Provisional Patent Application of

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For

RANDOM ACTION FILTERING METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS Not Applicable

FEDERALLY SPONSORED RESEARCH Not Applicable

SEQUENCE LISTING OR PROGRAM Not Applicable

BACKGROUND—FIELD OF THE INVENTION

The invention relates to filtering systems for low viscosity liquids in small scale liquid containment applications, and particularly to a type of filtering method acting within induced liquid turbulence from external or internal liquid agitation within an open or closably openable container.

BACKGROUND—DESCRIPTION OF PRIOR ART

Filtration methods for low viscosity liquids, particularly drinkable liquids such as water or ethyl alcohol, are well known in the prior art and date back to ancient times. Early liquid filtering methods utilized gravity to pass liquids through naturally occurring filtering media means, such as bark, moss, and sand. Liquids were also manually forced through woven fabric filter bags containing various filtering media. Although low viscosity liquid filtering is still performed by gravity and manual means, a plethora of other filtering devices have since been invented utilizing electromechanical pumping means to force a liquid through a filter media means in a linear, centrifugal, or other manner. Conversely, some liquid filtering devices currently in use force filtering media means through liquids in various ways, such as the French press piston method, or by manually pushing or dragging a larger scale filter through a liquid. Many alternate portable liquid filter methods have also been developed, for example, wherein a plastic bottle is squeezed to force a liquid through a filter, or wherein water is sucked through a straw that contains a filtering media means.

Although the present inventional method utilizes specific filter media means, i.e. various combinations of filter media, for the respective purposes of removing or reducing specific chemical, mineral or biological contaminants, the present invention does not fully utilize any of the aforementioned ancient or modern methods for filtering a low viscosity liquid to remove specific content from the liquid. Instead, the method of the present invention is to utilize induced chaotic turbulence in a contained liquid wherein an appropriate specific filter media means has been situated, so that the random waves of the turbulent liquid and the filter media means will interact with each other to cause a specific filtering effect upon the liquid. The present inventional liquid filtering method is based upon known and reliable principles of fluid dynamics principles regarding the probability distribution of molecules in turbulent fluids. Laboratory tests for statistical turbulence modeling conducted by researchers in the dynamics of fluid turbulence, such as Christian Beck, Professor of Applied Mathematics, Queen Mary, University of London, Professor Dr. Eberhard Bodenschatz, Professor of Physics, Director at the Max Planck Institute for Dynamics and Self-Organization, and other researchers studying induced turbulence in liquids, indicate that velocities and positions electronically measured on turbulently accelerated trace particles demonstrate that such particles will repeatedly traverse all points within a contained turbulent liquid volume in a relatively brief amount of time. Thus, contained induced liquid turbulence is a statistically deterministic process that results in the flow of all of the liquid molecules through all regions within the liquid container, and any porous object in the diverse paths of the turbulent liquid flow will experience this random liquid flow passing through itself.

No example of the RAF Method has been thus far observed in nature. That is, no personally known natural phenomenon in a physical or biological environs appears to place a filtering media means in the presence of a contained turbulent liquid volume for the purpose of filtering a liquid. The RAF Method is apparently not a natural phenomena and should therefore be deemed patentable as a manmade process of liquid filtering through induced liquid turbulence whenever an appropriate filtering media means is present in the liquid for the express purpose of filtering the liquid via random liquid wave action. The general principle of the inventional method is that a contained, low viscosity liquid volume that is vigorously agitated will incur a quickly moving chaotic wave turbulence that is causal to random, omnidirectional wave fronts that will pass through small porous objects such as a filtering media means, and thus be causal to the liquid being filtered.

It has been personally experimentally determined that, depending on the liquid containment means, closably openable or open, various degrees of liquid turbulence, i.e. turbulization, may be induced on a small scale by: vigorous shaking; by vigorous stirring in consistently irregular motions (as opposed to circular diffusive stirring); by intense vibration; or, via other dynamic agitational means. In the context of this apparently new method of filtration, it has also been personally experimentally determined that some of the various types of filter media means may be: freely movable loose particles, fibers, granules, etc., which are later screened out of the liquid; or, freely movable unweighted or weighted, particles, fibers, granules, etc., in porous bags, or in other porous encasements; or, freely movable unweighted or weighted, filter-media impregnated foam or spongy pads; or, any of the aforementioned filter media means that have been rigidly, or flexibly, or pendulously, or otherwise secured within a liquid container by being either directly connective with a portion of the liquid container, or otherwise connective to an internal extension of the container, such as a protruding rigid, or a flexible, or a pendulous stem mount such as flexible plastic, or other form of spring strip; or, may be any of the aforementioned filter media means that are moved by, or movably connective with, a rigid, or a flexible, or a pendulous stirring or vibrational means, wherein the motion of the filter media means through the liquid causally contributes to an inducing of the inventional method's required turbulization of a liquid volume to be filtered. The effect of the liquid filtering method of the present invention in all of the above instances of a filter media means situated within a liquid is that the turbulent random motion of the molecules in the agitated liquid repeatedly interact with the respective filter media means to force the liquid omnidirectionally through the filter media means.

In all of the above cited contexts of the present inventional method, the end result is a rapid filtering effect within the total volume of the liquid that is performed in terms of the physical characteristics and saturation limits of the filtering media means relative to the current physical nature of the liquid. The present inventional method of the filtering effect of a turbulized liquid interacting with a filter media means does not appear to be known in the prior art. No relevant filter method patent references were located in the searched patent data bases, or in the public domain, that appear to address the issues of situating a filter media means within a turbulent liquid environment for the purpose of filtering a liquid. In the numerous patented filter methods located, there is also no suggestion or speculation in any of the considered patent specifications or claims that their respective filtering systems could or should be utilized in the specific method of any embodiment of the present inventional liquid filtering method.

Summary

A Random Action Filtering Method, or RAF Method, of the type under consideration for relatively low viscosity liquids in small-scale applications, utilizes vigorous manual or electromechanical motive forces to either externally or internally induce turbulence within a contained liquid volume to compel all of the turbulized liquid to randomly and omnidirectionally pass through a provided appropriate filter media means situated within the liquid. Whenever turbulence is achieved and sustained for an appropriate duration, the induced liquid turbulence is utilized to provide an overall filtering effect upon the complete liquid volume within a minimal time frame. The efficacy of the effect occurs in terms of the physical characteristics and saturation limits of the filter media means, and the intensity and duration of the agitational force, as well as upon other relevant factors, such as: the actual viscosity of the liquid; the actual temperature of the liquid; the actual amount of specific contaminants within the liquid which are to be filtered out; the addition of inertial mass (weight) to a freely movable or partially movable filter media means; the allowed air gap within the open or closably openable container; and, the actual density and porosity of the filter media means and any provided porous encasing material or protective porous caging means. The porous encasement may be any porous material such as microporous mesh screening, or any other commonly used filter media encasing material. The porous cage may be any surrounding grid fabricated from plastic or other materials. The actual composition of the filter media means is predetermined by the objectives of a particular liquid filtering process.

Objects and Advantages

The primary object of the invention of a Random Action Filtering Method, or RAF Method, of the type under consideration for relatively low viscosity liquids in small-scale applications, is to provide a convenient, effective, and simple to utilize process for filtering small volumes of a liquid. The present invention achieves this object by providing a filtering process that relies on the chaotic hydraulic pressure within a turbulized liquid to provide a full filtering effect upon the liquid volume. In all of the present invention's embodiments, random, non-linear, eddy wave fronts of a turbulized liquid are relied upon to interact with a filter media means to cause a filtering effect upon the liquid.

It is a still further object of the inventional method to provide various exemplificational embodiments of the method which utilize either open or closably openable containers for liquids turbulized to different degrees of intensity that will interact with various forms of filter media means to produce liquid filtering effects. For example, in open containers, turbulization typically occurs at low intensities and therefore requires longer durations, typically several minutes for the filtering effect to fully occur, whereas, with vigorous shaking, or intense vibration, or agitating action in a closably openable container, turbulization is rapidly achieved and the filtering effect typically occurs in well under a minute. Many of the present invention's considered exemplificational embodiments also include useful features, such as differing ways for inducing turbulence into a contained liquid, and differing means for securing attachably removable filter media means for simplified saturated filter media means exchange.

It is still a further object of the present invention to provide a liquid filtering method that is also relatively simple and inexpensive to manufacture and to use, and that is durable and reliable during use, and that is fabricated from commonly available materials.

The primary advantage of a Random Action Filtering Method, or RAF Method, is that it combines a number of possible filtering features and abilities in simple embodiments that are useful in association with practical small-scale liquid-filtering activities. A further advantage is that a typical RAF embodiment does not utilize a mechanical hydraulic pump, and has either no liquid seals, or a minimal number of liquid containment seals. A RAF embodiment is typically portable, requires little effort or time to utilize, and rapidly filters small volumes of liquid, while also allowing for quick and easy filter change and disposal. The RAF Method also utilizes filtering media means that are typically soft, pliable, non-scratching, generate little sound, and have a low product liability.

RAF embodiments can typically filter successively through numerous filtering cycles prior to media saturation, thus reducing the cost per cycle, for example, to reduce chlorine and minerals in drinking water to improve taste and remove odor. Other use examples would be in terms of the specific low viscosity liquid in use and the type of filter media required to remove specific content in the liquid, e.g., for the removal of bitter tastes from ethanol based liquids.

Experiments utilizing the RAF Method are also currently underway to provide filter media means for removing other more hazardous physical and biological contaminants from drinking water, and other low viscosity liquids, as well as to experimentally attempt to extend the RAF Method to other low viscosity fluids, that is, to other liquids and gases, as a Random Action Fluid Filtering Method.

There is a clear need for a Random Action Filtering Method, or RAF Method, for small scale liquid filtering applications that is simple to use, reliable during use, and that is fabricated from inexpensive commonly available materials and components, and that is relatively easy to manufacture, maintain, clean, and repair. Other objects and advantages of the invention will become clear upon review of the following detailed description and accompanying drawings.

Although it may appear that there that there is a great deal of redundancy in the detailed description as each of the respective drawings are considered, each slightly differing exemplification of the RAF Method serves to prove a single point, which is that irrespective of how liquid turbulization is generated, or how an appropriate filter media means is situated within a turbulized liquid, the end effect is invariably the same: When an appropriate filter media means is present in a sufficiently turbulized liquid for a sufficient duration, a filtering effect on the liquid will always occur.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A shows a cutaway diagrammatic perspective view of a typical rectangular, porously encased, unweighted, foam pad filter.

Fig. 1B. shows a diagrammatic perspective view of the foam pad filter of Fig. 1A having a provided weight.

Fig. 1C shows a diagrammatic cutaway perspective view of a typical porously encased, unweighted, spherical filter.

Fig. 1D shows a diagrammatic frontal cutaway view of the spherical filter of Fig. 1C having a provided internal weight.

Fig. 1E shows a diagrammatic frontal perspective view of the spherical filter of Fig. 1C having a provided external weight and a provided protective porous cage.

Fig. 2 shows a diagrammatic perspective view of a closably openable container RAF embodiment having a freely movable filter media means and turbulized by external manual force.

Fig. 3 shows a diagrammatic perspective view of an open container RAF embodiment having a freely movable filter media means and turbulized by internal manual force.

Fig. 4 shows a diagrammatic cutaway perspective view of a closably openable container RAF embodiment having an external electromechanical vibrational turbulization means.

Fig. 5 shows a diagrammatic cutaway perspective view of a closably openable container RAF embodiment having an internal electromechanical vibrational turbulization means.

Fig. 6 shows a diagrammatic perspective view of a closably openable container RAF embodiment having a downwardly disposed rigid or flexibly pendulous stem.

Fig. 7 shows a diagrammatic perspective view of a closably openable container RAF embodiment having an upwardly disposed rigid or flexibly pendulous stem.

Fig. 8A shows a diagrammatic perspective view of a closably openable container RAF embodiment having a circular filter mount connective with a closably openable liquid container.

Fig. 8B shows a top view stand-alone diagram of the circular filter mount of Fig. 8A.

Fig. 9 shows a diagrammatic perspective view of an open container RAF embodiment wherein a filter media means is connective with a drinking straw.

Fig. 10 shows a diagrammatic cutaway perspective view of a closably openable container RAF embodiment having an internal electromechanical agitator turbulization means.

Fig. 11 shows a diagrammatic perspective view of a preferred closably openable container RAF embodiment having a perforated hollow stem straw with a downwardly secured or attachably detachable filter media means.

DESCRIPTION AND OPERATION

PRELIMINARY INFORMATION

Induced liquid turbulence, as it applies to the present inventional context, is defined as: the provision of externally or internally applied motive force means, i.e., a kinetic energy, to a volume of liquid gravitationally or centrifugally held within an open or closably openable container, wherein the provided applied kinetic energy is sufficient in intensity and duration to be causal to an accelerated chaotic flow of the liquid volume within itself in the form of erratic vortices that interact with each other, and cascade into smaller, high velocity eddies with no preferential spatial direction, leading to the high statistical probability that all portions of the contained liquid volume will traverse and repeatedly intersect all spatial regions of the container within brief periods.

The operating principle of the inventional method, i.e. the Random Action Filtering, or RAF method, is an induced liquid turbulence filtering effect, or "RAF effect" that occurs whenever an appropriate filtering media means is present within a turbulized liquid, the effect being that all portions of a contained turbulized liquid will repeatedly pass through the filter media means and thereby filter the liquid in terms of the filtering media means. This induced liquid turbulence filtering effect will hereinafter be referred to as the RAF effect to differentiate it from conventional filtering processes that do not rely on the induced turbulence of a liquid to provide the passage of a liquid through a filter media means, i.e., to differentiate the present inventional filtering effect from typical filtering methods wherein a liquid is either hydraulically forced by mechanical liquid pressure means through a stationary filtering media means, such as a filter cartridge, or conversely, wherein a filter media means, such as a circular carbon block, is directly forced through a tube having liquid content, as in a French pump system, or wherein a filter media means is manually pushed or dragged through a liquid without inducing a complete turbulization of the liquid.

As earlier noted, the RAF effect has been personally experimentally demonstrated to occur within a variety of low viscosity liquids, using a variety of filter media means, and a variety of turbulizing means. The RAF effect can be generated when the filter media is either freely movable or anchored within a contained turbulized liquid, or when the filter media means is positionally secured within a turbulized liquid within a container, or when a filter media means is randomly stirred or vibrated within a liquid to causally turbulize the liquid. The filter media means selected for use to generate the RAF effect may be something as simplistic as loose activated charcoal filter media granules that are later screened out; or, may be filter media that is impregnated with a filtering substance, for example, as activated charcoal is commonly impregnated into foam pads; or, may be media granules such as ion beads, or other filtering media substances that are encased in porous encasement packets. Such substances may be placed within sealed bags or packets, or left loose between porous material layers, or impregnated into another media, and may be further porously caged for protective purposes.

The actual composition of the filter media means is predetermined by the objectives of the liquid filtering process. The porous encasement may be any porous material such as microporous mesh screening, thin woven fabric, porous foam, or any other commonly used filter media encasing material. The protective porous cage may be any surrounding grid fabricated from plastic or other materials. Filter pads and encased packets may also be internally or externally weighted, typically with metal bands or otherwise connective metal attachments to increase inertial effects, reduce filter media means buffeting, increase flow-through, and to generally decrease the required agitation time to induce liquid turbulence. Turbulence may be induced into the liquid by internal or external, manual or electromechanical motive forces, as dependent upon the specific open or closably openable containment means, and the type of RAF Method embodiment, i.e. RAF "device" under consideration.

In view of the above, a RAF "device" is herein defined as any embodiment of the present inventional method that utilizes the RAF effect. That is, a RAF device is any operable liquid filtering device wherein an appropriate filtering media means is situated within a contained turbulized liquid for the purpose of filtering the liquid volume in terms of the filtering media means.

In order to make the specification more clear, examples of RAF filtering media means will be first provided, followed by brief generalized examples of RAF devices, and ending with a preferred embodiment of a RAF device.

Examples of RAF Filtering Media Means — Figs. 1A – 1E

Referring to the appended drawings, Fig. 1A shows a cutaway diagrammatic perspective view of a typical rectangular, porously encased, unweighted, foam pad filter **101A**, having a porous encasement **101B**, and a filter foam media **101C** (revealed in the cutaway portion). Foam pad filter **101A** is typically a 2.5" x .75" (6.4 cm x 1.91 cm) piece of activated charcoal impregnated filter foam such as are sold in larger sheets by various manufacturers, such as Fluval Inc. and Eheim Inc. Porous encasement **101B** is a sewn fabric micromesh fabric covering into which filter foam media **101C** has been sewn. Foam pad filter **101A** may be used in any RAF device embodiment. The efficiency of foam pad filter **101A** depends on porosity, pad surface area, thickness, degree of activated charcoal (AC) impregnation, degree of agitational intensity and duration, and other interrelated factors, e.g. type of liquid, amount of liquid contaminants, liquid viscosity, the volume of liquid relative to any provided air gap, etc. All of these factors determine whether or not a RAF effect will occur, and whether it will occur for a one time only use, or for multiple filtering cycles, and thus either be a disposable or a multiuse filter media means.

Although the planar design shape of foam pad filter **101A** is shown in Fig. 1A as a parallelepiped, foam pad filter **101A** may be any planar, or curviplanar, or cylindrical shape, or may be otherwise fashioned into any other open or closed configuration or geometric design. Foam pad filter **101A** may be left unencased or arbitrarily encased within an appropriate porous encasement **101B**, such as thin woven cloth, nonwoven plastic or metallic mesh, or thin non-impregnated foam, or other appropriate materials. Porous encasement **101B** is typically provided to prevent the passage of any filter foam media **101C** fibers or particles from foam pad filter **101A** into any liquid volume to be filtered. Alternately, foam pad filter **101A** can be a porous carbon block, but this is atypical because the flow rate through such material is significantly slower and leads to longer periods of turbulization to induce the RAF effect.

Fig. 1B shows a diagrammatic perspective view of foam pad filter **101A** with a porous encasement **101B**, that has been weighted by weight **101D**. Weight **101D** is typically a metal band made of stainless steel or other metal, that has been crimped onto, or adhesively attached to, or otherwise been made securely connective with foam pad filter **101A**. Other weight means may be utilized for the addition of weight to foam pad filter **101A**, such as weights which passes through foam pad filter **101A**, for example as a nut and bolt attachment wherein the primary weight is internal, or wherein foam pad filter **101A** is passed through and wedged or otherwise secured within an aperture in a metal or other physical weighting means, or situated within a grid weighting means wherein the primary weight is external. When utilized in a RAF device, weighted freely movable filter media means, such as are exemplified by Fig. 1B, and in reference to Figs. 1D and 1E below, tend to expedite the RAF effect by reducing the tendency of a freely movable filter media means to move with the flow of a turbulized liquid, and increasing the tendency of a freely movable filter media means to remain suspended toward the middle of a contained turbulized liquid.

Fig. 1C shows a diagrammatic cutaway perspective view of a typical unweighted, spherical filter **102A** containing a filter media **102B** that has been porously encased using an appropriate porous encasing material **102C**, such as thin woven cloth, or thin non-impregnated foam. Filter media **102B** may be any appropriate filtering material, such as Granulated Activated Carbon (GAC), ion beads, Kinetic Degradation Fluxion (KDF®), or other appropriate filtering material relative to the specific contaminants sought to be removed from a liquid.

Although the design shape of spherical filter **102A** is spheroidal, it can be otherwise fashioned and encased in any geometric design using any appropriate porous encasing material. Porous encasing material **102C** is provided to prevent the passage of any filtering media **102B** fibers, particles or granules from spherical filter **102A** into any liquid volume to be filtered.

Fig. 1D shows a diagrammatic frontal cutaway view of spherical filter **102A** that has a provided internal weight **102D**. Internal weight **102D** is typically a small piece of metal, such as a stainless steel, or other metal, that has been inserted into filter media **102B** that is securely held in place by porous encasing material **102C** or by any further outer encasing means for filter **102A** (not shown), such as a plastic, or other material grid. Other internal weight means may be utilized for the addition of weight to spherical filter **102A**, for example as a nut and bolt or other linear or geometric arrangement, passing through spherical filter **102A**.

Fig. 1E shows a frontal perspective view of spherical filter **102A** that has a provided external weight **102E** and a provided outer transparent plastic, or other appropriate material, protective porous cage **102F** having a plurality of apertures **102G** for the required passage of a liquid volume through spherical filter **102A**. External weight **102E** is typically a metal weight made of stainless steel or other metal, that has been crimped onto, adhesively attached, tethered to, or otherwise been made securely connective with spherical filter **102A**. Other weight means may be utilized for the addition of weight to spherical filter **102A**, such as weights with attachment means that pass through spherical filter **102A**, for example as a nut and bolt attachment wherein the primary weight is external, or wherein spherical filter **102A** is passed through and wedged or otherwise secured within an aperture in a metal or other physical weighting means, or external grid weighting means. Protective porous cage **102F** may be sealed after placement around spherical filter **102A** by various means, such as adhesives or welding, or be a closably openable protective porous caging means. Protective porous cage **102F** is typically utilized in combination with any external metal weighting means **102E** to prevent damage to a liquid containment means during turbulization. Apertures **102G** may alternately be any plurality of provided openings in protective porous cage **102F** for liquid flow-through. Protective porous cage **102F** may be fabricated from plastic, rubber, or other pliable material, or be metallic caging means are coated with other pliable materials. Examples of alternate protective caging means for an encased filter media means would be any other suitable geometric enclosure with a plurality of apertures that both encompasses a filter media means and allows a turbulized liquid a proper flow-through rate for a RAF effect. Typically, multiple RAF filters are not utilized together, whether tethered or caged or otherwise combined, for the reason that such combining reduces rather than increases the efficacy of the RAF effect.

RAF filters such as are typified in Figs. 1A-1E have only small amounts of filtering media present within them. For example, regarding filter media **102B** contained in spherical filter **102A**, typically only a level teaspoon (approx. .1 oz; approx. 2.83 g) of filter material is utilized in a .75" (1.91 cm) diameter porously encased spherical filter **102A**. The diameter of spherical filter **102A** may be slightly smaller, for example, for insertion into a small neck bottle, or may be slightly larger, for slightly larger liquid volumes, and accordingly the quantity of filter media **102B** utilized may be in a much smaller or larger amount, depending upon the actual media being used, the type and volume of liquid being filtered, the ppm of contaminants being reduced or removed, and the duration, means and intensity of liquid agitation.

When filter **101A** or **102A** are securely situated in RAF devices, they may not require weighting, but in situations where they are either freely or partially movable, the actual weighting that might be utilized is typically only a .5 oz (14.7 g) weight to provide a filter media means with sufficient inertia to generally center each within a contained turbulent liquid , i.e. to resist against fully flowing with a turbulized liquid. Under constant shaking pressure, filters **101A** or **102A** do not typically fully travel from one end of a liquid container to another, but from side to side and across a minimal central travel length. An appropriate inertial weight keeps the travel distance short to allow for better filter flow-through effect.

In view of the above explanations of filtering media means, henceforth in this specification, the filter media means indicated for Figs. 1A-1E above will be generically symbolized in Figs. 2-11 by the letter — **F** — for Filter, which is either encircled or contained within an encircling oval enclosure, and be hereinafter referred to in the specification text as — filter means **F** —.

It is important to understand that wherever a filter means **F** is further indicated in either the drawings, the specification, or the claims, that reference is being made both to a filter media **F** that is "appropriate" for the removal of specific contaminants within specific liquids, and to a filter means **F** which is also "appropriate" in the sense that the liquid flow-through rate for the filtering media, any porous encasement provided, and any protective porous outer caging provided, has been properly designed and fabricated so that this flow-through rate is not interrupted by a "turbulent tumbling" of a filter media means **F** within a turbulized liquid, which would lead to a diminishment or stoppage of the liquid flow-through rate through filter media means **F**. Turbulent tumbling can occur, for example, when any particular liquid filter media means is inappropriately, excessively or improperly weighted, or inappropriately designed and/or fabricated, or for example, when a provided filter media means is overly dense, or where liquid passage is restricted to a single tube, or to overly long, narrow external passages into and/or out from the provided filter media means.

For a simplification of the interpretation of the drawings and the reading of the specification, henceforth, in the appended drawings, a low viscosity liquid volume will be generically designated in Figs. 2-11 by the letters — **LV** —, and will be hereinafter referred to in the specification text as — liquid volume **LV** —.

Examples of Generic RAF Device Embodiments — Figs. 2 – 10

Fig. 2 shows a vertically orientated diagrammatic perspective view of a typical manually operated closably openable container RAF device **201** that has a freely movable filter means **F** within a liquid volume **LV**. RAF device **201** has a liquid volume **LV** containment means, here being a transparent plastic or other material closably openable cylindrical container **202** with a translucent plastic or other material, slidably closably openable translucent plastic or other material cap **203** and a sealed translucent plastic or other material bottom **204**. Closably openable container **202** has been provided with one or more of the filter media means of filter means **F** indicated in Figs. 1A-1E above. Container **202** is shown vertically filled to an imprinted or otherwise applied encircling fill line **205**. Liquid volume **LV** is shown being turbulized by a manual shaking of container **202** in both vertical and horizontal planes, as indicated by a set of shake arrow lines **206**. Shaking **206** need not be overly aggressive or hurried to provide a full filtering effect; but it must not be so non-aggressive or slow as to not properly move liquid volume **LV** in a continuously chaotic pattern within container **202**. Circular up/down shaking is preferable to any wrist tilting shaking method, as it allows for a fuller exposure of liquid volume **LV** to filter means **F**, and is also not conducive to carpal tunnel syndrome.

The liquid volume **LV** turbulization process is shown by erratic turbulence lines **207** and the directional effect of the turbulization of liquid volume **LV** on filter means **F** is indicated by a set of arrow lines **208**. When RAF device **201** or any other RAF device with a freely movable filter means **F** is intended as a portable filtered drink means, it may be provided with a grid cover **209** to prevent filter means **F** from flowing out of containment during liquid consumption if there is no appropriate drink hole means provided for container **202** that is smaller than filter means **F**. Grid cover **209** is a pliably rigid plastic or other material grid that is typically frictionally wedged into container **202** and is removably insertable via upwardly disposed handle **209A** which is molded into or otherwise attached to grid cover **209**.

Closably openable container **202** as shown in Fig. 2, and all other closably openable or continuously open liquid volume **LV** containers shown in Figs. 3-11, are generic container exemplifications for any shape, design, or material fabrication of a liquid volume **LV** containment means, such as other small scale plastic, metal, ceramic and other typical material liquid vessels of virtually any geometric shape and closuring means, such as mugs, jugs, bottles, cans, jars, and so on, that may have alternate slide on/off, screw on/off, or other attachably detachable capping means, to include a manual covering with a plate or a hand, and such liquid volume **LV** containment means may be either transparent, translucent, opaque, or any mixture of these. And, just as RAF device **201** may be further provided with a closably openable drink hole (not shown) in top cap **203**, all closably open container RAF devices may be provided with equivalent drink holes. It is thus to be generally understood that a liquid inlet means and a liquid outlet means for container **202**, and all other liquid containment means indicated or suggested in this specification, typically suggests the opened mouth of a liquid containment means, but that a liquid inlet and/or outlet means for a liquid containment means may further comprise differing types of drink holes, tubes, straws, or liquid valves, faucets, and other such devices as might facilitate or expedite the entry or removal of a liquid volume **LV** from a liquid containment means, or may even be a more complex arrangement of inlet and outlet devices with further connective tubing or any other such methods for allowing a liquid flow into and out from a liquid containment means. Accordingly, all further references in this specification to closably openable or fully open liquid volume

LV containment means will have these understandings of liquid inlet and outlet means.

RAF device **201** is typically operated in the following manner. Top cap **203** is slidably removed from container **202** and a liquid volume **LV** to be filtered is entered into container **202** and typically only filled up only to fill line **205** to allow for a suitable air gap for more efficient turbulization. Filter means **F** is then placed into container **202**. If grid cover **209** is to be used, it is then placed via grid cover handle **209A** into container **202**, and top cap **203** is replaced. Assuming, for example, that liquid volume **LV** is a small volume of water (8 - 24 oz; 236.59 - 709.76 ml), container **202** is manually grasped and vigorously typically shaken in an up/down, side to side or circular manner for approximately 30 shake cycles in under 15 seconds to yield a full volume RAF effect. As liquid volume **LV** increases up to 64 oz (1892.71 ml), the number of shake cycles required increases and the time required to filter liquid volume **LV** accordingly increases up to a minute or more to achieve a full RAF effect. Larger order containers up to 128 oz (3785.41 ml) require considerably more time and effort. The RAF effect can then typically be repeated numerous times by the same process with new liquid volumes **LV** for the same duration until filter means **F** is saturated and must be replaced. Prior to saturation, filter means **F** is either removed to a resealable storage means, or left in container **202** for future use. Depending on the physical nature of filter means **F**, it may be required to initially prepare filter means **F** for use by either rinsing with running tap water, or by doing the first few filtering cycles within container **202** using water that is subsequently discarded.

Fig. 3 shows a vertically orientated diagrammatic perspective view of a typical open container RAF device **301** that has a freely movable filter means **F**, and a liquid volume **LV**. Open container RAF device **301** has a liquid volume **LV** containment means, here being a transparent plastic or other material cylindrical container **302** with an open top **303** and a sealed translucent plastic or other material bottom **304**. Open container **302** is shown vertically filled to an imprinted or otherwise applied encircling fill line **305** with a low viscosity liquid volume **LV**. Liquid volume **LV** is shown being turbulized by a manual internal stirring of liquid volume **LV** within container **302** via a long-handled paddle **301A**.

RAF device **301** is typically operated in the following manner. A liquid volume **LV** to be filtered is entered into container **302** and typically filled up only to fill line **305** to allow for any possible splash effects during turbulization. Filter means **F** is placed into container **302**. Long handled paddle **301A** is then manually operated in a vigorous irregular side to side manner in a horizontal plane, as indicated by a side to side stirring arrow line **306**. Such stirring can also include vigorous random dipping, as a tea bag might be dipped, but only when filter means **F** is secured to, or securably releasably physically connective to a stirring means such as paddle **301A**, as is explained for RAF device **901**. The liquid volume **LV** turbulization process is for RAF device **301** is shown by a set of erratic turbulence lines **307** and the directional effect of the turbulization of liquid volume **LV** on filter means **F** is indicated by a set of arrow lines **308**.

Assuming liquid volume **LV** is a small volume of water (8 - 24 oz, 236.59 - 709.76 ml), container **302** is so stirred for approximately one to two minutes to yield a full volume RAF effect, depending on the actual quantity of liquid volume **LV**. As liquid volume **LV** increases up to 64 oz (1892.71 ml), the stirring time required to filter liquid volume **LV** increases by several minutes. Larger order containers up to 128 oz (3785.41 ml) require considerably more time and stirring effort. The RAF effect can then be typically repeated numerous times by the same process with new liquid volumes **LV** for the same duration until filter means **F** is saturated. Prior to saturation, filter means **F** is either removed to a resealable storage means, or left in container **302** for future use. Depending on the physical nature of filter means **F**, it may be required to initially prepare filter means **F** for use by either rinsing with running tap water, or by doing the first few filtering cycles within container **302** using water that is subsequently discarded.

The operation of all other manually actuated RAF devices, shown in Figs. 6-9 and 11 and explained below, which utilize either positionally secured or securably releasable versions of filter means **F** for closably open and continuously open containers, will then follow the same operational procedures as just given for RAF devices **201** and **301**. The operation of electromechanical RAF devices shown in Figs. 4-5 and 10 will be explained in turn.

Fig. 4 shows a vertically orientated diagrammatic cutaway perspective view of a RAF device **401** that utilizes an external electromechanical vibrator **401C** rigidly connective by plastic or other material molding within a rigid plastic or other material case **401A** as a vibrational turbulization means. RAF device **401** has a freely movable filter means **F**, and a liquid volume **LV** within a containment means, here being a transparent plastic or other material cylindrical container **402** with a translucent plastic or other material, slidably closably openable top cap **403** and a sealed translucent plastic or other material bottom **404** (shown slightly elevated for clarity). Container **402** is shown vertically filled to an imprinted or otherwise applied encircling fill line **405** with low viscosity liquid volume **LV**. Liquid volume **LV** is shown being turbulized by an external electromechanical vibration of container **402** as indicated by a horizontal vibrational arrow line **406**. The liquid volume **LV** turbulization process itself is shown by a set of erratic turbulence lines **407**. Container **402** is shown situated within an aperture **401B** (shown slightly elevated for clarity) in electromechanical vibrator case **401A**. Electromechanical vibrator case **401A** has a generic vibrational motor **401C** of the type used in electric toothbrushes and other devices, and is powered by an electrical power source, here being a small battery **401D** within a battery compartment **401E**. Vibration occurs when connective generic electrical switch button **401F** is used to actuate electrical wire connections (not shown) within an open area of electromechanical vibrator case **401A** to further actuate an electrical connection between generic vibrational motor **401C** and battery **401D** within battery compartment **401E**. External electromechanical vibrator case **401A** has an openably closable bottom portion (not shown) for the replacement of battery **401D**. RAF device **401** may be further provided with a closable openable drink hole (not shown) in top cap **403**. Alternately, vibration may be performed on container **402** in a vertical plane via the use of an electromagnetically vibrating diaphragm method of inducing liquid volume **LV** turbulence.

RAF device **401** is operated in the same manner as RAF device **201** with the primary difference being that the actuation of electromechanical vibrator **401C** replaces the physical shaking of container **201** to yield a RAF effect.

Fig. 5 shows a vertically orientated diagrammatic cutaway perspective view of a RAF device **501** that utilizes an internal electromechanical vibrator, being a waterproof generic vibrational motor **501A** as a turbulization means, and has a partially movable vibrational filter means **F**, and a liquid volume **LV**. RAF device **501** has a liquid volume **LV** containment means, here being a transparent plastic or other material cylindrical container **502** with a slidably closably openable translucent plastic or other material top cap **503** and a slidably closably openable transparent plastic or other material bottom cap **504** having a top rim **504A**. Container **502** is shown vertically filled to an imprinted or otherwise applied encircling fill line **505** with low viscosity liquid volume **LV**. Liquid volume **LV** is shown being turbulized by an electromechanical internal vibration of liquid volume **LV** within container **502** as indicated by horizontal vibrational arrow line **506**. The liquid volume **LV** turbulization process itself is shown by a set of erratic turbulence lines **507.** A rigid or flexibly rigid filter means **F** is shown attachably detachably connective with an upwardly disposed rigid or flexible plastic or other material stem **501B** which is downwardly connective with vibrational motor **501A**, a type of waterproof motor used in electric toothbrushes and similar devices, and which is powered by a power source, here being a battery **501C** within waterproof battery compartment **501D**. Filter means **F** is securably removably connective with an upper portion of stem **501B** either by adhesives, or by an insertion into a provided split stem embodiment of **501B** (not shown), or by an insertion of stem **501B** into a tubular pocket provided within filter means **F** (not shown), or by other suitable attachment means. Battery compartment **501D** is upwardly connective with vibrational motor **501A** and downwardly connective with bottom cap **504**, typically by having bottom cap **504** molded to accommodate compartment **501D** and motor **501A**, and otherwise by adhesives or threaded connections with bottom cap **504**.

Vibration occurs when connective electrical switch button **501E** is used to actuate electrical wire connections (not shown) within the bottom portion of bottom cap **504** between vibrational motor **501A** and battery **501C**. Vibration is typically performed in a horizontal plane, as indicated by vibrational arrow line **506**. The liquid volume **LV** turbulization process is shown by a set of erratic turbulence lines **507** and the directional effect of the turbulization of liquid volume **LV** via vibrational filter means **F** is indicated by a set of arrow lines **508**. Bottom cap **504** is slidably removed from container **502** when filter means **F** or battery **501C** requires replacement. RAF device **501** may be further provided with a closable openable drink hole (not shown) in top cap **503**.

RAF device **501** is operated in the same manner as RAF device **201** with the primary difference being that the actuation of electromechanical vibrator motor **501A** replaces the physical shaking of container **201** to yield a RAF effect.

Fig. 6 shows a vertically orientated diagrammatic perspective view of a RAF device **601** that has a downwardly disposed rigid or flexibly pendulous plastic, or other material stem **601A**, which is securely embedded into, or frictionally, or otherwise attachably detachable from a translucent plastic or other material slidably closable openable top cap **603**. RAF device **601** utilizes manual external force as a turbulization means, and has a liquid volume **LV** and a filter means **F**, which is slidably or otherwise attachably detachably connective, for example, by a threaded matching between a filter means **F** mount **601B** that is secured to or attachably detachable from stem **601A**. RAF device **601** has a liquid volume **LV** containment means, here being a transparent plastic or other material cylindrical container **602** with a sealed translucent plastic or other material bottom **604**. Container **602** is shown vertically filled to an imprinted or otherwise applied encircling fill line **605** with low viscosity liquid volume **LV**. Liquid volume **LV** is shown being turbulized by a manual external vibration of liquid volume **LV** within container **602** as indicated by a set of vertical and horizontal vibrational arrow lines **606**. The liquid volume **LV** turbulization process is shown by a set of erratic turbulence lines **607** and the directional effect of the turbulization of liquid volume **LV** on filter means **F** is indicated by a set of arrow lines **608**. RAF device **601** may be further provided with a closable openable drink hole (not shown) in top cap **603**. Alternately, stem **601A** may be made hollow and perforated, and filled with a filter means **F**, and utilized to achieve a RAF effect in its own right.

RAF device **601** is operated in the same manner as RAF device **201** with the primary difference being that stem-mounted filter means **F** is held securely in place on stem **601A** when RAF device **601** is shaken to cause a RAF effect.

Fig. 7 shows a vertically orientated diagrammatic perspective view of a RAF device **701** that has an upwardly disposed rigid or flexibly pendulous plastic or other material stem **701A**, which is firmly securely embedded into, or attachably detachable from a translucent plastic or other material slidably closable openable bottom cap **704**. RAF device **701** utilizes manual external force as a turbulization means, and has a liquid volume **LV** and a filter means **F**, which is secured to, or slidably or otherwise connectively attachably detachable to stem **701A** via a plastic or other material filter means **F** mount **701B**. RAF device **701** has a liquid volume **LV** containment means, here being a transparent plastic or other material cylindrical container **702** with a translucent plastic or other material slidably closable openable top cap **703**. Container **702** is shown vertically filled to an imprinted or otherwise applied encircling fill line **705** with low viscosity liquid volume **LV**. Liquid volume **LV** is shown being turbulized by a manual external vibration of liquid volume **LV** within container **702** as indicated by a set of vertical and horizontal vibrational arrow lines **706**. The liquid volume

LV turbulization process is shown by a set of erratic turbulence lines **707** and the directional effect of the turbulization of liquid volume **LV** on filter means **F** is indicated by a set of arrow lines **708**. RAF device **701** may be further provided with a closable openable drink hole (not shown) in top cap **703**. Alternately, stem **701A** may be made hollow and perforated, and filled with a filter means **F**, and utilized to achieve a RAF effect in its own right.

RAF device **701** is operated in the same manner as RAF device **201** with the primary difference being that stem-mounted filter means **F** is held securely in place on stem **701A** when RAF device **701** is shaken to cause a RAF effect.

Fig. 8A shows a vertically orientated diagrammatic perspective view of a RAF device **801** having a transparent plastic or other material, circularly shaped filter means **F** mount **801A** connective with a liquid volume **LV** containment means, here being a transparent plastic or other material cylindrical container **802**. Fig. 8B shows a stand-alone top view diagram of the circular filter means **F** mount **801A** of Fig. 8A. Circular filter means **F** mount **801A** is a circular plate with a plurality of apertures **801C** for the passage of a liquid volume **LV**, and arranged around a larger central aperture **801B** suitably sized for the frictional or other secure form of insertion of a filter means **F**. A right angle plastic or other material rod **801D** for vertical insertion and withdrawal of filter **F** mount **801A** into and out from container **802** is positioned between two of apertures **801C**. Filter means **F** is either a secured portion of circular filter means mount **801A**, via adhesives or other means, or is attachably detachably frictionally inserted into circular filter means **F** mount **801A** which is then attachably detachably inserted via rod **801D** into container **802** as a complete unit. Container **802** has a translucent plastic or other material slidably closable openable top cap **803** and a translucent plastic or other material sealed bottom **804**.

RAF device **801** utilizes manual external force as a turbulization means for filter means **F** and liquid volume **LV** to interact. Container **802** is shown vertically filled to an imprinted or otherwise applied encircling fill line **805** with low viscosity liquid volume **LV**. Liquid volume **LV** is shown being turbulized by a manual external vibration of liquid volume **LV** within container **802** as indicated by a set of vertical and horizontal vibrational arrow lines **806**. The liquid volume **LV** turbulization process is shown by a set of erratic turbulence lines **807** and the directional effect of the turbulization of liquid volume **LV** on filter means **F** is indicated by a set of arrow lines **808**. RAF device **801** may be further provided with a closable openable drink hole (not shown) in top cap **803**.

RAF device **801** is operated in the same manner as RAF device **201** with the primary difference being that filter means **F** is held securely in place within circular filter mount **801A** when RAF device **801** is shaken to cause a RAF effect.

Fig. 9 shows a vertically orientated diagrammatic perspective view of a typical open container RAF device **901**. Open container RAF device **901** has a liquid volume **LV** containment means, here being a transparent plastic or other material cylindrical container **902** with an open top **903** and a sealed translucent plastic or other material bottom **904**. RAF device **901** has a liquid volume **LV** and a filter means **F** that is either securely adhesively connective with a plastic or other material rigid drinking straw **901A**, or is attachably detachable with rigid straw **901A**. Filter means **F** is typically wrapped around a portion of straw **901A**, and either adhesively or alternately externally bound to straw **901A**, or straw **901A** is provided with a retaining clip or clips, or a provided porous material pocket for insertion and withdrawal of filter means **F**. Open container **902** is shown vertically filled to an imprinted or otherwise applied encircling fill line **905** with a low viscosity liquid volume **LV**. Liquid volume **LV** is shown being turbulized by a manual internal stirring of liquid volume **LV** within container **902** via rigid straw **901A**, which is being manually operated in a vigorous irregular side to side manner in a horizontal plane, as indicated by a side to side stirring arrow line **906**. The liquid volume **LV** turbulization process is shown by a set of erratic turbulence lines **907** and the directional effect of the turbulization of liquid volume **LV** on filter means **F** is indicated by a set of arrow lines **908**. Such stirring **906** can also include vigorous random dipping, as a tea bag is dipped.

RAF device **901** is operated in the same manner as RAF device **301** with the primary difference being that filter means **F** is secured to rigid straw **901A** when RAF device **901** is internally stirred to cause a RAF effect. Rigid straw **901A** is utilized for drinking purposes when liquid volume **LV** is a drinkable liquid. Alternately, when liquid volume **LV** is a not a drinkable liquid, rigid straw **901A** may be replaced with a non-hollow rigid rod of any suitable material such as plastic, metal, or wood.

Fig. 10 shows a vertically orientated diagrammatic perspective cutaway view of a RAF device **1001** having a liquid volume **LV** containment means, here being a transparent plastic or other material cylindrical container **1002** with a translucent plastic or other material, slidably closable openable top cap **1003**, and a slidably closable openable bottom cap **1004** with an upper rim **1004A**. Container **1002** is shown vertically filled to an imprinted or otherwise applied encircling fill line **1005** with low viscosity liquid volume **LV**. RAF device **1001** utilizes an internal electromechanical agitator turbulization means, being a generic waterproof agitator motor **1001A**, a type of miniature electric motor typically used in kitchen mixing tools to effect a cycling, back and forth, partial rotary motion. Agitator motor **1001A** has an upwardly disposed rigid plastic or other material stem **1001B** that is downwardly connective with agitator motor **1001A**, which is powered by an electrical power source, a small battery **1001C**. Battery **1001C** is situated within a waterproof plastic or other material battery compartment **1001D**. Battery compartment **1001D** is upwardly connective with agitator motor **1001A** and downwardly connective with bottom cap **1004**, typically by having bottom cap **1004** molded to accommodate compartment **1001D** and motor **1001A**, and otherwise by adhesives or threaded connections.

A rigid or flexibly rigid filter means **F** is securably removably connective with an upper portion of stem **1001B** either by insertion into a provided split stem embodiment of **1001B** (not shown) or by an insertion of stem **1001B** into a tubular pocket provided within filter means **F** (not shown), or by adhesives or other attachment means. Liquid volume **LV** is shown being turbulized by an electromechanical agitator action that forces filter means **F** in a horizontal, semicircular back and forth agitation of liquid volume **LV** within container **1002**, as indicated by a set of curved back and forth agitational arrow lines **1006**. The liquid volume **LV** turbulization process itself is shown by a set of erratic turbulence lines **1007**. Agitation occurs when connective electrical switch button **1001E** is used to actuate electrical wire connections (not shown) within a bottom portion of bottom cap **1004** between agitator motor **1001A** and battery **1001C**. Agitation is indicated by agitational arrow line set **1006.** The liquid volume **LV** turbulization process is shown by a set of erratic turbulence lines **1007**, and the directional effect of the turbulization of liquid volume **LV** on filter means **F** is indicated by a set of arrow lines **1008**. Bottom cap **1004** is slidably removed from container **1002** when filter means **F** or battery **1001C** requires replacement. Alternately, agitator motor **1001A** may be of a type that agitates liquid volume **LV** in a vertical or multi-directional manner.

RAF device **1001** is operated in the same manner as RAF device **201** with the primary differences being that the actuation of electromechanical agitator motor **1001A** replaces the physical shaking of container **201** to yield a RAF effect, and that stem-mounted filter means **F** is held securely in place on stem **1001B** when RAF device **1001** is induced to cause a RAF effect.

Preferred RAF Device Embodiment — Fig. 11

Fig. 11 shows a vertically orientated diagrammatic perspective view of a RAF device **1101** that has a perforated hollow stem straw **1101A** with a downwardly securably attachably detachable filter means **F**. Hollow stem straw **1101A** is firmly securely upwardly embedded into, or secured or attachably detachable from a downwardly molded portion **1103A** of a translucent plastic or other material, slidably closable openable top cap **1103**. Downwardly molded portion **1103A** of top cap **1103** has a hollow tube for the frictional insertion of stem straw **1101A**. Filter means **F** is typically slidably or otherwise attachably detachably connective to stem **1101A**, for example, by a threaded matching between a filter means **F** mount **1101B** and stem **1101A**.

RAF device **1101** utilizes manual external force as a turbulization means, and has a liquid volume **LV**. RAF device **1101** has a liquid volume **LV** containment means, here being a transparent plastic or other material cylindrical container **1102** with a sealed translucent plastic or other material bottom **1104**. Container **1102** is shown vertically filled to an imprinted or otherwise applied encircling fill line **1105** with low viscosity liquid volume **LV**. Liquid volume **LV** is shown being turbulized by a manual external vibration of liquid volume **LV** within container **1102** as indicated by a set of vertical and horizontal vibrational arrow lines **1106**. The liquid volume **LV** turbulization process is shown by a set of erratic turbulence lines **1107** and the directional effect of the turbulization of liquid volume **LV** on filter means **F** is indicated by a set of arrow lines **1108**. Filter means **F** has an attached upper portion **1109** that is attachably connective with the bottom portion of stem straw **1101A**. Stem straw **1101A** typically has an upper external plastic or other material hollow top cap **1109** that has a connective plastic or other material strap **1110**. Hollow top cap **1109** is typically slidably releasably connective with the externally protruding top of stem straw **1101A**, but may be otherwise made attachably detachably connective with stem straw **1101A**, for example by a mating threaded connection with stem straw **1101A**. Stem straw **1101A** has a minimum of one, but more typically a plurality of apertures **1101C** that serve to allow liquid volume **LV** to pass from container **1102** into straw stem **1101A** and out of the top of stem straw **1101A** as a liquid outlet for container **1102** when external cap **1109** is removed and suction is applied to the top of stem straw **1101A**. Alternately, stem straw **1101A** may be otherwise structured, for example in a curving or circular manner, or other geometric design, with filter means **F** otherwise securely or attachably detachably connected to the alternate structure, and otherwise perforated, for example with slots or designer holes.

RAF device **1101** is operated in the same manner as RAF device **201** with the primary difference being that stem-mounted filter means **F** is held securely in place on stem **1101A** when RAF device **1101** is shaken to cause a RAF effect.

CONCLUSIONS, RAMIFICATIONS, AND SCOPE

The various shown Random Action Filtering Method, or RAF Method, embodiments, and other RAF embodiments not shown, but discussed below, indicate that the RAF effect invariably occurs whenever an appropriate filter media means is situated within a contained, turbulized, low viscosity liquid. The RAF effect occurs irrespective of the presence or absence of, or suggested positioning of, any static or dynamic support means provided for an appropriate filter media means within a turbulized liquid. The RAF effect also occurs irrespective of the causal motive force means to induced liquid turbulence, manual or electromechanical, vibrational or otherwise agitational, internal to the liquid volume or external to the liquid containment means, and usually irrespective of the structural form or material of a small scale liquid volume containment means.

In alternate RAF Method embodiments, a liquid container need not be merely a simple singular housing, such as has been shown in the appended drawings for the purposes of example. A liquid containment means may as well be any liquid containment structure suitable for securely or detachably attachably containing a filter media means, such as a rectangular parallelepiped (box-like) or elliptical-cylinder shaped housing, or any other geometrically suitable form of liquid containment means. A closably openable liquid container may also alternately have one or more removable liquid inlet and outlet means, such as a removable top or bottom or side ports that are either sealed via a screw on, slide on, snap on, or other attachably removable means, such as a cap, or cork, or wedge cap, or may be simply temporarily sealed by placing a flat plane-surfaced object, or the palm or thumb of a hand, over a portal of a container, or may be designed like a typical cocktail shaker where one container is inverted over another to provide a temporary closuring means.

An alternate liquid containment means may also be any appropriate multi-chambered liquid containment structure suitable for securely or detachably attachably situating a filter media means, wherein a larger-order liquid flow system application is performed in terms of small scale cycles. For example, in performing the RAF effect in a closably openable container, a closably openable container may be one into which a low viscosity liquid volume is added, the container closed, the filtering cycle performed, the container emptied, new liquid added, the container sealed again, and the filtering cycle redone, and more new liquid filtered in repeating cycles. Therefore, in principle, it is possible to fabricate an ongoing multi-gated liquid system wherein manual or automatic control valves allow a liquid volume in a larger order chamber to enter a fixed liquid volume into a closably openable container, which is then closed, the RAF effect performed, and the smaller container then emptied a lower larger order chamber as an ongoing filtering process. Thus, an inlet and/or outlet means for a liquid containment means may be a complex arrangement of inlet and outlet devices with connective tubing or any other such method for allowing a flow into and out from a smaller liquid containment housing where a RAF effect is performed.

Alternately, filter media means may be loose granules, beads, or in fiber forms, such as Granulated Activated Carbon (GAC), Kinetic Degradation Fluxion (KDF®), or ion beads, or bioactive nano alumina fibers, which are encased in porous enclosures. A RAF filter media means may also be an alternate filter material like Mycelx®, a filtering substance that is used for the removal of oily substances from other liquids. Porous encasement means may alternately be metallic, or plastic, or other substances formed into various micromesh configurations. Filter encasement materials may thus also include woven cloth and non-woven mesh or netting, such as porous sintered stainless steel, bronze, and special alloys, or filter cloth made of stainless wire, polyester, nylon, polypropylene, and other non-woven filter media, such as microporous ceramics.

A RAF filter media means may be for a one-time use after which it is disposable, or for multiple uses prior to disposal, or may be otherwise made to be openably closable and so refillable with various filter media means. An alternate RAF filter media means may also be of virtually any appropriate geometric shape or irregular design. Variously sized filter media means might be used for different liquid container mouth sizes, i.e. narrower for bottles and wider for jars or mugs.

A filter media means may thus be otherwise sized or shaped than has thus far been shown and described, and, for example, may be of a funnel or cylindrical shape, or be of a differing geometric form, such as having triangular, rectangular, lenticular, octagonal, flat disk, or may have alternately geometric or abstract shaped side walls, or may be pleated, so long as the specific alternate design and fabrication does not lead to the earlier explained turbulent tumbling. Such filter media means could be done in various sizes of designer or abstract shaped encasements, e.g., as diverse logo shapes, for use as publicity designs for ad campaigns, or as giveaways imprinted with art or text, etc. Alternately, filter media means may also appear in plural formats, either where several such filter means are independently utilized, or otherwise networked in a segmented packeting system, or done in a planar manner using opposing polyester or other residue-trapping materially covered pads to capture debris. Such alternate filter media means might be banded to, or otherwise framed, or caged, or affixed to a frame means connective with, for example, a spring strip, so that a liquid is always passing through in an appropriate manner. Typically, filter media means are never packed together in any dense way that will diminish the flow-through rate of a liquid during a turbulent filtering process. A RAF filter media means may also be alternately extended above or below a support means to better suit the application for which the RAF effect is being utilized. And a freely movable filter media means may also be alternately provided with a floatable string or other tethering means for simplified removal.

Alternately, a filter media means support means need not be permanently affixed to a container, but may also be temporary, insertably removable devices, such as circular or otherwise shaped rubber or other pliable material wedge bases that approximate the lower internal diameters of a typical small liquid containment means, such as a 16 oz travel water bottle, i.e. approximately 2.5" (6.4 cm), or may be a flexible basket design, or other elastic means that are insertably removable from a liquid containment means from the top as well as the bottom.

Alternately, filter media means that operate in a downwardly or upwardly pendulous manner within a RAF device may be alternately provided with a V-shaped cowl situated near a liquid container’s top or bottom cap to enclose an upper or lower pendulous support means for a filter media means, and so limit the travel distance of the support means, i.e., to prevent a support means from allowing a weight mass to strike the inside walls of a closably openable container, thus averting any possible damage to the weight mass or the container walls, and minimizing audible noise in a RAF device. Alternately, a circular, rubberized buffer ring may be installed in the container at the end regions of the support’s swing-travel arc to ease the striking force of a mass weight. Alternately, a pendulous filter media means within a RAF device may be supported on any wall surface, top, bottom or sides, and thus face in any preferred direction wherein a pendulous filter media means can travel freely through its intended arc.

Various filter media means saturation detection methods may be utilized in a RAF device, from simple chemical color change methods to more complex optical detection methods. Such complex optical saturation detection method detection systems may also include an audio and/or visual alarm means, and/or a circuit interruption type of power source disconnect switching system may be provided for an electrically operated RAF device that is cooperatively utilized in conjunction with any optical saturation detection method.

Alternately, if a filter media means is weighted, the weighting means may be virtually any non-rusting, chemically inert inertial mass, and may be present at any point internal or external to a filter media means, and may be tethered or otherwise connective with a filter media means by virtually any means. Alternately, a filter media means may be provided with various types of internal or external fins or vanes for either stabilization or gyroscopic spin effects.

RAF inertial weights might also be alternately done for encased foam pad configurations and other filter media means as solid designer rings, or removable clasp rings, or be made in various shapes, sizes, and overall weights. Attachably detachable weights would allow for "refillable" filters for use with designer inertial weight systems. Numerous alternate choices of weight mass type and placement within or external to a filter media means may be made, e.g., centered, off-center, peripheral, or within a frame device or cage.

Alternately, various stem and other connectively secured or attachably detachable mounting means may be utilized for static or dynamic filter media means, for example, adhesives, clasps, spring catches, plug in/out or slide in/out, etc., utilizing plastic or other appropriate material. And static or dynamic support means for a freely movable or partially movable filter media means may alternately be virtually any support means, for example, a filter media means support means may be electromagnetic in nature within a container, wherein turbulization occurs due to an electromagnetic pulsing of a filter media means, or wherein a flexibly or hinged pendulous filter media means is provided with an electromagnetic interaction to drive the pendulous movement to turbulize a liquid. Alternately, changing the lateral sizing of a pendulum weight in a RAF device would also change the possible sweep angle of a pendulous RAF device, and could led to unusually wide based container means embodiments.

RAF device turbulization processes are thus not limited to those thus far shown and/or described, and can alternately be complete different. For example, turbulization may be initiated by contrarotating disk means, piston action, and other manual or electromechanical action means. Or, liquid turbulization may be otherwise induced via a heating means, such as via flame, electric element, or microwave method.

As noted above, RAF filtering efficacy increases by providing optimal “splash space” within an open or closably openable container by allowing the generation of a more severe liquid turbulence, and it is thus helpful to indicate this optimal splash space by placing an indelible externally or internally imprinted, color contrasted fill line indicia is as a marking method. It is also preferable to utilize a raised or curved surface beneath the aforementioned marked fill line to prevent upward hand slippage when grasping the bottle for manual shaking.

There are numerous practical uses for the various embodiments of a RAF Method, and the following list of examples is by no means complete. RAF filter media means can be manufactured as independent consumer items, for example, for filtering tap or well water for drinking. Such RAF filter media means could be manufactured as a pre-rinsed items in sealed re-closable packets, or other resealable containers, for immediate use. Done as individual filter devices, a consumer would be free to utilize his/her own travel water bottle, and simply insert a RAF filter media means to produce a RAF device. Alternately, various types of travel bottles might be manufactured as RAF devices, and offered with replaceable or refillable filter media means. Certain types of filter media means may apply to medical uses for filtering small liquid volumes, or for removing oily substances from valuable liquids, or for other practical applications.

In addition to filtration, RAF filter media means may also be utilized for dispersion of a flavoring, i.e., added to or infused into a RAF filter media means for dispersion into a drinkable liquid such as water or ethyl alcohol. RAF filter media may also be utilized in an agitational system such as is found in an agitator washing machine where there is sufficient turbulence generated over time on the faster wash agitator cycles to utilize a RAF filter media means to clear unwanted contaminants from the wash water in terms of the filter media means being chosen for use.

Essence of the Invention

The essence of the invention of a Random Action Filtering Method, or RAF Method, is that it comprises the provision of a liquid containment means having a liquid inlet means and a liquid outlet means for the low viscosity liquid volume, and the entering of the liquid volume into the containment means through the liquid inlet means, and the situating of an appropriate filter media means within the contained liquid volume, and then applying a motive force means to the liquid volume within the liquid containment means to turbulize the liquid volume within the liquid containment means, or applying a motive force means to the liquid containment means to turbulize the liquid volume within the liquid containment means. Within a brief duration of such turbulization, the turbulized low viscosity liquid volume within the liquid containment means is filtered by the appropriate filter media means situated within the liquid volume, and the contained liquid volume may be removed from the liquid containment means as an appropriately filtered liquid volume through the provided liquid outlet means. The containment means may have either an open mouth as a liquid inlet/outlet means or have a closably openable liquid inlet means and a closably openable liquid outlet means. Turbulization may be performed by applied motive force means which are either manually externally applied to the liquid containment means, or electromechanically externally applied to the liquid containment means, or manually internally applied to the liquid volume, or electromechanically internally applied to the liquid volume. An appropriate filter media means may be further provided with a porous encasement means, and/or with a protective porous encasement means, or with an internal or external weight means, and may be either freely movable, or secured to a rigid support means connective with the liquid containment means, or attachably detachably secured to a rigid support means connective with the liquid containment means, or secured to a flexible support means connective with the liquid containment means, or attachably detachably secured to a flexible support means connective with the liquid containment means, or secured to an attachably detachably secured support means connective within the liquid containment means, or attachably detachably secured to an attachably detachably secured support means connective within the liquid containment means, or may otherwise be secured to a manual stirring motive force means non-connective with the liquid containment means, or may be attachably detachably secured to a manual stirring motive force means non-connective with the liquid containment means.

To reiterate, the essence of the invention of a Random Action Filtering Method, or RAF Method is that it comprises a low viscosity liquid filtration method for small scale applications which utilizes vigorous manual or electromechanical motive forces to either externally or internally induce turbulence within a contained liquid volume to compel all of the turbulized liquid to randomly and omnidirectionally pass through a provided filter media within the liquid. Whenever turbulence is achieved and sustained for an appropriate duration, the induced liquid turbulence provides an overall filtering effect upon the complete liquid volume within a minimal time frame. The efficacy of the filtering effect occurs in terms of the agitational intensity of the induced turbulence, the physical characteristics and saturation limits of the filter media, and the duration of the agitational force, as well as upon other relevant factors, such as the actual volume and viscosity of the liquid, the allowed air gap in the container, the addition of inertial mass to a movable filter media, and the actual density and porosity of the filter media and any provided filter media porous encasing material and protective porous caging means. The porous encasement may be any porous material such as microporous mesh screening, or any other commonly used filter media encasing material. The porous cage may be any surrounding grid fabricated from plastic or other materials. The composition of the filter media is predetermined by the objectives of the liquid filtering process. Generally, with vigorous turbulization and an appropriate filter means, a full volume filtering effect occurs in typically under a minute for volumes less than 64 oz (1892.71 ml), and in briefer time frames for lesser volumes. Equivalent filtering cycles can then be repeated until filter media saturation occurs.

What is new and significant about the present invention is that its various embodiments provide a novel, multifunctional liquid filtering method that is based on the presence of a filter media means within a contained, induced liquid turbulence, i.e., embodiments that may be employed within a variety of small scale systems that require a quick and simple liquid filtering method, for example for the filtering of tap or well water.

Using the proposed RAF Method, portable RAF "water filter balls" might be sold anywhere as a point of purchase item, and RAF water filter bottles might be sold wherever such items are on display. Such products would have lasting benefits for consumers, retailers, and for a RAF filter manufacturer. Consumers who welcome having the choice of using RAF filter balls in their own travel containers, might later choose to purchase a manufactured RAF water filter bottle when they understand its advantages, e.g. easy withdrawal and exchange of the filter media, as well as clearly marked, externally imprinted fill lines, and other similar benefits.

The several embodiments described above are only illustrative examples of the present invention, and it should not be construed that the present invention is limited to those particular embodiments. Various changes and modifications in alternate embodiments of the present invention, as noted above, or as may be determined in the future, may be effected by one skilled in the art to which the invention relates without departing from the spirit or scope of the present invention as defined in the appended claims.

CLAIMS

I claim:

1. A method for filtering a low viscosity liquid volume, comprising:

   a. providing a liquid containment means having a liquid inlet means and a liquid outlet means for said low viscosity liquid volume;

   b. entering said low viscosity liquid volume into said liquid containment means through said liquid inlet means;

   c. situating an appropriate filter media means within said low viscosity liquid volume within said containment means; and,

   d. applying a motive force means to said low viscosity liquid volume within said liquid containment means to turbulize said low viscosity liquid volume within said liquid containment means, or applying a motive force means to said liquid containment means to turbulize said low viscosity liquid volume within said liquid containment means,

   whereby, within a brief duration of said turbulization, said turbulized low viscosity liquid volume within said liquid containment means is filtered by said situated appropriate filter media means within said low viscosity liquid volume within said liquid containment means, and, thence, said low viscosity liquid volume may be removed from said liquid containment means as an appropriately filtered said low viscosity liquid volume through said liquid outlet means.

2. A method for filtering a low viscosity liquid volume according to claim 1, wherein said liquid containment means having a liquid inlet means and a liquid outlet means for a low viscosity liquid volume is a liquid containment means having a closably openable liquid inlet means and a closably openable liquid outlet means.

3. A method for filtering a low viscosity liquid volume according to claim 1, wherein said applied motive force means for a turbulization of said low viscosity liquid volume is manually externally applied to said liquid containment means.

4. A method for filtering a low viscosity liquid volume according to claim 1, wherein said applied motive force means for a turbulization of said low viscosity liquid volume is electromechanically externally applied to said liquid containment means.

5. A method for filtering a low viscosity liquid volume according to claim 1, wherein said applied motive force means for a turbulization of said low viscosity liquid volume is manually internally applied to said low viscosity liquid volume.

6. A method for filtering a low viscosity liquid volume according to claim 1, wherein said applied motive force means for a turbulization of said low viscosity liquid volume is electromechanically internally applied to said low viscosity liquid volume.

7. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is further provided with a porous encasement means.

8. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is further provided with a protective porous caging means.

9. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is further provided with an internal weight means.

10. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is further provided with an external weight means.

11. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is freely movable.

12. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is secured to a rigid support means connective with said liquid containment means.

13. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is attachably detachably secured to a rigid support means connective with said liquid containment means.

14. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is secured to a flexible support means connective with said liquid containment means.

15. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is attachably detachably secured to a flexible support means connective with said liquid containment means.

16. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is secured to an attachably detachably secured support means connective within said liquid containment means.

17. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is attachably detachably secured to an attachably detachably secured support means connective within said liquid containment means.

18. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is secured to a manual stirring motive force means non-connective with said liquid containment means.

19. A method for filtering a low viscosity liquid volume according to claim 1, wherein said appropriate filter media means is attachably detachably secured to a manual stirring motive force means non-connective with said liquid containment means.

20. A method for filtering a low viscosity liquid volume according to claim 1, wherein said liquid outlet means comprises a perforated straw means.

RANDOM ACTION FILTERING METHOD

ABSTRACT

A low viscosity liquid filtration method for small scale applications that utilizes vigorous manual or electromechanical motive forces to either externally or internally induce turbulence within an open or closably openable liquid volume containment means to compel all of the turbulized liquid to randomly and omnidirectionally pass through a provided appropriate filter media means within the liquid. Whenever turbulence is achieved and sustained for an appropriate duration, the induced liquid turbulence provides an overall filtering effect upon the complete liquid volume within a minimal time frame. The efficacy of the effect occurs in terms of the physical characteristics and saturation limits of the filter media, and the intensity and duration of the agitational force, as well as upon other relevant factors, such as: the actual viscosity of the liquid; the actual temperature of the liquid; the actual amount of specific contaminants within the liquid which are to be filtered out; the addition of inertial mass (weight) to a freely movable or partially movable filter media; the allowed air gap within the open or closably openable container; and, the actual density and porosity of the filter media means and any provided porous encasing material and/or protective outer caging means. The porous encasement may be any porous material such as microporous mesh screening, or any other commonly used filter media encasing material. The protective porous cage may be any surrounding grid fabricated from plastic or other materials. The actual composition of the filter media means is predetermined by the objectives of a particular liquid filtering process.