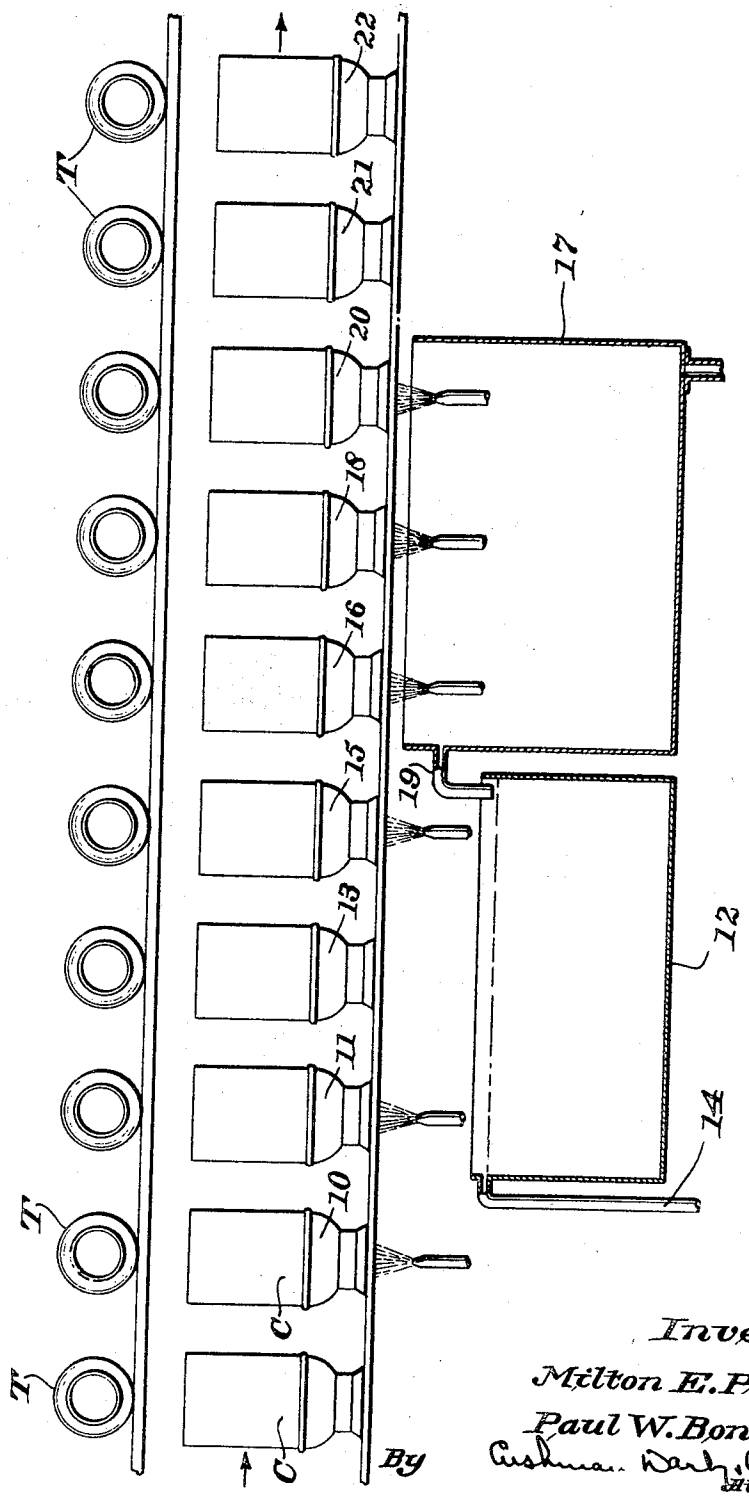
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METHOD OF CLEANING CONTAINERS

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METHOD OF CLEANING CONTAINERS

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2 Claims. (Cl. 134—3)

The present invention relates to the treatment of containers for the purpose of cleaning the same, and it is particularly concerned with the sanitizing of large metal cans generally used for the bulk transport of milk, cream and other milk products.

There are available numerous processes for cleaning such containers which utilize rinsing treatments with steam and water and generally include a chemical treatment with a suitable alkali. Careful research has developed that the use of an alkaline cleaning agent does not promote such a thorough cleaning of the can as will preclude microbiological activity when the cleaned can is allowed to remain overnight subject to humid conditions. That is to say, it has been found that the alkali cleaning material does not remove from the surface of the can nutrient films which, in the presence of moisture, allow microorganisms to propagate and develop a putrefactive condition on the surface of the can.

It is the principal object of the invention to eliminate such a condition and to provide a container which will not only be physically clean but bio-chemically clean as well so that objectionable microbiological activity is precluded.

Another object of this invention is to provide a method of cleaning in which a non-corrosive acid cleaning material is employed. The use of acid substances for cleaning metal containers has been avoided by reason of the corrosive action of the acid materials. We have not only found that a non-corrosive acid such as gluconic or levulinic may be utilized, but also have found that an acid may be utilized in such small amount as to give effective results with a substantial saving in expense over the usual alkali treatments.

A further object of the invention is to provide a container, the food contact surfaces of which give an acid reaction. This not only prevents the development of putrefactive and oxidizing types of microorganisms, but is beneficial in that it promotes the activity of favorable acid-forming and reducing types of microorganisms.

In addition to the foregoing objects, the invention reduces substantially the amount of steaming customarily employed in present cleaning practice, and this is a factor which enables a considerable economy to be realized. In other words, the cleaning action is complete. Therefore, subsequent rinsing with hot water is so effective that the usual means of heating a can with steam following such rinsing practice can be dispensed with in view of the fact that the hot water so employed rapidly drains and presents a surface which can be more readily dried by any subsequent treatment, for example, with hot air blasts.

A marked advantage of the present invention resides in maintaining both the initial rinse water and the rinse water employed after the container has been subjected to the acid cleaning, in a condition where this water is substantially free of nutrients for putrefactive and oxidizing microorganisms. Furthermore, by the presence therein of a suitable concentration of the acid cleaning solution which maintains the rinse waters in an acid condition, there is developed a situation unfavorable to the growth of such objectionable microorganisms, but which is beneficial from the standpoint both of its cleaning action and its effectiveness in creating a condition favorable for the development of reducing and acid forming types of organism.

We have found that the acid cleaner applied to a container which has been given a previous rinse or otherwise cleaned to remove as much as possible of the extraneous matter adherent to the wall thereof, and then subsequently rinsed, will be more sanitary than as has heretofore been possible using conventional alkali treating systems. With the present invention, the acid cleaner appears to loosen adherent objectionable films present on the wall of the container and a simple hot water rinse effectively removes all such adhesions. A remarkable observation which we have made is that the amount of acid cleaner which may be effectively employed is but a fractional percent of the amount of alkali heretofore regarded as essential. Furthermore, the acid cleaner solution is used in an amount which constitutes but a small volume relative to the volume of the container (such as a milk transport can being cleaned) and is preferably introduced therein in finely divided form so that a thin film of the cleaning solution reaches every point in the interior area of the container to accomplish its loosening and releasing function with respect to the films of extraneous matter to be acted upon. This is another reason why a simple rinse following the acid cleaning treatment is conducive to the thorough cleaning which the can evidences upon severe tests. This method is a distinct departure from present alkali cleaning systems wherein large volumes of alkali cleaning solution are discharged under pressure against the wall of the container. That is to say, the present practice requires not only a substantial volume of the alkali cleaning solution, but relies upon the scrubbing action of hydraulically produced sprays of

such solution to shear any film on the wall of the container before the same can be effectively penetrated and completely released. With the present invention, however, the acid cleaner is deposited as a thin film upon the container wall, for example, as from a mist and has the quality of penetrating through the adhering substances so as to release and loosen them whereupon they are thoroughly removed by the use of a simple jet spray of hot water subsequently applied. This result is attributable to the superior wetting, emulsifying, penetrating (deflocculating), dispersing and solvent properties of the acid cleaner.

An important feature of the present invention using an acid cleaning solution is its effect upon milkstone deposits. The acid cleaning solution has the property of dissolving such milkstone deposits as may be adhering to the wall of the container and also of preventing their original formation due to the softening properties of the acid cleaner on any water in which it is carried. It will be recognized then, that the acid cleaning solution is not dependent upon the type of water available at a particular plant or depot but is equally effective with water having all kinds and degrees of hardness and does not necessitate any complicated procedures of water treatment where, for example, hard water is encountered. This acid treatment of the water has a definite economical advantage in preventing the closing or clogging of hydraulic jets which frequently occurs when hard waters are subjected to reaction with alkali substances occasioning a resultant precipitation of calcareous deposits.

The method of cleaning comprehended by this invention is continuous and is practically foolproof in its operation so that relatively inexperienced personnel may carry out the sanitizing of cans with the assurance that the quality of the cleaned containers will meet the most severe tests.

The results achieved by the present invention are of an unexpected order, since the cleaning of metal containers has engaged the attention of many research workers, all of whom have apparently concluded that the use of hydraulic rinses and an alkali cleaner applied with hydraulic scrubbing action constitutes the best procedure. The present invention, however, has been severely tested, and these tests disclose that a very substantial improvement is possible in the use of an acid cleaning solution applied in very small concentration and without the use of the hydraulic scrubbing effect in the application of the acid cleaning solution to the container.

Of equal importance with the foregoing, is the provision of an acid solution which exerts a germicidal action, i. e., a lethal effect upon microorganisms. This lethal effect is a property either of an acid reaction at elevated temperatures or of the specific nature of special acids regardless of temperature or both the acid and elevated temperature. The use of a wetting agent in the acid cleaning solution itself enhances this lethal effect by providing for a greater penetration of the acid principle in destroying germ life. This wetting agent also may be of a type to exert or contribute to a lethal effect in itself.

This invention will be described in connection with the usual milk transport can having varying capacities of about ten gallons more or less, and which is generally provided with a tin coating on its interior and exterior surfaces. In this connection, the cleaning method to be described

is equally applicable wherever films of extraneous matter are strongly adhered to such metal surfaces, and we have been successful in cleaning dairy equipment such as pasteurizing vats, holding tanks, pipe lines, milk and cream coolers and other types of dairy processing equipment. The important advantage which we find, in addition to the thorough cleaning which is achieved, as has been explained above, namely, the acid condition of such cleaned equipment is favorable to the development of the more desirable reducing and acid-forming bacteria. It is recognized, of course, that perfect sterility cannot be achieved, but the present invention approaches this optimum condition and maintains the same to a much greater extent than has heretofore been accomplished. For example, containing bacteria are present in the air and water supplies, and when the same come in contact with surfaces which have been cleaned in accordance with this invention, the opportunity for their development and objectionable activity is very substantially lessened over containers and equipment cleaned by present practice with alkaline cleaners.

Referring to the drawing, the numeral 10 indicates a position at which a milk transport can C and its top T is subjected to a cold or tepid water rinse preferably applied by means of a hydraulic spray device or jet. The can has previously preferably been steamed, if necessary, to remove as far as possible adhering cream in the case of cans transporting sour cream, for example. At the station 10, the amount of water necessary to effect the rinse may be only a fractional volume of the total volume of the container, i. e., 1 to 2 pints in the case of a ten-gallon can, but with the present invention this is quite satisfactory. The water is preferably supplied from a source of fresh water and the soiled rinse water is led to waste. In this connection, in some cases instead of using a fresh supply of water, rinse water from a subsequent operation and containing the acid cleaner solution may be used to accomplish the rinse at the station 10, such water being either cold or tepid or being hot if desired.

From the station 10, the can is moved to station 11 and treated with a scrubbing spray of hot water containing entrained acid cleaner material from a subsequent operation. At this station 11, most of the nutrient and microorganisms are removed and continue to drain at the draining station 13. It is to be noted that the tank 12 contains the hot water rinse utilized for the hydraulic scrubbing at the station 11, and this supply of rinse water is maintained substantially constant with respect to the acid cleaner solution as will be later explained. The rinse water constantly drains from the tank 12 through the outlet 14 and at no time does this rinse water approach anywhere near the viscosity of the customary alkali rinse waters. Such alkali rinse waters are used over and over again and after one hundred cans have been washed, develop an objectionable viscosity in addition to providing a favorable environment for the development and propagation of oxidizing and putrefactive microorganisms. The presence of the acid cleaner solution in the rinse water contained in the tank 12 is at all times in an amount effective to give the rinse water an acid reaction which, as explained above, is unfavorable to the growth of the objectionable microorganisms, but favorable to the development of reducing and acid-forming

microorganisms so that at the very outset of the process, the scrubbing treatment precludes initial development of objectionable micro-biological activities. The presence of the acid cleaning solution in the rinse water in the tank 12 also has the effect of preventing any objectionable viscosity developing in that unlike an alkali cleaning solution which combines with the protein ingredients of milk and cream for example, to form viscous products, the acid cleaner has a dispersing effect upon such constituents which is magnified by the presence of a suitable wetting agent and thereby precludes the development of any similar viscosity noted in the case of alkali cleaning solutions. The temperature of the rinse water in the tank 12 is maintained at about 140° F.

After the can has been permitted to drain, it is subjected to the acid cleaning treatment at the station 15. This treatment is carried out by injecting the acid cleaner through the medium of steam, hot water or air. It is preferably introduced to the interior of the can in a state of fine subdivision, for instance as a mist, in contradistinction to a hydraulic scrubbing jet. As pointed out, the action of the cleaning agent is to penetrate the extraneous film on the can and release the same so that it may be readily removed by a conventional water rinse. In addition to its detergent effect, the cleaner exerts a lethal effect upon objectionable microorganisms, and this effect is facilitated by reason of its own specific bactericidal properties as well as its penetration into and through the extraneous film on the food contact surface of the receptacle, which has the added effect of augmenting any specific bactericidal properties of special acids used in the acid cleaner composition. Preferably, a wetting agent is included in the acid cleaner composition which accelerates both the detergent and germicidal effect. The acid composition is supplied from a suitable source not shown and any appropriate type of ejector or atomizing device may be employed to produce and maintain the finely divided condition of the acid cleaning solution within the container. In this connection, we preferably employ a valve mechanism which will introduce a definite volume of the aqueous cleaning composition automatically as each can is presented to the cleaning station 15 in the form of a fog or mist.

The predetermined quantity of the cleaning agent so supplied is of very small volume, and is practically non-corrosive. The concentration of the active cleaning ingredients is about one and one quarter percent and a charge will consist of about ⅓ ounce of the aqueous acid cleaning composition, for a ten gallon can.

As pointed out above, the acid cleaner dissolves milkstone deposits and likewise prevents their precipitation as calcareous deposits upon the wall of the container.

A further advantage of the acid cleaning solution is its equal efficiency with both hard or soft water. Where hard water is used, it must be softened or the matter of milkstone deposits must be neglected if used with alkali cleaners, it being a characteristic of the acid cleaning composition that it so softens the water as to make the formation of milkstone deposits impossible. This property, moreover is highly important in relieving a very serious condition occasioned by the use of alkali cleaners, namely, the clogging of the jets with calcium and magnesium solids which are precipitated from water supplies possessing any appreciable hardness. The necessity

for cleaning such jets occasions frequent stoppage of the operation, since unless the jets are cleaned, the rinses are only partially effective. In many cases, plants have been known to continue operating with the jets partially closed by the deposits of precipitated calcium and magnesium compounds, with attendant ineffective cleaning results. All of this is overcome by the present invention.

Any draining, by reason of the activity of the mist at the cleaning station 15, takes place in the chamber 12, but the effective removal of the loosened film on the wall of the container is carried out at rinsing station 16. At this rinsing station either a jet spray of fresh water is directed upon the interior of the can to remove the loosened film or the rinse is obtained by pumping water from the tank 17 which also contains the acid cleaner solution rinsed from the can at the station 16. From the rinsing station 16, the can is conducted to the rinsing station 18 and is treated with a spray of fresh not water or a spray of water containing the acid solution which is drained into the tank 17. Where the treatment at the station 16 was with fresh hot water, an acid reaction may be imparted to the can at 18 by using the rinse water from the tank 17. On the other hand, if the rinse employed at station 16 was obtained from the tank 17, a rinse with fresh water may be utilized at station 18 to impart a neutral reaction to the can. In this connection, the rinses at stations 16 and 18 may both be fresh water or may both be obtained from the tank 17. When it is desired that the cans have an acid reaction, this may be imparted whenever the container, after treatment at stations 16 and 18, has a neutral reaction, by giving the container a further rinse at 20 with liquid from the tank 17, or a treatment with acid cleaner similar to that at station 15 or the food contact surface may be rendered acid, for example, as described in the application of Parker and Bonewitz, Serial No. 359,785, filed October 4, 1940, by introducing as a fog or mist or as an aqueous solution, an acid cleaner, e. g., a solution containing gluconic or levulinic acid and forming a film having an acid reaction on the food contact surface of the container. Any drainage from the can at station 20 is into the tank 17.

It is to be observed that the tank 17 has an outlet 19 from which hot water containing the acid cleaning solution constantly overflows to the tank 12. In this tank 17, there is thus maintained a substantially constant concentration of acid cleaner and, since the liquid is constantly overflowing into the tank 12 and from this tank to waste through the outlet 14, the concentration of bacteria and nutrient in the tanks 12 and 17 is reduced to a satisfactory minimum, and the acid present will preclude the propagation and development of oxidizing and putrefactive microorganisms; yet, such acid condition in the tanks 12 and 17 is favorable to the development of favorable reducing and acid-forming types of microorganisms. In other words, by having the continuous flow from tank 17 to tank 12 with discharge at outlet 14, a proper substantially constant dilution of such germ life is provided and an acid reaction is maintained. Hence, at no time is the rinse water from the tank 12 or the tank 17 objectionable as a contaminating influence, but on the contrary, it exercises by reason of the presence of the acid solution a definite detergent and germicidal action.

At station 21, containers treated at stations 16

and 18, and 20 in case this station is used, are permitted to drain into tank 17 and thereafter are suitably dried at 22 as by means of a hot air blast if desired. At this point, it is important to note that the temperature of the rinses, either fresh hot water or from the tank 17 supplied at stations 16 and 18, are in the neighborhood of 190° F. or higher, and hence no extensive drying procedure is normally necessary; although in some cases drying may be hastened by means of an air blast.

In practicing the method hereinabove described, using an acid cleaner, it is necessary that the acid employed be one which is non-corrosive or can be used in low enough concentration to be non-corrosive, and at the same time, is effective to insure the desired cleaning. We have found that gluconic and levulinic acids are preferable in view of their relatively non-corrosive character.

Other acids effective to insure the optimum cleaning results described without being objectionably corrosive may be utilized, such as phosphoric acid in properly dilute solution, as well as hydroxy-acetic acid, as prepared by Du Pont Company, and sodium acid pyro-phosphate or mono-ammonium phosphate, as made by Monsanto Chemical Company and others.

While it is not always necessary, we prefer to employ a wetting agent in the acid cleaner composition such as alkyl aryl sulphonate, preferably "Santomerse #3" of Monsanto Chemical Company, or sulphonated petroleum fractions which are effective bactericidal agents. Other wetting agents may be employed, such as 3, 9-diethyl tridecanol, 7-ethyl-2 methylundecanol and 2-ethyl hexonal, but these are not preferred. In addition, "Duponol" and "Alkanol WXN" of Du Pont Company, as well as "Nacconol" of National Aniline and Chemical Company, and the "Areskap" products of Monsanto Chemical Company may be used.

A suitable acid cleaning composition comprises a solution of gluconic or levulinic acids or mixtures of the same in about 50%, a wetting agent, in about 10%, a suitable enzyme such as pepsin, trypsin, or papain, in about 1%, and the remainder water. The wetting agent, as stated above, is preferred but is not always required, while the use of the enzyme is optional. About 20% of a water soluble oil may also be included. The composition is added to water to form an acid cleaning solution having a concentration of about 2%. By reason of the method employed, this solution gives the highly satisfactory results above mentioned.

Another suitable cleaning composition comprises a mixture of levulinic acid and gluconic acid in about 35%, a wetting agent in about 10%, a water soluble oil in about 25% and the remainder water. An enzyme as with the previous composition may or may not be employed.

In the several formulae described above, the levulinic acid is present in amount of about 2 to 5%. It imparts a desirable odor and exercises an inhibiting effect on the growth of microorganisms, particularly molds. The levulinic acid is non-corrosive to dairy metal and also exerts detergent properties. The gluconic acid is likewise non-corrosive to dairy metal and exercises a buffering action.

The wetting agent contains no fillers which would react with the acids, thereby removing any likelihood of the formation of corrosive acids. For example, should the wetting agent contain an excess of sulphates, there may result the formation of sulphuric acid, the corrosiveness of which would be highly objectionable.

The water soluble oil gives a superior result in many cases and is of a type which makes for a true solution with no oiling off, even at high temperatures. Preferably the oil has detergent properties and protects the solution against formation of corrosive substances which might otherwise be formed when the solution is further diluted with water containing sulphates, etc., as when the stock solution is diluted for use in the plant.

With respect to the water soluble oil, there are many varieties available, but the important characteristic which such oil must possess for our purposes is that it remain in true solution in an acid reacting composition. That is, the oil must not be affected by pH or temperature changes in the solution, as distinguished from oils frequently used in making emulsions. We have found that "#25 acid compound" prepared by Standard Oil of Indiana is a most desirable soluble oil for our purposes, and we also have found satisfactory as the soluble oil, a mixture of "Petromix #1–B" and "Klearol White Mineral Oil" as prepared by L. Sonneborn Sons, Inc., Chicago, Illinois.

As pointed out above, the acid constituent may be entirely levulinic or entirely gluconic, or any proportions of mixtures of the same. The two examples are illustrations of preferred compositions which have been found highly useful.

Phosphoric acid is used in the proportions specified in the above examples, and it is important to utilize an amount of the soluble oil or other corrosion inhibiting agent effective to preclude corrosion. When the phosphoric acid is used in the proportions stated in the foregoing examples, at least 25% of the soluble oil should be employed for this purpose.

Where hydroxyacetic acid or sodium acid pyrophosphate or mono ammonium phosphate are used, they will be employed in the proportions such as specified in the foregoing examples. In this connection, dry compositions may be produced containing these materials and a wetting agent; water may be added to the powder by the user. Further, with such substances, it is not necessary to use a water soluble oil.

It is preferred to use the organic acids, since should the same be present in excess, there is little or no likelihood of corrosion, whereas when inorganic acids of the order of phosphoric are employed, a careful control must be exercised to prevent corrosion effects.

It is to be understood that all of the acids referred to above, or any two or three of them, may be used as a mixture to provide the acid constituent of our improved cleaner.

It is preferred to use, in all of the cleaning compositions or solutions, a wetting agent and a water soluble oil. The compositions or solutions may, however, be prepared without the use of the enzyme or the oil, but we prefer to use the oil with the gluconic and levulinic acids and particularly with phosphoric acid, since in the latter case it acts to control corrosiveness, should the phosphoric acid be present in excess.

Referring to the chambers 12 and 17, when the operation is initially started, water is introduced in the tanks, together with sufficient acid cleaner to give the same an effective acid reaction. Thereafter, the communicating tanks 12 and 17 are replenished and maintained with an effective acid reaction by drainage from the stations 16, 18,

20, and 21 and to some extent by drainage from the station 15.

The method illustrated in the drawing is the preferred manner of carrying out the invention. If desired, the acid cleaning solution can be used with ordinary can washing equipment, for example, such as now employed with alkali cleaners. Under these circumstances, the alkali cleaner solution is replaced with an initial charge of approximately 8 ounces of acid cleaning material and 60 gallons of water which is placed in the conventional tank associated with such apparatus. The solution is supplied from said tank to a can and injected therein, preferably as a fog or mist, although the usual hydraulic spray may be used. The can is permitted to drain so that the acid washing solution returns to the tank for continuous reuse on subsequent cans. After about 300 cans have been so washed, an additional charge of approximately 1 ounce of acid cleaner per 100 cans to be washed is added.

The term "fresh" as used in the specification is intended to describe virgin rinse water and cleaning solution which has not heretofore been used but is fed directly and fresh from the source of supply.

It is to be understood that the body and top are successively treated in the manner above described to produce a dry or moist container and top which are not only visibly clean, but free from microorganisms detrimental to quality.

Where the acid cleaner is used with ordinary can washing equipment, the cans may be given a final acid reaction in the manner explained herein.

This application is a division of our application Serial No. 402,722, filed July 16, 1941, Patent No. 2,338,688, patented January 4, 1944.

We claim:

1. The method of cleaning a plurality of containers comprising treating each container with an aqueous solution of acid cleaner which contains an organic acid and which is non-corrosive to the container material and prevents substantial precipitation of calcium and magnesium solids at temperatures in excess of 190° F., draining each container and collecting the drained solution and employing the same at a temperature in excess of 190° F., to also treat each container, the said solution at all times preventing substantial precipitation of calcium and magnesium solids.

2. The method of cleaning a plurality of containers successively comprising treating each container with an aqueous solution of acid cleaner which contains an organic acid and which is non-corrosive to the container material and prevents substantial precipitation of calcium and magnesium solids at temperatures in excess of 190° F., rinsing each of the containers with an aqueous solution of the acid cleaner having a temperature in excess of 190° F., draining the containers and continuously collecting the drained solution, and employing the said drained solution in the treatment of the said containers, the said solution at all times preventing substantial precipitation of calcium and magnesium solids.

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