

Nov. 4, 1958

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2,859,020

MAGNETIC DRIVEN COLLAPSIBLE AGITATOR ASSEMBLY

Filed Nov. 10, 1955

FIG. 1.

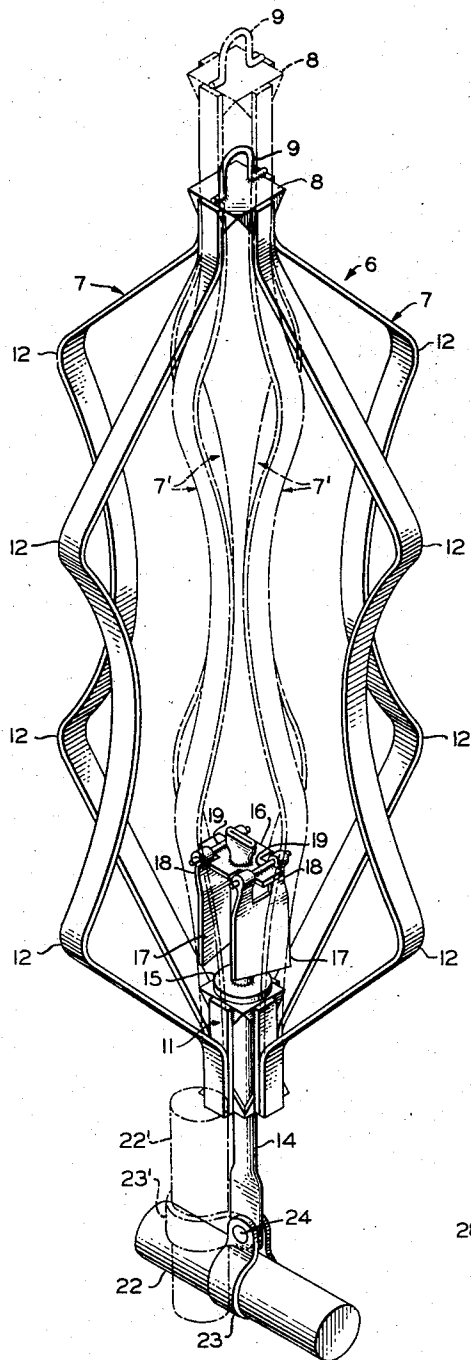
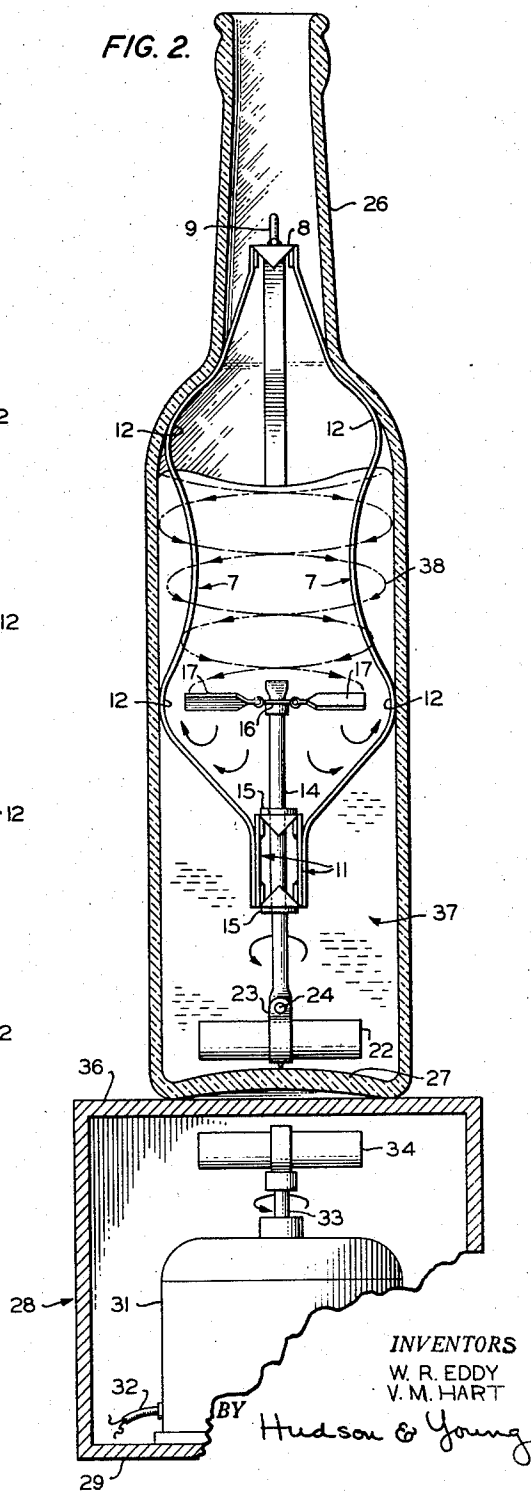


FIG. 2.



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MAGNETIC DRIVEN COLLAPSIBLE AGITATOR ASSEMBLY

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Application November 10, 1955, Serial No. 546,168

6 Claims. (Cl. 259-108)

This invention relates to magnetically driven agitators or stirrers. In one aspect it relates to a collapsible agitator assembly adapted to be driven by complimentary magnet means. In another aspect it relates to an agitator especially adapted for insertion in narrow-neck bottles or similar containers.

It is a common practice in laboratories carrying out research on organic chemistry reactions to employ as reaction vessels narrow-neck bottles or containers, such as so-called "pop" bottles. These bottles are capped and placed in a constant bath and the reaction is allowed to proceed under pressure with controlled agitation. Satisfactory agitation of the contents of these bottles has been a serious problem, especially when carrying out polymerization reactions where the rate of agitation must be rigorously controlled. The use of an agitator shaft projecting through a packing gland in the mouth of the bottle has not been suitable since it is desired to employ a simple agitator construction. The use of a conventional magnetic bar stirrer immersed in the reaction mixture and driven by an external rotating magnetic field has been found unsuitable because only a non-uniform, incomplete and slow type of agitation results. Undesirable agitation usually results especially when the reaction bottle employed has a crown base. With such a reaction bottle a conventional magnetic bar stirrer tends to spin to one side of the base, resulting in an incomplete and uncontrolled type of agitation. Thus, there has arisen a need for a suitable agitator device, preferably of a simple construction, whereby the rate of agitation may be controlled and a uniform, complete and fast agitation obtained regardless of the reaction vessel configuration.

Broadly speaking, the preferred embodiment of our agitator assembly comprises a plurality of collapsible agitator positioning members adapted to carry a shaft having attached thereto agitator members and a primary rotatable magnet. Said assembly is adapted to be readily inserted in narrow-neck reaction vessels commonly used to carry out chemical reactions, such as polymerization reactions. The primary magnet is adapted to be driven simultaneously by a secondary rotatable magnet external to the reaction vessel. The agitator assembly of this invention is especially well suited for agitating reaction mixtures in so-called "pop" bottles having a crown base, although it is to be understood that the agitator assembly is equally well suited for employment with any type of reaction vessel commonly used to carry out laboratory chemical reactions where it is necessary to provide controlled agitation.

An object of this invention is to provide an improved magnetically driven agitator assembly.

Another object is to provide a collapsible agitator assembly which may be readily inserted in narrow-neck reaction vessels.

Another object is to provide an improved agitator assembly having rigidly supported agitator means adapted to uniformly and completely agitate liquids and the like.

A further object is to provide an improved agitator as-

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sembly characterized by its simplicity of construction, strength, reliability and efficiency; and

A still further object is to provide an improved agitator assembly which may be employed in agitating liquids and the like in narrow-neck reaction vessels and where it is desirable to control the rate of agitation.

Other objects and advantages of this invention will become apparent to those skilled in the art from the accompanying specification, appended claims, and drawings in which like characters of reference designate like parts throughout the several views, and wherein:

Figure 1 is an elevational view of an agitator assembly constructed in accordance with the present invention; and

Figure 2 is an elevational view in partial cross-section of the agitator assembly of Figure 1 in its operative position in a reaction vessel which is seated on the housing of a conventional externally driven secondary magnet.

Referring to the drawings now, and to Figure 1 in particular, the preferred embodiment of our agitator assembly generally designated 6 is shown provided with a plurality of agitator positioning members 7. The upper portions of the agitator positioned members 7 are preferably secured to a retaining plate 8, surmounted by a loop member 9. The lower portions of the agitator positioning members 7 are preferentially secured by welding or other suitable means to the outside of a yoke-type guide member 11. The agitator positioning members 7 are preferentially constructed from thin strips or straps of spring metal deformed as shown to provide protuberant portions 12 for a purpose which will be hereinafter set forth. Guide member 11 is provided with apertures at either end thereof to provide a passage for agitator shaft 14 which centrally extends through guide member 11. Stop rings 15 are secured to agitator shaft 14 adjacent to and outside of guide member 11 whereby shaft 14 is centrally supported in an upright position and whereby free rotation of the same is permitted. The upper end of shaft 14 is substantially centrally located between the agitator positioning members 7. Secured to shaft 14 by welding or other suitable means is an agitator support plate 16. A plurality of downwardly depending agitator or impeller members 17 in the form of bars or similar configuration are pivotally connected to agitator support plate 16 by means of link portions 18 and pins 19 for swinging movement. Agitator members 17 are preferentially deformed as shown to provide members 17 with a pitch, thereby aiding uniform rotation.

The lower portion of the agitator shaft 14 is pivotally connected to a primary rotatable magnet 22 by means of a clamp 23 and pivot pin 24. Primary magnet 22 is preferably coated with Teflon or similar material adapted to resist the attack of liquid to which it comes into contact with and is preferentially in the form of a bar or similar configuration.

Agitator positioning members 7 are adapted to assume the shape shown by the broken lines 7'; primary magnet 22 and clamp 23 are pivotally adapted to assume the positions shown by broken lines 22' and 23', respectively, for purposes which will hereinafter become apparent.

Referring to Figure 2, the agitator assembly of Figure 1 is shown inserted in a narrow-neck reaction vessel 26 having a crown base 27. Protuberant portions 12 of the agitator positioning members 7 contact the inside wall of the reaction vessel 26, thereby substantially positioning the agitator shaft 14 in the center of the reaction vessel 26. Reaction vessel 26 is seated on secondary magnet housing 28, the latter being provided with a base 29 upon which is centrally supported in an upright position electrical motor 31. The electric cord or cable 32 supplies current to electric motor 31 from which extends a rotary motor shaft 33 surmounted by secondary bar magnet 34 which is located just below the

table 36 of housing 28. The primary magnet 22 of the agitator assembly 6 is preferentially rotated in axial alignment with the external secondary magnet 34. Agitator members 17 are shown extended in their operative position and are immersed in the liquid 37.

While we have described and illustrated our agitator assembly provided with four agitator positioning members, each having two protuberant portions, and provided with two agitator members, we do not intend to so limit our invention, and it is obvious that these elements may be varied in size, shape and number without departing from the scope of our invention. For example, the agitator positioning members can be constructed of a plurality of jointed members, associated in a collapsible manner, rather than the integral construction shown.

Operation

It is believed that the operation of the agitator assembly 7 of our invention will be readily apparent from a consideration of the foregoing. Briefly, the agitator assembly 7 may be inserted in a reaction vessel, such as the narrow-neck reaction vessel 26 of Figure 2, by grasping the agitator positioning members and deforming them to the position shown by the broken lines 7' of Figure 1. The agitator assembly 7 is tilted to allow the primary magnet 22 to pivotally assume the position shown by the broken line 22'. The agitator assembly may then be readily inserted in the narrow-neck reaction vessel 26 of Figure 2 and the agitator positioning members 7 then allowed to expand so that the protuberant portions 12 may come into contact with the inside wall of the reaction vessel 26, thereby maintaining the agitator shaft 14 in the center of the reaction vessel 26. Upon insertion of the agitator assembly 7 in the reaction vessel 26 the primary magnet 22 pivotally falls to a position which is perpendicular to that of the agitator shaft 14. After the agitator assembly 7 is thus inserted, the electrical motor 31 is turned on whereby the motor shaft 33 and the secondary magnet 34 are caused to rotate. With the reaction vessel in the position shown in Figure 2 the rotation of the secondary magnet 34 causes simultaneous rotation of the primary magnet 22 at the same rate. The reaction vessel 26 remains stationary while the rotary motion of the primary magnet 22 transmitted to the agitator shaft 14 causes the agitator members 17 to spin outwardly and assume the extended position shown in Figure 2. Agitation of the liquid 37 is thereby achieved. A Variac or similar means may be electrically connected to the electric motor 31 to permit adjustment of the rate of agitation. When a substantial rate of agitation is desired the Variac is adjusted accordingly and sufficient rotary motion is transmitted to the agitators 17 to cause complete agitation of the liquid 37. Therefore, not only the lower portion of the liquid 37 in proximity to the primary magnet 22 will be agitated but also the upper portion of the liquid 37 will be completely agitated and when the rate of rotation of the agitator member is sufficient a desirable vortex 38 will occur in the upper portion of the liquid 37.

When it is desired to withdraw the agitator assembly from the reaction vessel, the loop member 9 is grasped by hand or with the aid of a suitable lifting tool. Pulling on the loop member 9 results in the collapse of agitator positioning members 7 by reason of their contact with the inside wall of the neck of the reaction vessel. Since the agitator members 17 depend downward in their inoperative position after the electric motor 31 is shut off, their passage through the neck of the vessel is unobstructed. While the withdrawal of the agitator assembly is being effected the vessel is tilted to allow the primary magnet 22 to pivotally assume its withdrawal position, shown in broken line 22', thereby permitting its passage through the neck of the vessel.

One desirable feature of this invention is the maintaining of the primary magnet 22 in a central position in the

reaction vessel 26 due to the collapsible agitator positioning members 7 contacting the inside wall of the reaction vessel 26. The displacement of the primary magnet 22 to a position off center because of the crown base 27 of the reaction vessel 26 is thereby obviated.

Not only is a complete and uniform agitation of the liquid 37 of the reaction vessel 26 achieved by the employment of our agitator assembly 26 but also the rate of agitation is controllable and when employed in reactions dependent upon the degree of agitation, very desirable savings in reaction times are achieved. In reducing to practice the preferred embodiment of our invention, we have perfected a simple and reliable agitator assembly which when employed in polymerization reactions, for example, have considerably reduced the time required for the desired reaction. For example, in said polymerization reactions heretofore requiring about 18 hours to completely agitate the reaction mixture, we have reduced this reaction time to 6 hours by employing our improved agitator assembly. Besides the saving in the time required for these reactions, a more complete polymerization was effected.

While we have set forth the illustrative purposes the preferred embodiment of our invention, it is to be understood that various modifications will become apparent to those skilled in the art without departing from the scope of this invention and we do not intend to unnecessarily limit our invention to that shown in the drawings and discussed in the specification.

We claim:

1. An agitator assembly of the character described for use in combination with a mixing chamber comprising, in combination, a rotatable shaft, a plurality of normally expanded positioning members adapted to support and centrally dispose said shaft in said mixing chamber, said positioning members adapted to assume a collapsed condition, a magnetically driven member pivotally connected to the lower end of said shaft, and impellers pivotally affixed to said shaft and adapted on rotation to extend from a normal depending position outwardly from said shaft.

2. An agitator assembly of the character described for use in combination with a mixing chamber comprising, in combination, a rotatable shaft, a plurality of normally expanded shaft positioning members adapted to support said shaft, said members having protuberant portions adapted to contact the walls of said chamber and thereby centrally dispose said shaft in said chamber, said positioning members adapted to assume a collapsed condition, a magnetically driven member pivotally connected to the lower end of said shaft, and impellers pivotally mounted on the upper end of said shaft, said impellers normally depending downward and on rotation to extend radially from said shaft.

3. An agitator assembly of the character described for use in combination with a mixing chamber comprising, in combination, a rotatable shaft, a guide member adapted to receive said shaft, a plurality of normally expanded positioning members secured to said guide member, said positioning members having protuberant portions adapted to contact the walls of said chamber and thereby centrally dispose said shaft therein, said positioning members adapted to assume a collapsed condition to permit passage of said assembly through an opening in said chamber, a magnetically driven member pivotally connected to the lower end of said shaft, said driven member being adapted to move about its pivotal axis to a position substantially parallel to said shaft to permit its passage through the opening of said chamber, and impellers pivotally connected to the upper end of said shaft and normally depending downward therefrom, said impellers adapted on rotation to extend radially from said shaft.

4. An agitator assembly of the character described for use in combination with a mixing chamber comprising,

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in combination, a rotatable shaft, a guide member having aligned openings to receive said shaft, a plurality of normally expanded positioning members secured at their lower end to said guide member, said positioning members having protuberant portions adapted to contact the walls of said chamber and thereby centrally dispose said shaft therein, said positioning members adapted to assume a collapsed condition when pressure is applied to said protuberant portions and thereby permit passage of said assembly through an opening in said chamber, a magnetically driven member pivotally connected to the lower end of said shaft and normally disposed at right angles to said shaft, said driven member adapted to move about its pivotal axis to a position substantially parallel to said shaft to permit its passage through the opening of said chamber, said driven member adapted to be driven by magnetic means external to said chamber, and impellers pivotally connected to the upper end of said shaft and normally depending downward therefrom, said impellers adapted on rotation to extend radially from said shaft.

5. An agitator assembly of the character described for use in combination with a mixing chamber comprising, in combination, a rotatable shaft extending through aligned openings in a guide member and mounted thereon, a plurality of normally expanded positioning members secured at their lower end to said guide member, said positioning members comprising straps of metal bent so as to form protuberant portions adapted to contact the walls of said chamber and thereby centrally

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dispose said shaft therein, said straps adapted to assume a collapsed condition when pressure is applied to said protuberant portions and thereby permit passage of said assembly through the opening of said chamber, a magnetically driven member pivotally connected to the lower end of said shaft and normally disposed at right angles to said shaft, said driven member adapted to move about its pivotal axis to a position substantially parallel to said shaft to permit its passage through the opening of said chamber, said driven member adapted to be driven by magnetic means external to said chamber, and impellers pivotally connected to the upper end of said shaft and normally depending downward therefrom, said impellers adapted on rotation to extend radially from said shaft, said impellers encircled by said straps, and stationary means secured to the upper ends of said straps to permit withdrawal of said assembly from said chamber.

6. An agitator assembly according to claim 1 wherein said mixing chamber has a relatively small opening at its upper end, and wherein said positioning members are further adapted to assume a collapsed condition to facilitate insertion of said agitator assembly through said small opening of said mixing chamber.

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