MAGNETICALLY COUPLED SELF-STIRRING BEVERAGE CONTAINER SYSTEM

TECHNICAL FIELD

The present disclosure relates generally to beverage containers. More specifically, the present disclosure relates to self-stirring containers configured to mix a liquid using a magnetically driven internal mixing element. The disclosure further pertains to systems incorporating an external base unit that provides power and rotational drive without requiring physical penetration of the container. The subject matter also relates to user-actuated control mechanisms and configurations that facilitate cleaning and sealing integrity.

BACKGROUND

Beverage consumption, particularly for hot drinks such as coffee, tea, and similar liquids, frequently involves the addition of supplementary ingredients, including sweeteners, creamers, flavoring agents, and powdered additives. Such additions typically require subsequent mixing to achieve a uniform distribution throughout the liquid. In many everyday environments, including offices, vehicles, travel settings, and outdoor locations, a dedicated stirring implement such as a spoon or stir stick is not readily available. As a result, users can resort to improvised techniques, including shaking the container or attempting to stir with unsuitable objects, which can be inconvenient, ineffective, or unsanitary.

Conventional approaches to addressing this issue have included the provision of disposable stirrers or the incorporation of manually actuated stirring mechanisms within beverage containers. Disposable stirrers contribute to material waste and can be impractical in certain contexts. Manually actuated mechanisms, such as those requiring twisting, pumping, or other user-driven motion, can be cumbersome and can fail to provide consistent or sufficient mixing, particularly for viscous additives or layered liquids. Furthermore, such mechanisms can introduce structural complexity that complicates cleaning and maintenance.

Electrically powered self-stirring mugs have also been developed, typically incorporating a motor and rotating element within the body of the container. However, many such designs rely on direct mechanical coupling between the motor and the stirring element, which often necessitates the presence of a shaft or other component that penetrates the wall or base of the container. These penetrations can create potential leakage paths, reduce long-term durability, and introduce challenges in achieving reliable sealing, especially under

repeated thermal cycling and washing conditions. Additionally, internal placement of electrical components can limit the ability to safely clean the container using conventional methods such as dishwashing.

Other configurations attempt to integrate electrical components within the container in sealed compartments, but these arrangements can increase manufacturing complexity and cost, while also imposing constraints on size, weight, and ergonomics. Battery replacement or charging can also become inconvenient when electrical components are embedded within the container body. Moreover, the presence of internal electronics can restrict material choices and can reduce the overall robustness of the container in demanding use environments.

Accordingly, there exists a need for improved systems and methods for mixing beverages within a container that avoid reliance on separate stirring implements, while also addressing issues of leakage, cleanability, durability, and user convenience. Such a need has persisted despite ongoing developments in beverage container design, indicating a long-felt but unresolved demand within the relevant field.

SUMMARY

The present disclosure describes a beverage container system configured to facilitate automated stirring of a liquid contained therein through a magnetically coupled drive arrangement. In one aspect, the system comprises a container having an interior volume for receiving a beverage and an internal mixing element positioned within the interior volume. The mixing element is configured to rotate relative to the container to agitate the beverage. A base unit is provided that is configured to support the container and includes a motor and a magnetic drive component. The magnetic drive component is configured to generate a rotating magnetic field that couples with the internal mixing element to induce rotation without requiring a physical penetration through a wall of the container.

In another aspect, the system includes a user-actuated control interface, such as a button, that is operatively connected to the motor to selectively initiate and terminate rotation of the mixing element. The base unit can further include a power source, such as a rechargeable battery, and associated circuitry for controlling operation of the motor. The container can be removably positionable on the base unit such that magnetic coupling occurs when the container is properly seated. The absence of direct mechanical coupling between

the motor and the mixing element enables the container to remain fully sealed, thereby improving resistance to leakage and facilitating cleaning using conventional methods.

In further aspects, alternative configurations are contemplated in which the motor and power source are integrated within the container itself, while still maintaining a magnetically coupled relationship between the drive mechanism and the mixing element. Additional features can include sensing components, such as temperature sensors, that can be used to monitor conditions of the beverage, as well as control logic for adjusting operation based on sensed parameters. The structural and functional features described herein can be implemented in a variety of forms and combinations while maintaining the core functionality of magnetically induced stirring within a sealed container.

In a first general aspect, a beverage container system comprises a container defining an interior volume configured to receive a liquid, a mixing element positioned within the interior volume and configured to rotate relative to the container, the mixing element comprising a magnetic component, and a base unit configured to support the container, the base unit comprising a motor and a magnetic drive element operatively coupled to the motor, wherein rotation of the magnetic drive element generates a magnetic field that couples with the magnetic component of the mixing element to induce rotation of the mixing element within the interior volume without physical penetration of the container. The container can comprise a sealed bottom wall and sidewall that prevent liquid from passing therethrough. The mixing element can comprise a propeller configured to agitate the liquid. The mixing element can be supported by a bearing structure disposed within the interior volume. The base unit can further comprise a rechargeable power source electrically coupled to the motor. The base unit can further comprise a user-actuated control interface configured to selectively activate the motor, and the user-actuated control interface can comprise a button positioned on an exterior of the base unit. The magnetic drive element can comprise at least one permanent magnet configured to rotate with the motor.

In a second general aspect, a beverage container comprises a container body defining an interior volume configured to receive a liquid, a mixing element disposed within the interior volume, the mixing element comprising a magnetic component, a drive assembly disposed within the container body and isolated from the interior volume, the drive assembly comprising a motor and a magnetic drive element, and a control interface operatively coupled

to the motor, wherein the magnetic drive element is configured to magnetically couple with the magnetic component to induce rotation of the mixing element without a mechanical shaft extending into the interior volume. The drive assembly can further comprise a power source contained within the container body. The container body can comprise a sealed compartment that houses the drive assembly and prevents liquid from contacting the drive assembly. The control interface can comprise a user-actuated button disposed on an exterior surface of the container body. The mixing element can be rotatably supported by a bearing structure within the interior volume. The beverage container can further comprise a sensor configured to detect a condition of the liquid within the interior volume, and the sensor can comprise a temperature sensor.

In a third general aspect, a method of assembling a beverage container system comprises providing a container defining an interior volume, disposing a mixing element within the interior volume, the mixing element comprising a magnetic component and being supported for rotation relative to the container, providing a base unit comprising a motor and a magnetic drive element operatively coupled to the motor, and configuring the container and the base unit such that, when the container is positioned relative to the base unit, the magnetic drive element is magnetically coupled to the magnetic component to induce rotation of the mixing element without physical penetration of the container. The method can further comprise sealing the container such that no apertures extend through a wall of the container for transmitting mechanical motion. The method can further comprise installing a rechargeable power source within the base unit and electrically coupling the rechargeable power source to the motor. The method can further comprise coupling a user-actuated control interface to the motor to selectively control operation of the motor. The method can further comprise forming the mixing element as a propeller and supporting the mixing element on a bearing structure within the interior volume.

Certain advantages of the systems and methods include elimination of the need for separate stirring implements, thereby improving user convenience and reducing dependency on external tools; improved sealing integrity by avoiding physical penetrations through the container, which can reduce leakage risks and enhance durability; and enhanced cleanability, as the container can be configured to be dishwasher safe without exposure of sensitive electromechanical components. Additional advantages include flexible power configurations,

including external base units and integrated power systems, and ease of operation through simple user interfaces such as a single-button control; among others.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of any described embodiment, suitable methods and materials are described below. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting. In case of conflict with terms used in the art, the present specification, including definitions, will control.

The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description and claims.

BRIEF DESCRIPTION OF DRAWINGS

The present embodiments are illustrated by way of the figures of the accompanying drawings, which may not necessarily be to scale, in which like references indicate similar elements, and in which:

FIG. 1 is a perspective view of a magnetically coupled self-stirring beverage container system including a container and a base unit, according to one embodiment.

FIG. 2 is a cross-sectional view of the base unit illustrating a motor and a magnetic drive element configured to magnetically couple with a mixing element within the container, according to one embodiment.

FIG. 3 is a cross-sectional view of a beverage container having an integrated drive assembly disposed within a sealed compartment of the container, according to one embodiment.

FIG. 4 is a schematic representation of a beverage container system including a sensor configured to detect a condition of a liquid within the container and a control circuit configured to control operation of a motor based on the detected condition, according to one embodiment.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

Referring now to FIG. 1, a magnetically coupled self-stirring beverage container system 100 is shown, according to one embodiment. The system 100 comprises a container 102 and a base unit 104. The container 102 defines an interior volume 106 configured to receive a beverage, such as coffee, tea, or other liquid consumables. The base unit 104 is configured to support the container 102 and to provide a driving force for inducing motion within the interior volume 106.

The container 102 comprises a sidewall 108 and a bottom wall 110 that together define a sealed structure. The container 102 can be formed from materials suitable for food and beverage use, including, for example, stainless steel, polymeric materials, ceramic materials, or combinations thereof. The bottom wall 110 is configured to provide a planar or substantially planar surface for stable placement on the base unit 104. The container 102 is configured such that no apertures extend through the bottom wall 110 or sidewall 108 for purposes of transmitting mechanical motion from the base unit 104 into the interior volume 106.

Positioned within the interior volume 106 is a mixing element 112. The mixing element 112 can comprise a propeller, impeller, paddle, or other structure configured to impart motion to the beverage when rotated. The mixing element 112 can be supported for rotation relative to the container 102 by a bearing structure 114. The bearing structure 114 can be integrated into the bottom wall 110 or can be provided as a separate component secured within the interior volume 106. In certain embodiments, the bearing structure 114 can comprise a low-friction material, such as a polymer or ceramic, to facilitate smooth rotation of the mixing element 112.

The mixing element 112 further comprises a magnetic component 116. The magnetic component 116 can comprise a permanent magnet embedded within or attached to the mixing element 112. The magnetic component 116 is configured to interact with a corresponding magnetic drive component located external to the container 102, as described in greater detail below. In some embodiments, the magnetic component 116 can be encapsulated within the material of the mixing element 112 to prevent exposure to the beverage and to facilitate cleaning.

Referring now to FIG. 2, the base unit 104 is shown in greater detail. The base unit 104 comprises a housing 118 that encloses a motor 120, a drive shaft 122, and a magnetic drive element 124. The motor 120 can comprise an electric motor configured to produce rotational motion when energized. The drive shaft 122 is mechanically coupled to the motor 120 and is configured to transmit rotational motion to the magnetic drive element 124. The magnetic drive element 124 can comprise one or more permanent magnets arranged to produce a rotating magnetic field when driven by the motor 120.

The base unit 104 further comprises a support surface 126 upon which the container 102 is positionable. The support surface 126 is arranged such that, when the container 102 is placed on the base unit 104, the magnetic drive element 124 is positioned in proximity to the magnetic component 116 of the mixing element 112. This proximity enables magnetic coupling between the magnetic drive element 124 and the magnetic component 116, such that rotation of the magnetic drive element 124 induces corresponding rotation of the mixing element 112 within the interior volume 106.

The base unit 104 further comprises a power source 128, which can include one or more rechargeable batteries. The base unit 104 can further include charging circuitry configured to receive external power through a port 130, such as a universal serial bus port or other electrical interface. In some embodiments, the base unit 104 can include wireless charging capability. The motor 120 is operatively connected to the power source 128 and is controlled by a control circuit 132.

A user-actuated control interface 134 is provided on the base unit 104. The control interface 134 can comprise a button configured to be pressed by a user to initiate operation of the motor 120. In response to actuation of the control interface 134, the control circuit 132 energizes the motor 120, causing the magnetic drive element 124 to rotate. This rotation produces a corresponding rotation of the mixing element 112 within the container 102, thereby stirring the beverage contained within the interior volume 106. The control circuit 132 can further be configured to terminate operation of the motor 120 upon a subsequent actuation of the control interface 134 or after a predetermined time interval.

Referring now to FIG. 3, an alternative embodiment is shown in which a self-contained container system 200 incorporates internal drive components. In this embodiment, the container 202 includes an integrated motor 220, power source 228, and control circuit

232 housed within a compartment 236 that is isolated from the interior volume 206. The compartment 236 is sealed relative to the interior volume 206 to maintain liquid containment. The motor 220 is coupled to a magnetic drive element 224 positioned adjacent to a wall separating the compartment 236 from the interior volume 206. A mixing element 212 with a magnetic component 216 is positioned within the interior volume 206. As in previously described embodiments, magnetic coupling between the magnetic drive element 224 and the magnetic component 216 induces rotation of the mixing element 212 without requiring a mechanical penetration through the wall of the container 202.

In certain embodiments, the compartment 236 can be removable to facilitate charging or replacement of the power source 228. In other embodiments, the container 202 can include an external charging interface, including wired or wireless charging capabilities. The control interface 234 can be provided on an exterior surface of the container 202 and can function in a manner similar to the control interface described with respect to the base unit embodiment.

Referring now to FIG. 4, an embodiment incorporating sensing functionality is shown. A sensor 140, such as a temperature sensor, is positioned to detect a condition of the beverage within the interior volume 106. The sensor 140 is operatively connected to the control circuit 132 or 232, depending on the configuration. The control circuit can be configured to adjust operation of the motor based on the sensed condition. For example, the control circuit can limit stirring at elevated temperatures or can initiate stirring upon detection of a temperature change indicative of the addition of an ingredient.

In some embodiments, the system can include communication circuitry configured to transmit data to an external device, such as a mobile device. The communication circuitry can utilize wireless communication protocols, including Bluetooth or Wi-Fi. A corresponding software application can provide user control over stirring parameters, including duration, speed, and timing, and can display information such as temperature or battery status.

The structural features described herein can be modified in various ways. The shape and size of the container can vary, and the mixing element can assume different geometries depending on the desired flow characteristics within the beverage. Multiple magnetic elements can be used to increase coupling efficiency or to stabilize rotation. The base unit can include alignment features to ensure proper positioning of the container relative to the

magnetic drive element. Additionally, sealing features such as gaskets can be incorporated to further enhance liquid containment.

It should be understood that features described in connection with any one embodiment can be applied to other embodiments, where appropriate. For example, sensing features described with respect to one configuration can be incorporated into other configurations, and power delivery arrangements can be interchanged between base-supported and self-contained embodiments. The scope of the present disclosure is intended to encompass such variations and combinations.

A number of illustrative embodiments have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the various embodiments presented herein. Accordingly, other embodiments are within the scope of the following claims.

WHAT IS CLAIMED IS:

1. A beverage container system comprising:

   a container defining an interior volume configured to receive a liquid;

   a mixing element positioned within the interior volume and configured to rotate relative to the container, the mixing element comprising a magnetic component; and

   a base unit configured to support the container, the base unit comprising a motor and a magnetic drive element operatively coupled to the motor,

   wherein rotation of the magnetic drive element generates a magnetic field that couples with the magnetic component of the mixing element to induce rotation of the mixing element within the interior volume without physical penetration of the container.
2. The beverage container system of claim 1, wherein the container comprises a sealed bottom wall and sidewall that prevent liquid from passing therethrough.
3. The beverage container system of claim 1, wherein the mixing element comprises a propeller configured to agitate the liquid.
4. The beverage container system of claim 1, wherein the mixing element is supported by a bearing structure disposed within the interior volume.
5. The beverage container system of claim 1, wherein the base unit further comprises a rechargeable power source electrically coupled to the motor.
6. The beverage container system of claim 1, wherein the base unit further comprises a user-actuated control interface configured to selectively activate the motor.
7. The beverage container system of claim 6, wherein the user-actuated control interface comprises a button positioned on an exterior of the base unit.
8. The beverage container system of claim 1, wherein the magnetic drive element comprises at least one permanent magnet configured to rotate with the motor.
9. A beverage container comprising:

   a container body defining an interior volume configured to receive a liquid;

   a mixing element disposed within the interior volume, the mixing element comprising a magnetic component;

   a drive assembly disposed within the container body and isolated from the interior volume, the drive assembly comprising a motor and a magnetic drive element; and

   a control interface operatively coupled to the motor,

wherein the magnetic drive element is configured to magnetically couple with the magnetic component to induce rotation of the mixing element without a mechanical shaft extending into the interior volume.

10. The beverage container of claim 9, wherein the drive assembly further comprises a power source contained within the container body.
11. The beverage container of claim 9, wherein the container body comprises a sealed compartment that houses the drive assembly and prevents liquid from contacting the drive assembly.
12. The beverage container of claim 9, wherein the control interface comprises a user-actuated button disposed on an exterior surface of the container body.
13. The beverage container of claim 9, wherein the mixing element is rotatably supported by a bearing structure within the interior volume.
14. The beverage container of claim 9, further comprising a sensor configured to detect a condition of the liquid within the interior volume.
15. The beverage container of claim 14, wherein the sensor comprises a temperature sensor.
16. A method of assembling a beverage container system comprising:

providing a container defining an interior volume;

disposing a mixing element within the interior volume, the mixing element comprising a magnetic component and being supported for rotation relative to the container;

providing a base unit comprising a motor and a magnetic drive element operatively coupled to the motor; and

configuring the container and the base unit such that, when the container is positioned relative to the base unit, the magnetic drive element is magnetically coupled to the magnetic component to induce rotation of the mixing element without physical penetration of the container.

17. The method of claim 16, further comprising sealing the container such that no apertures extend through a wall of the container for transmitting mechanical motion.
18. The method of claim 16, further comprising installing a rechargeable power source within the base unit and electrically coupling the rechargeable power source to the motor.

19. The method of claim 16, further comprising coupling a user-actuated control interface to the motor to selectively control operation of the motor.
20. The method of claim 16, further comprising forming the mixing element as a propeller and supporting the mixing element on a bearing structure within the interior volume.

ABSTRACT

A beverage container system is provided that facilitates automated stirring of a liquid without requiring physical penetration of a container wall. The system comprises a container defining an interior volume and a mixing element disposed within the interior volume, the mixing element including a magnetic component. A base unit includes a motor and a magnetic drive element configured to generate a rotating magnetic field. When the container is positioned relative to the base unit, the magnetic drive element magnetically couples with the magnetic component to induce rotation of the mixing element, thereby stirring the liquid. The container can remain fully sealed to improve leakage resistance and cleanability. In certain configurations, the motor and power source can be integrated within the container in an isolated compartment. A user-actuated control interface enables selective activation of the stirring function.