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WASHING APPARATUS

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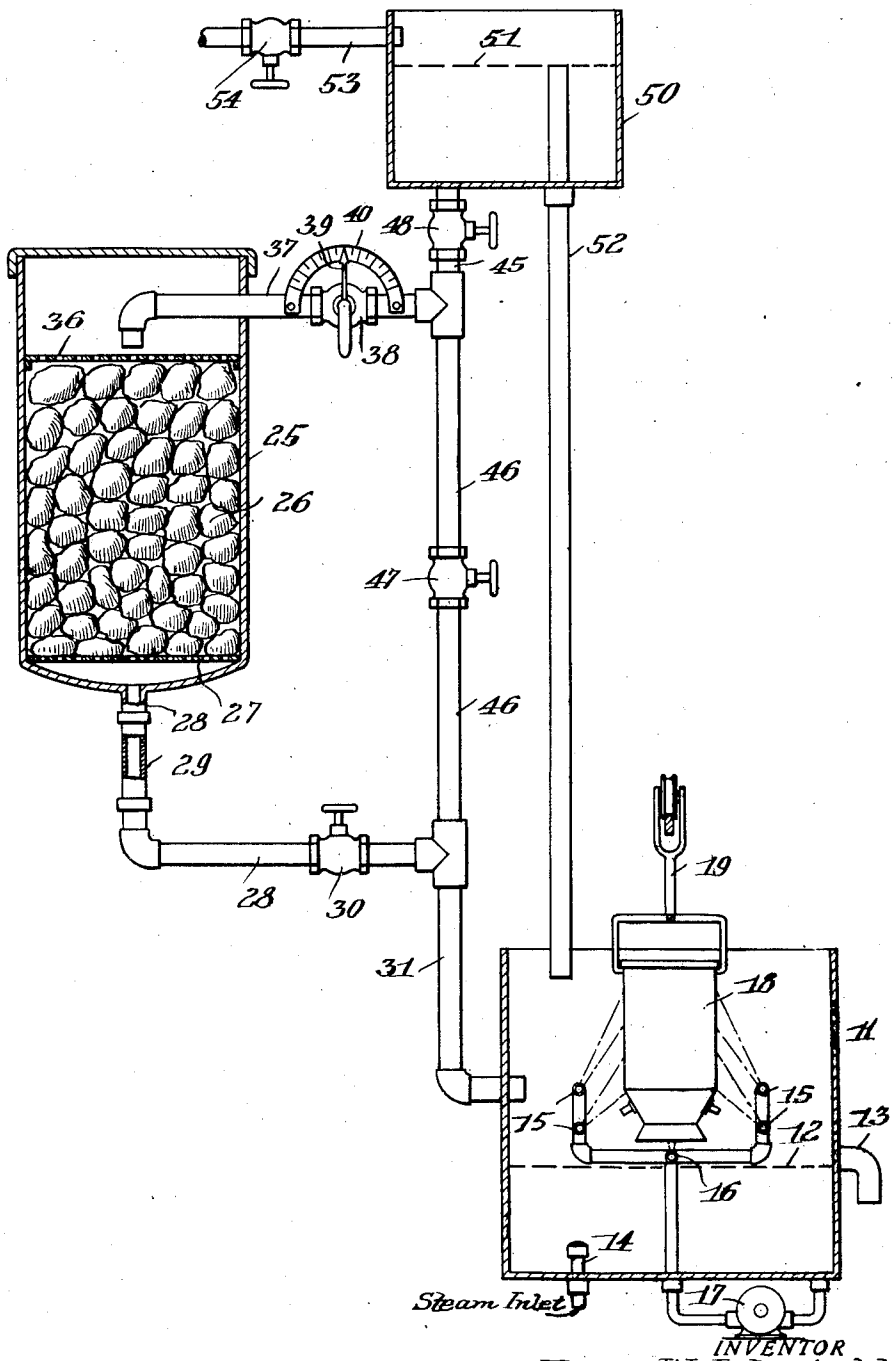

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WASHING APPARATUS

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This invention relates to the washing of various articles, and more especially to articles such as milk cans, ice cream cans, milk bottles, and similar containers for food for human consumption, which must be washed in an effective and sanitary manner before being reused.

An object of the invention is to provide an improved method and an improved apparatus for washing such articles, whereby the efficiency of the washing is maintained throughout the entire washing operation, so that the articles washed at the end of a long run will be as clean and sanitary as those washed at the beginning.

Another object is the provision of a method and apparatus for controlling the alkalinity of washing water in such manner that it may be maintained at substantially constant alkalinity during the washing operation, notwithstanding a tendency to decrease in alkalinity.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

The single figure of the drawing is a diagrammatic view partly in elevation and partly in vertical section through one form of apparatus constructed in accordance with this invention.

The washing of articles which must be kept clean and sanitary, as for example milk cans, ice cream cans, milk bottles, and the like, is frequently done with alkaline washing water, which is an effective and satisfactory washing agent. When the articles to be washed are milk bottles or other non-metallic containers, the washing water may be treated with caustic soda, for example. Caustic soda has an undesirable effect upon metal, however, and when washing milk cans or other metallic containers it is usual not to employ caustic soda but to employ other suitable alkali material, such for example, as a mixture of sodium carbonate and tri-sodium phosphate, with possibly a small amount of metasilicate.

In washing such articles with the use of a washing machine by which a considerable number of articles are successively washed, the proper amount of alkali is usually put in the water at the beginning of the operation, but the alkalinity of the water tends to decrease as washing is continued. This is due partly to the addition of fresh water necessitated by splashing and other wastage of the wash water, partly to contamination or dilution of the water by milk residue or by rinse water remaining in the containers from a previous rinsing operation, and partly to steam which may be injected into the washing water to heat it.

Consequently if the alkalinity of the washing water is right at the beginning of the washing operation, it tends to decrease as the washing continues, and those articles which are washed later are apt to be washed with water having insufficient alkali content, which will result in less effective washing.

According to the method of the present invention, a supply of alkaline water is added preferably continuously to the washing water bath, and it is regulated and controlled to flow at such a rate that it compensates for the loss of alkalinity which would otherwise occur in the wash water, thus producing a wash water which maintains substantially constant alkalinity at the proper amount, notwithstanding continued use. In this way, articles washed a considerable time after operation is begun will nevertheless be washed equally effectively, and be made as clean and sanitary as those washed near the beginning of the operation.

In the present method, there is provided a supply of soluble alkaline material, in solid form and preferably relatively hard, such as briquettes or lumps of the desired alkaline material. Water is supplied to this supply of alkaline material so that it may trickle downwardly over the briquettes or lumps of alkaline material and pick up alkalinity therefrom, forming an alkaline solution. After trickling over the alkaline material, the water is led to the receptacle containing the washing water. The amount of alkalinity added in this way is so regulated and controlled that it compensates as nearly as possible for the loss of alkalinity of the washing water, thus keeping the washing water at substantially constant alkalinity during operation.

The regulation and control is effected by regulating the inflow of water to the supply of alkaline materials. It is important to note that for most satisfactory operation, regulation should be undertaken before the water reaches the supply of alkaline material, rather than at a point after it leaves the alkaline material. The supply of alkaline material is thus not substantially or materially submerged at any time, but simply has a supply of water trickling down through it, over the surfaces of the various lumps or briquettes. A free outflow is provided from the vicinity of the alkaline material to the washing water receptacle, so that water does not accumulate in contact with the alkaline material, but

as soon as it passes the alkaline material it flows on to the wash water bath.

If the control is effected by regulating the outflow of the water after it has passed over the alkaline material, this would be apt, at least under some conditions, to cause the water to back up and submerge a substantial part of the alkaline material, which in turn would produce a saturated solution of the alkaline material in the water. The dissolving of this alkaline material in water is sometimes accompanied by the giving off of heat, so that a saturated solution would be formed at a temperature higher than the normal temperature of the water, and then upon flowing along the conduit to the wash water receptacle, the water would cool off somewhat, with consequent precipitation of some of the alkaline material, which precipitation would gradually tend to block up the conduit. For these and other reasons, it is found that a more accurate, reliable, and satisfactory control is attained by regulating the water as it flows to the supply of alkaline material, and providing a free outflow so that the alkaline material is never materially submerged but is simply subjected to the passage of a film of water over it, which may be described as the trickle of water over or through the material. The solution thus formed by the trickling of the water is ordinarily not a saturated solution, since the water does not remain in contact with the alkaline material sufficiently long to form a saturated solution, and consequently alkaline material is not precipitated in the conduits and the conduits are kept clean and free without difficulty.

Also it is found that when the water trickles over the alkaline material, the degree of alkalinity or strength of the solution thus formed remains more nearly uniform as the alkaline material is being used up or dissolved, than is the case when the alkaline material is submerged in a container into and out of which the water is flowing. In the latter case, greater differences in the strength of the solution are apparent as the alkaline material approaches exhaustion. For the greatest uniformity, it is preferable to keep a fairly constant amount of alkali in the container **25**, adding fresh material from time to time as the alkali is dissolved away.

In carrying out the method, tests of the alkaline content of the washing water may be made at intervals during the washing operation, and the water supplied to the alkaline material to form the solution to be added to the washing water is supplied substantially continuously and regulated from time to time as may be necessary in order to keep the washing water constantly at substantially the desired alkalinity. The washing of the successive articles to be washed proceeds at approximately a constant rate, whether by machine or by hand, so that the loss of alkalinity, while washing is going on, is substantially constant per unit of time. Therefore, when the supply of water to the alkaline material has once been properly regulated at a rate to compensate for the loss of alkalinity of the washing water, this regulation ordinarily can be maintained and need not be further changed so long as washing is continued at the same rate.

Tests of the alkalinity of the washing water may be made at different rates of washing, or when washing different articles, for determining the proper regulation of the water supplied to the alkaline material under each different condition of operation. When such tests have once been made and the proper regulation of the water for each condition of operation has once been determined, further tests need not ordinarily be made except at infrequent intervals to furnish a check on the proper functioning of the system. A graduated regulating valve may conveniently be provided for controlling the inflow of water to the alkaline material, and a notation or record may be made of the position to which this valve should be set for each separate condition of operation of the washing apparatus, as to different rates of washing or different articles being washed. Then whenever washing is being done under any particular conditions, the regulating valve for the supply of additional water can be set to the desired predetermined setting appropriate to those conditions, and it will be known that sufficient alkalinity is being added to the washing bath to compensate at least approximately for the loss of alkalinity of the washing water.

Referring now to the drawing, which illustrates diagrammatically one suitable form of apparatus for carrying out the method, there is shown at **11** a suitable receptacle for holding washing water up to a level indicated at **12**, and having an overflow **13** leading to waste. A steam inlet **14** is provided for introducing steam into the washing water to heat the water to any desired temperature. The washing water bath within the receptacle **11** may be employed for washing in any suitable or known manner; for instance, the water may be sprayed into and upon the articles to be washed, as for example by spray nozzles **15** and **16** supplied with the wash water under pressure by any suitable means such as the pump **17**. There is shown diagrammatically a milk can **18** held in inverted position by any suitable holding means such as the trolley hanger **19**, for holding the can in proper position adjacent the spray nozzle.

It is to be understood that this part of the apparatus may constitute or be built in accordance with any suitable known form of washing machine, such as is now available on the market, and may be adapted for washing any desired articles, and suitable known means may be provided for advancing the milk cans or other articles successively to washing position so that the articles are washed substantially automatically and at a substantially uniform rate.

At **25** there is illustrated a container for holding a supply of alkaline material **26** in the form of solid pieces, blocks, or briquettes, which may be of any desired shape, regular or irregular. The alkaline material itself will be of a composition depending upon the articles to be washed and other circumstances. As previously explained, when the articles to be washed are of metal, such as milk cans or ice cream cans, it is usually preferred that the alkaline material be composed largely of sodium carbonate and trisodium phosphate, with perhaps a slight amount of metasilicate.

The alkaline material **26** rests upon a foraminous partition or perforated plate **27** near the bottom of the container **25**, so that liquid may easily flow through this plate and out the bottom of the container through the conduit **28** having some suitable observation means for watching the flow through the conduit, such as the observation glass **29**. The conduit **28** leads, through a valve **30**, into the conduit **31** which leads to the washing water receptacle **11**. Thus the conduits

28 and 31 provide free outflow conduit means through which water added to the container 25 may flow freely out of the container and into the washing water receptacle 11. It is to be noted that in operation, the valve 30 is kept open sufficiently wide so that water added to the container 25 may flow freely out of it at a rate at least as fast as that at which it is supplied to the container, and will not back up in the container or materially submerge the alkaline material.

Near the top of the container 25, above the alkaline material 26, is suitable distributing means such as the foraminous partition or perforated plate 36. The water to form the alkaline solution is introduced above this plate 36, a suitable water supply conduit 37 leading from a suitable source of water supply through the regulating valve 38 which is of the graduated variety, having a pointer 39 cooperating with a graduated scale 40 so that the valve may be opened readily to any predetermined extent and the rate of flow through the valve may be known by observing the position of the pointer 39 on the scale 40.

The supply conduit 37 leads from any suitable source of water supply, which may be supplied through the conduit 45. If desired, the conduit 45 may be connected to the conduit 31 by a conduit 46 in which is interposed a valve 47. Another valve 48 may be placed in the conduit 45 above the connection to the conduit 36.

If the pressure of the water supplied to the regulating valve 38 varies to any considerable extent, it is found that the difference in pressure causes a difference in rate of flow through the valve for any particular opening or setting of the valve. Consequently, in order that there may be a substantially fixed known ratio between the rate of flow through the valve and the reading of the pointer 39 on the scale 40, it is desirable to furnish the water to the regulating valve 38 always under a substantially constant pressure or head. Where the pressure would otherwise vary, or whenever otherwise desired, this constant pressure or head may be readily secured by providing a water tank 50 slightly above the alkaline container 25, in which tank water may be kept at a substantially constant height or level indicated at 51. This substantially constant elevation of the water level may be maintained as by means of a float controlled inlet valve, for example, or by placing an outlet or overflow at the proper elevation. The latter is ordinarily preferred, and as shown in the drawing, there is an outlet conduit 52 leading from the desired water level 51, and in the present case emptying into the washing water receptacle 11.

Water may be supplied to the tank 50 as by means of a conduit 53 controlled by a valve 54. The conduit 45 is connected to the tank 50 at a point below the water level therein.

In operation, as washing of the various articles continues, the alkalinity of the washing water tends to decrease as above explained, due partly to dilution by steam entering through the inlet 14, partly to dilution by rinsing water which may remain in the cans or other articles being washed from a previous rinsing operation, partly to dilution or contamination by a residue of milk or other material from the articles being washed, and partly to dilution caused by the supply of additional fresh water to replace water splashing out of the receptacle 11 or flowing out through the overflow 13. As the alkalinity of the washing water decreases, the efficiency of the washing operation becomes less and less. In order to maintain the alkalinity at the proper amount, the regulating valve 38 is opened to an extent sufficient to supply the necessary amount of alkaline solution to maintain the washing water at substantially constant alkalinity.

The fresh water, supplied to the conduit 37 under substantially constant pressure or head (as from the constant level tank 50, for example) flows into the upper part of the container 25 and is distributed fairly evenly throughout the cross section of the container, by means of the perforated plate 36. It then trickles down from this plate onto and through the alkaline material 26, dissolving some of the alkaline material and forming an alkaline solution which is found in practice to be of substantially constant strength so long as the container 25 is kept reasonably filled with the alkaline material. The alkaline solution thus formed passes through the lower perforated plate 27 and flows freely out of the bottom of the container through the discharge conduit 28, in which its flow may be observed through the glass 29. It flows on from the conduit 28 into the conduit 31 and thence into the washing water bath 11, where it mixes with the washing water and thus compensates for the loss of alkalinity of the washing water, keeping the alkalinity substantially constant.

Tests of alkalinity of the washing water may be made at suitable intervals to determine how well the system is operating, and the setting of the control valve 38 may be varied as necessary to provide more or less of the alkaline solution. Since the washing operation usually proceeds at a substantially constant rate, the loss of alkalinity is substantially constant, and therefore when the proper setting of the control valve 38 to compensate for this loss of alkalinity has once been determined, it ordinarily need not be changed. Thus when the apparatus is not in operation, the valve 38 may be closed, but when the apparatus is next put into operation, the graduated scale 40 permits the valve to be opened to the proper amount which the operator knows, by experience or by test, will provide just the right amount of alkaline solution to compensate for the loss of alkalinity and keep the alkalinity of the wash water substantially uniform.

If all the water added to the washing bath to replace water lost by splashing, overflow, etc., were added in the form of the alkaline solution, too much alkaline solution would be added and the alkalinity of the bath would become too great. Hence plain water also is added to the washing bath to replace the lost water, and this plain water may be considered, in effect, as a diluent for the alkaline solution. The additional water added to the washing receptacle 11 may be provided by slightly opening the valve 47 in the conduit 46, permitting fresh water to be by-passed right to the receptacle 11 without flowing through the alkaline container. This system may be used to advantage when the water tank 50 is not employed.

When the tank 50 is used for furnishing water at constant pressure, however, it is preferred to keep the valve 47 normally closed, and to provide the fresh water for the washing receptacle 11 through the overflow conduit 52 of the water tank 50. This may be done by regulating the inflow valve 54 in such manner that water flows into the tank 50 at the proper rate not only to furnish the requisite water for the alkaline solution, but also to overflow at the desired rate into the conduit 52.

When operations are shut down, the valve 48

may be closed and the washing receptacle 11 may be rinsed out by water supplied through the overflow conduit 52, or, if preferred, the valves 38 and 39 may be closed, and the valves 47 and 48 opened, to drain the tank 50 or to supply rinsing water for cleaning the washing receptacle 11, or both.

It is to be noted especially that in this apparatus the amount of alkaline solution supplied to the washing water receptacle 11 is regulated and controlled by regulating the amount of water supplied to the alkaline material 26, rather than by regulating the amount of water flowing away from the alkaline material. In other words, it is the amount of water added to the alkaline material to form the solution, which is regulated, rather than a regulation of the flow of the alkaline solution itself. With this arrangement, the water never backs up upon or submerges the alkaline material, so there is little or no danger of forming a saturated solution of alkaline which might precipitate in and clog up the overflow conduit. Likewise, this arrangement permits the water to trickle slowly over the alkaline material 26, which results in using the material to the best advantage, prolonging its life, and keeping the alkalinity of the solution, per unit volume of water, substantially constant until practically all of the alkaline material is completely dissolved and exhausted.

The degree or percentage of alkalinity to be maintained in the washing water receptacle 11 is a matter of choice and depends upon the circumstances such as the character of the articles being washed, the length of time each one is subjected to the washing spray, and so on. It is found to be satisfactory in many instances to utilize for the washing water, an alkaline solution of about half of one per cent, the alkalinity being determined by titration with a standard acid solution, and being computed to sodium hydroxide using methyl orange as an indicator.

The terms alkali or alkaline material as used throughout this specification and in the accompanying claims, are intended in a broad sense as including any alkaline detergent whether it is a single chemical compound or a mixture of two or more compounds, and whether salts or bases.

I claim:

1. Washing apparatus of the type including a receptacle for holding a supply of alkaline washing water the alkalinity of which tends to decrease in use, comprising in combination a container, a supply of soluble alkaline material within said container, conduit means connecting said container to said receptacle and providing a free outflow for liquid within said container, a water supply tank for holding water at a substantially constant level above said alkali container, supply conduit means for supplying water from said tank to said container at a point above said alkaline material, so that said water may flow downwardly over said alkaline material to form an alkaline solution flowing thence through said outflow conduit means to said receptacle, and graduated regulating valve means in said supply conduit means for regulating the amount of water supplied to said container to control the amount of alkaline solution flowing to said receptacle.

2. Washing apparatus of the type including a receptacle for holding a supply of alkaline washing water the alkalinity of which tends to decrease in use, characterized by a container, a supply of soluble alkaline material within said container, conduit means connecting said container to said receptacle and providing a free outflow for liquid within said container, a water supply tank for holding water at a substantially constant level above said alkali container, supply conduit means for supplying water from said tank to said container at a point above said alkaline material, so that said water may flow downwardly over said alkaline material to form an alkaline solution flowing thence through said outflow conduit means to said receptacle, an overflow conduit leading from said tank to said receptacle, regulating valve means in said supply conduit means for regulating the amount of water supplied from said tank to said container, to control the amount of alkaline solution flowing to said receptacle, and means for supplying water to said tank to furnish water both to flow to said container to form said alkaline solution, and to flow through said overflow conduit to said receptacle to replace water lost during the washing operation.

3. Apparatus for supplying relatively large volumes of alkaline solution of substantially constant alkalinity over relatively long periods of time, comprising a container, a relatively large supply of alkaline material within said container in the form of relatively hard lumps with interstices between them, a water supply tank above said container to hold a supply of water at substantially constant head with respect to said container, conduit means leading from said tank to said container to supply water to said container at a point above said alkaline material so that said water may flow downwardly over said lumps and through said interstices, means providing a relatively fine adjustment over a relatively wide range of the flow of water through said conduit means, graduated scale means cooperating with said flow adjustment means to enable said adjustment means to be set readily to a position providing a predetermined rate of flow, and means providing a sufficiently free outflow of water from said container so that said alkaline material remains always unsubmerged and is subjected to the action of water only as it flows downwardly by gravity over the surfaces of said lumps.

4. Washing apparatus of the type including a receptacle for holding a supply of alkaline washing water the alkalinity of which tends to decrease in use, comprising in combination a container, a supply of soluble alkaline material within said container, conduit means for delivering liquid from said container to said receptacle and providing a free outflow for liquid within said container, substantially constant head water supply means for delivering water to said container at a point above said alkaline material so that said water may flow downwardly over said alkaline material to form an alkaline solution flowing thence through said outflow conduit means to said receptacle, and regulating valve means in said water supply means for regulating the amount of water supplied to said container, said regulating valve means having graduated scale means associated therewith so that said valve means may be readily set to a position providing a predetermined rate of flow.

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