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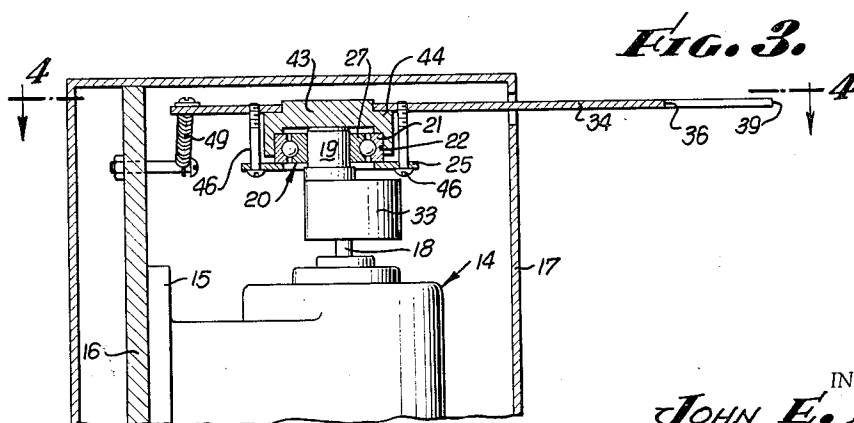
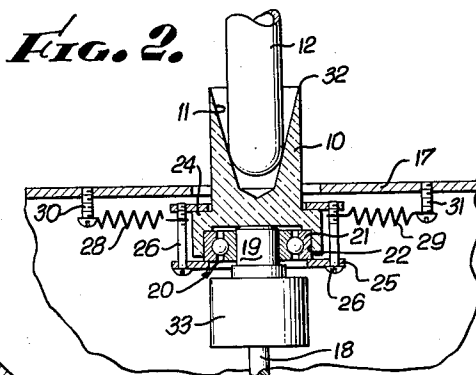
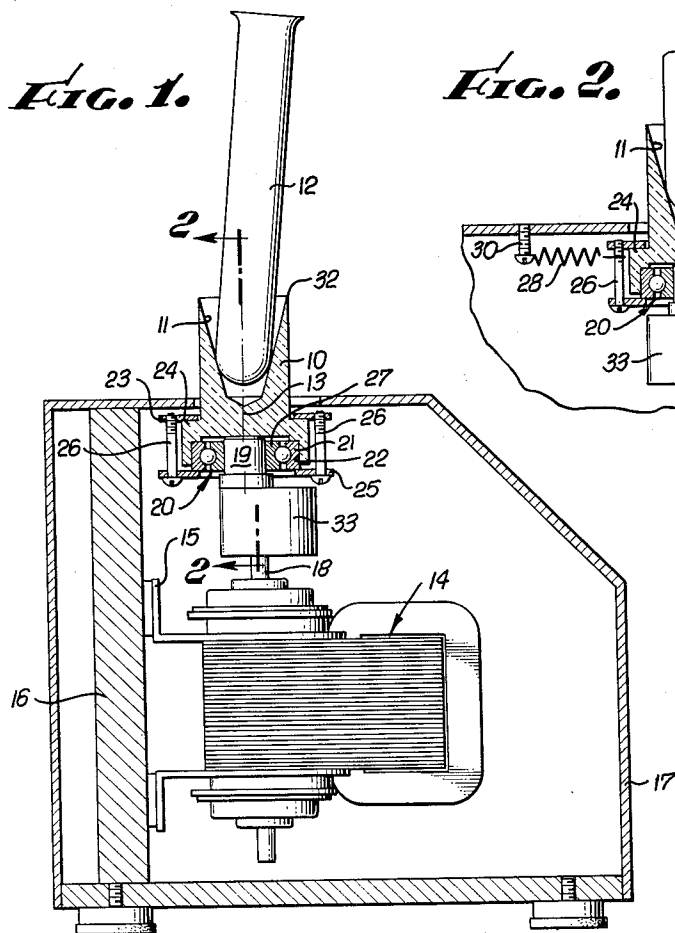
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3,159,384

AGITATOR FOR LABORATORY TUBES AND FLASKS

Filed July 2, 1962

2 Sheets-Sheet 1



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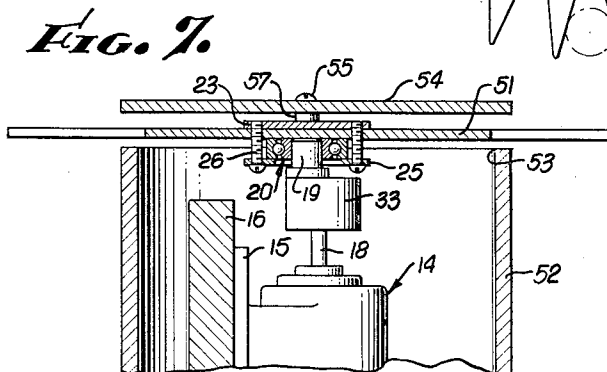
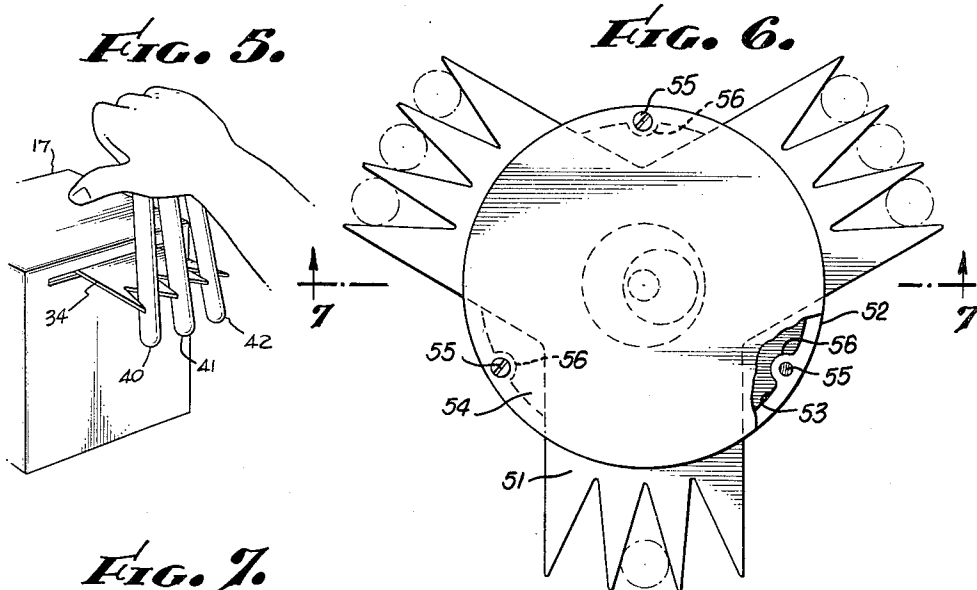
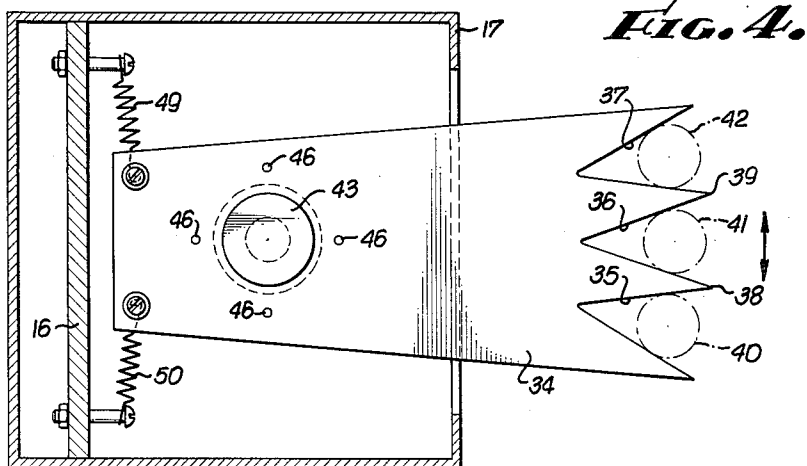
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AGITATOR FOR LABORATORY TUBES AND FLASKS

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2 Sheets-Sheet 2



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AGITATOR FOR LABORATORY TUBES AND FLASKS

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4 Claims. (Cl. 259-72)

This invention relates to an agitator for mixing the contents of laboratory tubes or flasks.

A common type of mixer is one in which a cup made of soft rubber material has its axis rotated about a parallel, slightly eccentric axis while the cup itself is nonrotary. A tube containing the material to be mixed is placed in the cup, and the upper end supported by hand or other means. Mixing is produced only by induced fluid motion.

It is often desirable to agitate a large number of tubes or flasks simultaneously. To answer this need, it has been common to provide multiple cup agitators, at a cost almost directly proportional to the number of cups. One of the primary objects of this invention is to provide a new improved agitator in which a number of tubes or flasks can be agitated by a single device. For this purpose, use is made of a plate shifted in its plane by an eccentric mechanism. The agitator plate has peripheral tapered slots forming recesses laterally, rather than axially, receiving the tubes or flasks. A series of tubes can all be held in their recesses by a simple manipulation.

Another object of this invention is to provide an agitator of this character in which its abrupt motion is transferred to particulate matter adhered to the walls of the tube or flask in order to break it up. Accordingly, mixing does not depend upon fluid motion alone, and a better mixing action is achieved. The agitator plate has only slight yielding characteristics to prevent any material damping.

Another object of this invention is to provide a simplified construction, and one that may be adapted to automation techniques. Thus, instead of lifting a tube from a conveyor rack and placing it in an agitator, the agitator itself can be moved against the tubes without removing the tubes from the conveyor rack.

Prior mixers utilizing rubber cups are not well suited to automatic operations. Thus the position of the cup when stationary is a matter of chance. Another object of this invention is to provide a modified cup structure for existing agitators whereby the cup is at all times effectively in position to receive a tube. For this purpose, the agitator cup is longitudinally tapered.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several embodiments of the invention. For this purpose, there are shown a few forms in the drawings accompanying and forming part of the present specification, and which drawings, unless as otherwise indicated, are true scale. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIGURE 1 is a vertical sectional view of an agitator incorporating one form of the present invention;

FIG. 2 is a sectional view taken along a plane corresponding to line 2—2 of FIG. 1;

FIG. 3 is a fragmentary sectional view of a modified agitator structure;

FIG. 4 is a sectional view taken along a plane corresponding to line 4—4 of FIG. 3;

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FIG. 5 is a pictorial view illustrating the manner in which the number of tubes may be simultaneously held for application to the agitator structure;

FIG. 6 is a top plan view of a further modified form of the present invention, a portion of the apparatus being broken away; and

FIG. 7 is a fragmentary sectional view taken along a plane corresponding to line 7—7 of FIG. 6.

In FIG. 1 there is illustrated an agitating cup 10 that is made of semi-rigid material such as Teflon, nylon or the like. The surface of the material 10 is quite hard as compared, for example, to rubber. Nevertheless, the surface of the material is slightly impressionable to avoid extreme pressure localization.

The agitating cup 10 has an upwardly opening conical recess 11 in which the lower end of a laboratory tube 12 may be seated. The contents of the tube 12 are intended to be mixed.

In order to agitate the contents of the tube 12, the axis 13 of the cup recess is rapidly reciprocated. For this purpose, a motor 14 is provided. The motor 14 has cushioned feet 15 attached to a vertical supporting wall 16. The supporting wall 16 and the motor 14 both are enclosed in a suitable housing structure 17.

The motor has a vertical shaft 18 on the upper end of which is an eccentric crank 19. The eccentric 19 mounts the cup 10, the cup projecting upwardly through a clearance opening in the housing 17. The axis of the recess 11 is centered on the eccentric 19.

Desirably the cup 10 is non-rotary so as to avoid the imposition of any turning torques upon the tube 12 therein supported. In order to permit the cup 10 to be non-rotary while the shaft 18 and eccentric 19 are rotary, a roller bearing structure is provided. The outer race 21 of the bearing structure 20 is fitted in a downwardly opening recess 22 formed in the bottom of the cup 10. It projects slightly beneath the recess for reasons presently to appear. A clamping structure holds the cup 10 and the outer race 21 together. The clamping structure includes two rings. One ring 23 rests upon and overhangs an upwardly facing shoulder 24 formed on the periphery of the cup 10. This shoulder is located at the area just beneath the top wall of the housing 17. A lower ring 25 engages the projecting part of the outer race 21 and itself projects laterally of the cup. Screws 26, acting between the peripherally projecting portions of the rings 23 and 25, lock the parts together and hold the bearing 20 in its recess.

The inner race 27 of the bearing structure 20 is fitted upon the eccentric 19. Thus as the eccentric 19 rotates, the cup oscillates in a circular path.

Since the bearing 20 is not frictionless, a drag would normally tend to rotate the cup 10 causing a good deal of friction upon initial engagement with the tube 12. In order to prevent this, restraining springs 28 and 29 (FIG. 2) are provided. One end of each of the restraining springs 28 and 29 is secured as by screws 30 and 31 to the housing 17, and the other ends of the restraining springs 28 and 29 are looped about the screws 26. The springs 28 and 29 thus restrain rotation of the cup 10 without preventing rotation of the cup axis 13 about the axis of the motor shaft 18.

The tube 12 containing material to be mixed may be lowered generally in a direction corresponding to the axis of the motor shaft 18, preferably when the motor is stopped. The degree of taper and the axial dimension of the conical recess 11 are such as to ensure that the tube 12 first engages beneath the edge 32 at the upper end of the recess 11, whatever may be the position of the cup axis. The tapered walls of the recess 11 then automatically guide the tube 12 into a seated position. A yielding mounting (not shown) at the top of the tube

12 may be designed to admit of such slight lateral movement.

When the tube 12 is held by hand or by some yielding mounting, it naturally resists movement by virtue of inertia effects.

Since the agitator cup 10 is made of semi-rigid material, the slight inertia of the tube 12 results in the cup 10 impacting upon the walls of the tube 12 at a rate corresponding to the speed of the motor shaft 18. This slight impacting is enough to cause breaking up of material that may adhere to the interior walls of the tube 12. This action, coupled with the vortex movement of fluid, induced by the oscillations, causes a very rapid and thorough mixing of the contents.

In order dynamically to balance the load on the motor shaft 18, a companion weight 33 is provided that is attached to the shaft 18. The weight 33 is so designed as to counterbalance the combined weight of the mass eccentrically shifted by the parts 19. Since the tube 12 forms a part of this mass, precise dynamic balancing may not be obtained. However, the cushioned feet 15 damp out any small vibrations.

In the form illustrated in FIGS. 3 and 4, an agitating plate 34 is provided in place of the cup 10. The agitating plate 34 is made of a semi-rigid plastic such as Teflon or other material, and it projects laterally of the housing 17 through a suitable access opening. The outer projecting portion of the agitating plate 34, as shown clearly in FIG. 4, is provided with a number of contiguous V-shaped recesses 35, 36 and 37. Adjacent sides of the recesses 35 and 36 intersect as at 38 to form a sharp wedge or finger, and adjacent sides of the recesses 36 and 37 also intersect at 39.

The recesses 35, 36 and 37 are adapted laterally to receive a series of tubes 40, 41 and 42. The tubes 40, 41 and 42 may simultaneously seat in the recesses for agitation thereby. This may be accomplished by a simple manipulation, as illustrated in FIG. 5. Thus the tubes held in the manner depicted may be simultaneously urged to seat by application of pressure exerted through the pad area of the hand at the base of the thumb.

The sharp wedges at 38 and 39 assist the spreading of the tubes 40, 41 and 42 as they are moved toward the recesses 35, 36 and 37.

For mounting the agitator plate 34, a mounting member 43 is provided. The mounting member 43 in general corresponds to the cup 10 of the previous form, except that it is truncated above a shoulder 44. The agitator plate 34 has a central aperture 45 that fits the member 43 and rests upon the shoulder 44. The agitator plate projects beyond the shoulder 44 for cooperation with screws 46 of a clamping structure.

Springs 49 and 50 (FIG. 4) are attached to the agitator plate 34 within the housing and serve to prevent the plate from being rotated by the drag of the bearing structure. Yet the springs 49 and 50 permit the oscillatory movement of the plate 34.

In the form of the invention illustrated in FIG. 6, an agitator plate 51 similar to the agitator plate 34 is provided. Instead of having one set of adjacent recesses, the agitator plate 51 has three sets of recesses located in equiangularly spaced relationship about the axis of the device. Thus when the plate 51 is rotated, it may be accessible for simultaneous use by a number of technicians, or the recesses of the several sets may be used simultaneously as by holding three tubes in one hand and three tubes in another.

In the present example, the housing structure 52 is generally cylindrical and has an upper opening 53 which the agitator plate 51 generally overlies. Suitable spring structures (not shown) are provided for holding the plate 51 against rotation. A cover plate 54 is superimposed over the central portion of the agitator plate 51 and the opening 53, and is attached by the aid of screws 55 to embossments 56 at the upper end of the

housing part 52. The agitator plate is contoured so as to clear the screws 55. Spacer sleeves 57 are interposed between the cover 54 and the housing 52.

The inventor claims:

1. In a laboratory mixer: a support; a flat agitating member suspended from the support, and having a peripherally opening, inwardly converging V-shaped recess; said support having foot means defining a contact plane parallel to and spaced from said flat agitating member, said V-shaped recess being accessible beyond the support from a direction parallel to said plane; said V-shaped recess converging inwardly for receiving a tube or flask; and motive means carried by the support for cyclically shifting said agitating member through a small distance in its plane to move the location of said recess for imparting agitating motion to a tube or flask pressed into the recess.

2. In a laboratory mixer: a support; an agitating member suspended from the support, and having a peripherally opening recess, said recess having tapered operative side edges converging inwardly of the recess in a substantially horizontal direction, said edges defining a seat for laterally receiving a tube or flask; said seat being accessible beyond the support from said substantially horizontal direction; and motive means carried by the support for cyclically moving said agitating member through a small distance to shift the said operative side edges substantially in a horizontal direction for imparting agitating motion to a tube or flask pressed against the said operative side edges.

3. In a laboratory mixer: a support; a flat agitating plate suspended from the support, and having a number of adjoining peripherally opening recesses, said recesses each having inwardly converging operative tapered side edges, the side edges of adjoining recesses merging at an apex at the periphery of said plate for guiding a plurality of tubes for entry into said recesses; said recesses being accessible beyond the support from a direction parallel to the plane of said flat agitating plate; and motive means carried by the support for cyclically shifting said agitating member through a small distance to move the location of said recesses for imparting agitating motion to tubes or flasks pressed against the said operative side edges of the recesses.

4. In a laboratory mixer: a support having foot means defining a contact plane; a flat agitating plate suspended from the support and having a part projecting laterally beyond said support and extending in spaced parallel relationship to said contact plane; said part having an edge remote from said support, there being a recess extending inwardly from said edge and having tapered operative sides converging inwardly for receiving a tube or flask; and motive means carried by said support for cyclically shifting said agitating member through a small distance in its plane to move the location of said recess for imparting agitating motion to a tube or flask pressed against the tapered sides of said recess.

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