United States Patent

[11] 3,625,485

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[54] **TEST TUBE ROCKER AND ROTATOR**
10 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **259/56,**
259/57, 259/75, 259/81
[51] **Int. Cl.** **B01f 11/00**
[50] **Field of Search** 259/54–57,
73, 75, 81, 72; 310/41, 156

[56] **References Cited**
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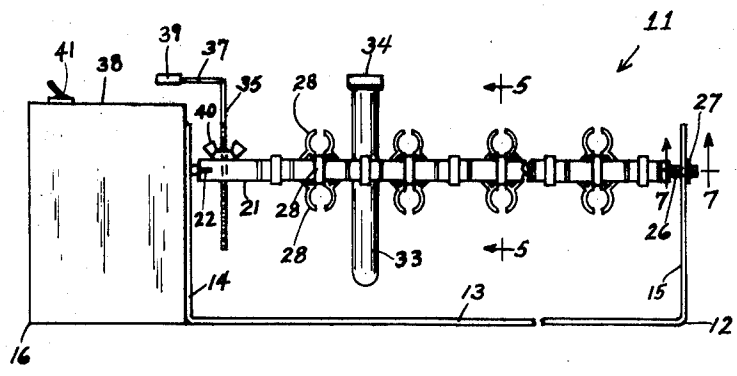
Primary Examiner—Edward L. Roberts
Attorney—Herman L. Gordon

ABSTRACT: A rotating or rocking rack device for test tubes or vials. The rack device consists of a support on which a shaft is rotatably mounted, the shaft having clips for supporting test tubes or vials. A bidirectional motor is mounted on the support and is connected directly to the shaft. The shaft has an arm which can be adjusted to engage the housing of the motor, causing the motor to oscillate the shaft, or it can be adjusted to clear the housing, whereby the motor will rotate the shaft continuously in one direction.



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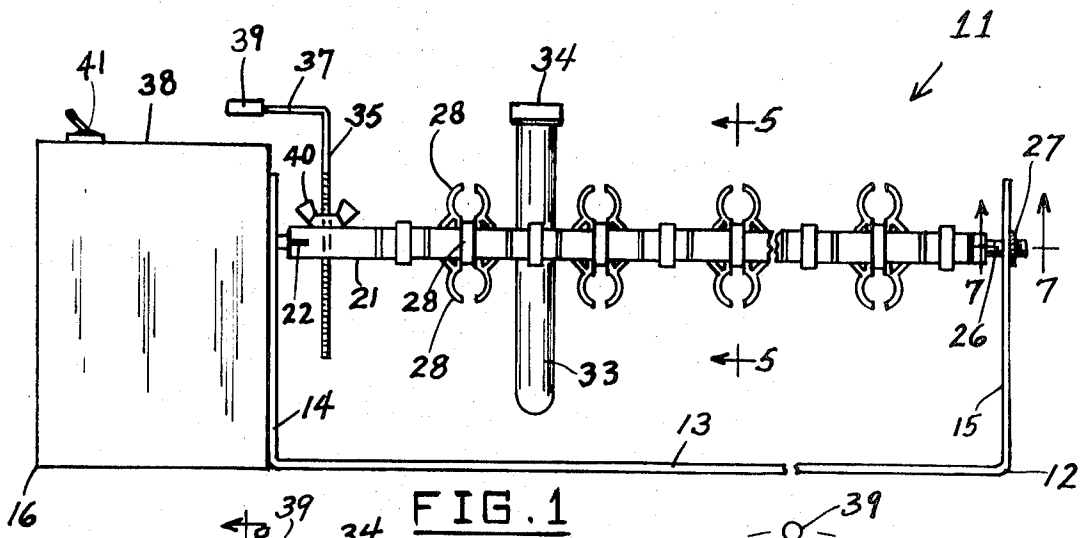

FIG. 1

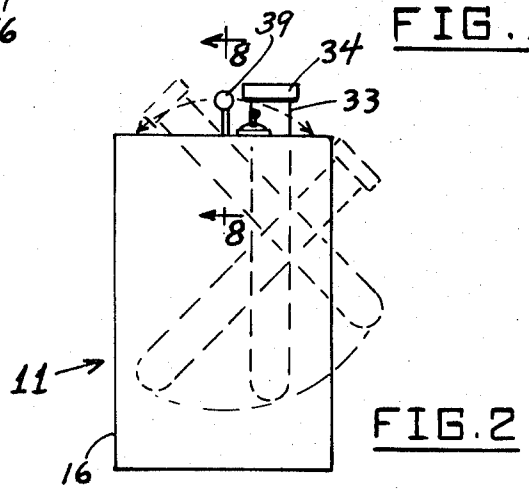

FIG. 2

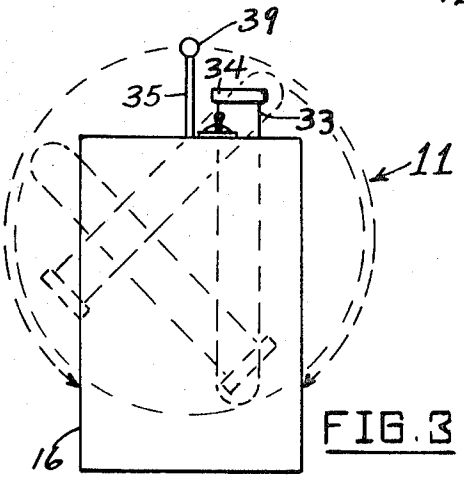

FIG. 3

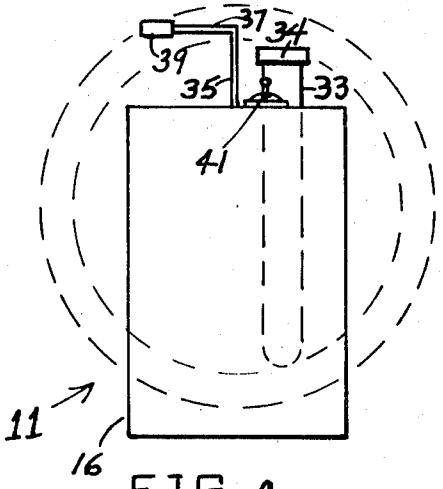

FIG. 4

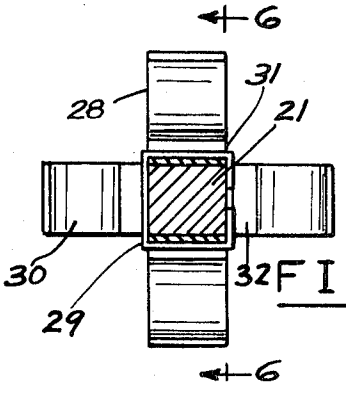

FIG. 5

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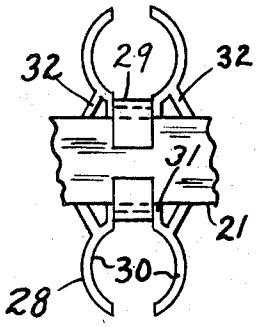

FIG. 6

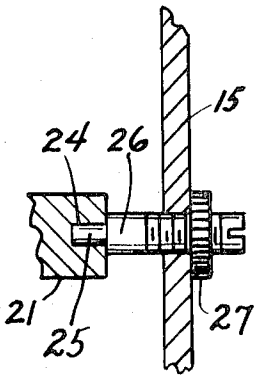

FIG. 7

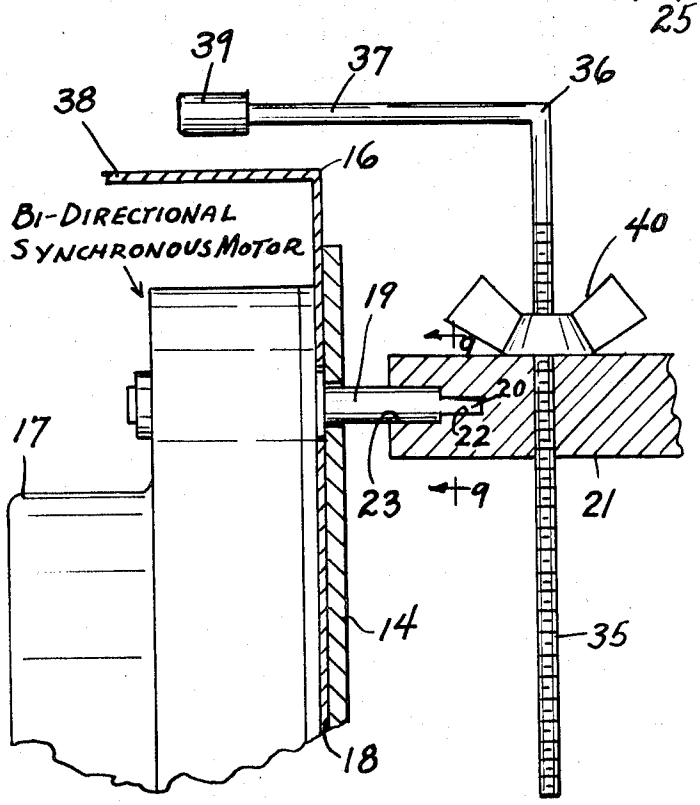

FIG. 8

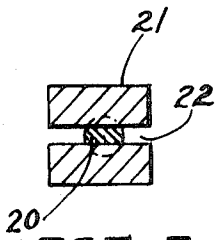

FIG. 9

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TEST TUBE ROCKER AND ROTATOR

This invention relates to test tube racks, and more particularly to test tube racks which rock or rotate test tubes supported thereon.

A main object of the invention is to provide a novel and improved rotating or rocking rack device for test tubes, said device being simple in construction, being compact in size, having a large capacity, and being easily adjustable to provide different modes of rocking action or of rotating action.

A further object of the invention is to provide an improved test tube rack device including means to rock or rotate test tubes or vials carried thereon, the rack device being inexpensive to manufacture, being durable in construction, being readily submersible in a liquid bath, and being adapted to support test tubes or vials of a wide range of sizes and to hold the test tubes or vials securely while they are rocked or rotated, either in the atmosphere or in a liquid bath.

A still further object of the invention is to provide an improved rocking or rotating support device for test tubes or vials, the support device being driven by a bidirectional synchronous motor which changes its direction whenever its rotation is impeded, the device including simple and easily manipulated means for adjusting the amplitude of its rocking action or for providing a continuous rotational action, as required.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIG. 1 is a side elevational view of an improved test tube rack device constructed in accordance with the present invention, set to provide relatively short-excursion rocking action.

FIG. 2 is an end elevational view of the test tube rack device of FIG. 1.

FIG. 3 is an end elevational view of the rack device of FIGS. 1 and 2, set to provide relatively wide-angle rocking action.

FIG. 4 is an end elevational view of the rack device of FIGS. 1 and 2, set to provide continuous rotational action.

FIG. 5 is 5—enlarged transverse cross-sectional view taken substantially on the line 5–5 of FIG. 1.

FIG. 6 is an elevational view taken substantially on the line 6—6 of FIG. 5.

FIG. 7 is an enlarged cross-sectional detail view taken substantially on the line 7—7 of FIG. 1.

FIG. 8 is an enlarged fragmentary cross-sectional view taken substantially on the line 8—8 of FIG. 2.

FIG. 9 is a transverse cross-sectional view taken substantially on the line 9—9 of FIG. 8.

Referring to the drawings, 11 generally designates an improved test tube supporting rack device according to the present invention. The device 11 comprises a generally U-shaped main supporting member 12 of rigid sheet material, or other suitable material, such as sheet metal, molded plastic, or the like, having a bottom wall 13 and upstanding vertical transverse end walls 14 and 15. Secured to the end wall 14 is a generally rectangular housing 16 in which is mounted a bidirectional synchronous motor 17, the motor being secured against the right transverse vertical wall 18 of the housing 16, as viewed in FIG. 8, and being thus secured adjacent end wall 14 of member 12.

Motor 17 has an output shaft 19 which is formed at its end with a flat tongue 20. Shaft 19 extends through registering apertures provided therefor in walls 18 and 14, as shown in FIG. 8.

Designated at 21 is a square supporting shaft keyed to motor shaft 19 and journaled to upstanding right end wall 15. Thus, at its left end, as viewed in FIG. 1, the shaft 21 is formed with an axially extending slot 22 and with an axial end bore 23 extending for part of the length of said slot. The cylindrical portion of shaft 19 is received in said bore 23 and the tongue 20 is nonrotatably received in the right end of slot 22, providing a driving connection between motor shaft 19 and square shaft 21. The right end of shaft 21 has an axial pivot bore 24 which rotatably receives the reduced pivot stud element 25 of a pivot shaft 26 threadedly engaged in upstanding wall 15 and rigidly locked thereto by a knurled locknut 27, as shown in FIG. 7.

Removably clamped on square shaft 21 are a plurality of resilient test tube clips 28, said clips being arranged in opposing pairs and being retained on the shaft 21 by generally C-shaped square resilient clamps 29, of flat resilient strap metal, or the like. As shown in 6, each clip 28 has opposed arcuate wings 30,30, with a rectangular channel 31 therebetween receiving an arm of the associated clamp 29. The clips 28 have integral inclined brace struts 32,32 engaging the flat surfaces of shaft 21 on opposite sides of the channels 31 to hold the clips 28,28 on opposite sides of shaft 21 with their axes parallel.

The pairs of clips 28,28 may be clamped to pairs of opposite sides of the square shaft 21 in alternating relationship along the length of shaft 21, as shown in FIG. 1. Each clip is adapted to clampingly support a test tube or vial 33 for rotation or rocking movement in a plane perpendicular to the shaft 21, as shown in FIG. 1.

Each test tube or vial 33 is provided with a stopper 34 to prevent spilling of the contents thereof during the rocking or rotating motion of the tube or vial.

Threadedly engaged through the end portion of shaft 21 perpendicularly thereto and adjacent wall 14 is a rod 35 bent at right angles at its top end, as shown at 36, to define a horizontal arm 37 of sufficient length to overly the top wall 38 of housing 16 when the arm is in a position substantially parallel to shaft 21, for example, as shown in FIGS. 1 and 8. Arm 37 is provided at its end with a rubber bumper cap 39 to provide resilient impact against housing 16 in a manner presently to be described. Rod 35 is provided with a winged locknut 40 clampingly engageable with shaft 21 to lock rod 35 rigidly to the shaft in an adjusted position relative thereto.

Rod 35 is adjustable to provide three possible modes of operation of the device, as follows:

1. With arm 37 overlying wall 38 and locked parallel to shaft 21, and extended only a short distance beyond the radial distance of wall 38 to the axis of shaft 21, the bumper 39 will engage top wall 38 at opposite ends of a relatively small angle of excursion of the test tubes or vials carried by the shaft 21, for example, as illustrated in FIG. 2.

2. With arm 37 overlying wall 38 and locked parallel to shaft 21, and extended so that bumper 39 is beyond the radial distance of the top corners of housing 16 to the axis of shaft 21, the bumper will clear said top corners and will engage the vertical front and rear walls of housing 16 at the opposite ends of a relatively large angle of excursion of the test tubes or vials carried by shaft 21, for example, as shown in FIG. 3. This angle will be of the order of 270°, whereas in Case 1 the angle of excursion is limited to about 90° or less, depending upon the adjustment of rod 35.

3. With rod 35 locked in a position such that arm 37 and bumper 39 clear housing 16, for example, with arm 37 in a plane perpendicular to shaft 21, as in FIG. 4, the shaft 21 and the test tubes or vials carried thereby can rotate continuously in one direction.

The bidirectional synchronous motor 17 is of a conventional type, for example, of the type described in detail in U.S. Pat. No. 3,253,169 to A. W. Haydon et al. This type of motor will start in either direction and will automatically reverse responsive to a moderate rebound upon encountering an obstacle to its rotation. Thus, a sufficient rebound will develop when the bumper 39 engages either the top wall 38 (in the first mode above described) or the vertical front or rear wall of housing 17 (in the second mode above described) to cause the motor to reverse its direction of rotation. Such a rebound will also develop if bumper 39 is omitted, but the use of the bumper is desirable to reduce noise.

As above mentioned in the above-identified patent to A. W. Haydon et al. if unidirectional operation of the motor is desired, a mechanical "no back" device may be employed, but there is no requirement for this in the present invention. As examples of this type of motor equipped with "no-back"

devices, reference is made to U.S. Pat. No. 3,473,058 to R. P. Landgraf et al. U.S. Pat No. 3,501,658 to E. R. Morley, U.S. Pat. No. 3,225,874 to L. A. Woolley and U.S. Pat. No. 3,462,668 to C. R. Tompson. In the case of the bidirectional synchronous motor **17** employed in the device of the present invention, the "no-back" device is omitted.

In operation, with the arm **37** set as in FIG. **2** (Case **1**), the test tubes or vials **33** will rock through relatively small angles of excursion, of the order of 90° or less, depending upon the adjusted position of rod **35**. With the arm **37** set as in FIG. **3** (Case **2**) the test tubes or vials **33** will rock through relatively wide angles of excursion, of the order of 270°. With the arm **37** set as in FIG. **4**, the test tubes or vials **33** will rotate continuously in one direction, namely, the starting direction of motor **17**.

The motor **17** may be provided with a control switch **41** conveniently mounted on the top wall **38** of housing **16**, as shown in FIG. **1**.

The device **11** may be employed either in the horizontal position thereof shown in FIG. **1** or in an inclined or vertical position with the shaft **21** carrying the test tubes or vials **33** immersed in a liquid bath for temperature control.

As will be readily apparent, different types or sizes of clips **28** may be easily substituted, as required, by detaching shaft **21** from support **12** by backing off pivot shaft **26** from the shaft **21** sufficiently to allow said shaft **21** to be disengaged from motor shaft **19**. The original clips may be slid off the shaft **21** and may easily be replaced by the desired substitute clips, after which the shaft **21** may be reinstalled in the operative position thereof shown in FIG. **1**.

Obviously, other suitable types of adjustable abutment members may be employed in place of the screw-adjusted abutment arm **37**, within the spirit of the present invention.

The shaft **21** may be replaced by a stirring rod with blades, the device **11** supported vertically, and reagent in a beaker placed on the wall member **15** may be mixed by the stirring rod.

Likewise, dialysis bags of membrane may be attached to the clips **28**, the device **11** immersed in the dialyzing reagent, and dialysis in the bags accelerated by movement of the bags through the dialyzing reagent. The clips employed may be suitably designed to simultaneously hold and close the dialysis membrane bags.

While a specific embodiment of an improved rocking or rotating support device for test tubes, or vials or other containers used in a laboratory has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. An agitating rack device for containers comprising support means, shaft means rotatably mounted on said support means, means to secure containers to said shaft means, a bidirectional motor mounted on said support means, said motor being of a type which automatically reverses responsive to encountering an obstacle, means drivingly coupling said motor to said shaft means, and abutment means on the shaft means engageable with the support means during rotation of said shaft means to cause reversal of said motor and reversal of the direction of rotation of said shaft means.

2. The rack device of claim **1**, and means to at times adjust said abutment means to a nonengaging position with respect to said support means, whereby to allow continuous rotation in one direction of said shaft means.

3. The rack device of claim **2**, and wherein said abutment means comprises rotatably adjustable rod means mounted on said shaft means, said rod means being provided with a projection spaced from the shaft means and being engageable with said support means during rotation of the shaft means.

4. The rack device of claim **3**, and wherein said rod means is threadedly engaged with said shaft means and is provided with a locknut to clamp it rigidly to said shaft means.

5. The rack device of claim **4**, and wherein said projection comprises a laterally extending arm at the end of said rod means.

6. The rack device of claim **5**, and wherein said support means includes a housing surrounding said motor, said laterally extending arm being engageable with portions of said housing to cause said motor to reverse its direction.

7. The rack device of claim **1**, and wherein said shaft means comprises a square shaft and said container-securing means comprises spring clips secured to the sides of said square shaft.

8. The rack device of claim **7**, and wherein the spring clips are arranged in pairs secured to opposite sides of said square shaft.

9. The rack device of claim **8**, and wherein said pairs of spring clips are secured to alternate pairs of opposite sides of the square shaft along the length of said square shaft.

10. The rack device of claim **6**, and wherein said support means comprises a generally U-shaped rigid member having a bottom wall and upstanding end walls, said motor and housing being mounted on one of said end walls, said shaft means comprising a square shaft drivingly coupled at one end to said motor, means on the other end wall pivotally supporting the other end of said square shaft, said container-supporting means comprising pairs of spring clips secured to alternate pairs of opposite sides of the square shaft along the length of said square shaft.

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