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APPARATUS FOR INDICATING AND REGULATING VISCOSITY

Filed Nov. 16, 1948

2 Sheets-Sheet 1

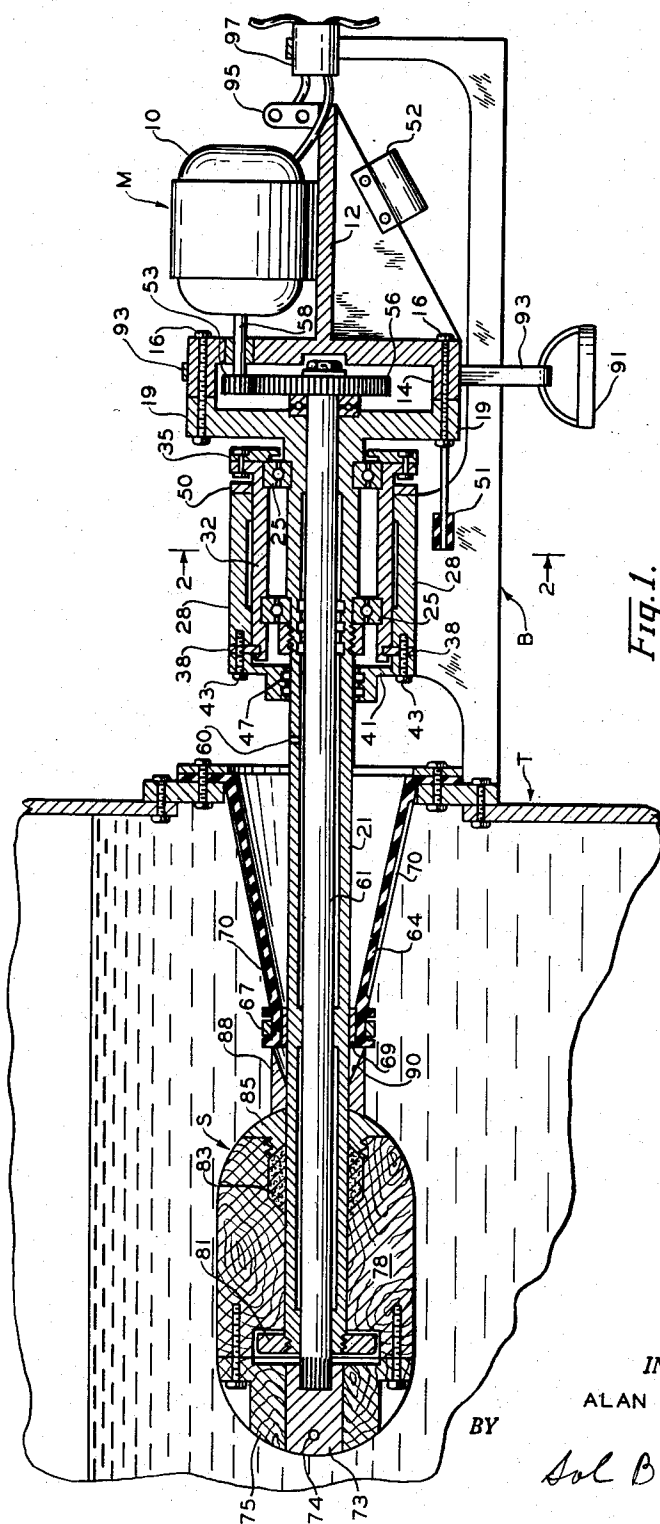


Fig. 1.

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2 Sheets-Sheet 2

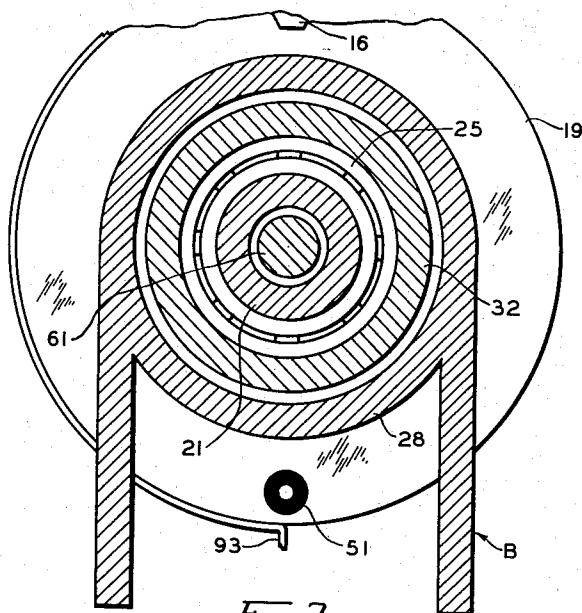


Fig. 2.

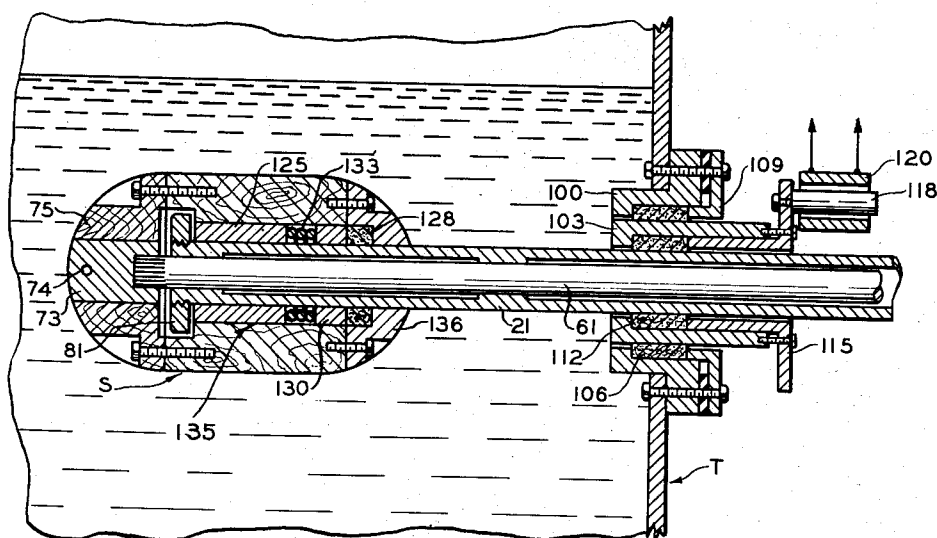


Fig. 3.

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APPARATUS FOR INDICATING AND
REGULATING VISCOSITY

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15 Claims. (Cl. 73-59)

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This invention relates to apparatus for automatically regulating the viscosity of liquids and also the apparent (non-Newtonian) viscosity of solid suspensions in liquids, and more particularly to regulating the solids content of a paper or other pulp suspension in a liquid as confined in a tank or pipe line. My present invention constitutes an improvement over the apparatus described in my prior Patent No. 1,888,431 of November 22, 1932, in providing certain changes in structure which overcome difficulties encountered in the operation of the previous device.

As set forth in my prior patent, I utilize the torque reaction between the stator housing of an electric motor and the rotor, wherein the rotor spins an element which is immersed in fluid the viscosity of which is to be regulated. The general construction is such that the motor and various support elements are secured to the outside of a tank or pipe line containing the fluid suspension while the spinning element is keyed to a shaft rotated by the motor and is disposed within the body of the fluid. In the prior patent a more or less conventional gland is used for sealing the shaft where it enters the tank or pipe line. It has been found that this gland causes difficulty by virtue of the fact that particles of foreign matter become entrapped therein thereby increasing the torque reaction between the motor housing and the spinning element, resulting in inaccurate operation of the apparatus. Further, the slight natural variation of the inherent friction of the gland which must be overcome by motor torque causes some inaccuracy of itself.

Accordingly, it is an object of the present invention to eliminate the above difficulty by isolating mechanically the rotor-oscillating system from its attachment to the liquid container so that the reaction on the oscillating element will truly reflect the torque necessary to maintain constant speed rotation of the spinner element.

A further object of my invention is to provide a simple sealing structure for certain elements of my device which enter the fluid, which means will in no way affect the operational characteristics thereof.

An additional object of my invention is to provide means for eliminating friction at the place of entry of such elements into a tank or pipe line.

Other objects and features of my invention will be apparent from the detailed description which now follows, taken in conjunction with the appended drawings in which:

Fig. 1 shows a longitudinal section of my invention;

Fig. 2 shows a section through 2-2 of Fig. 1;

Fig. 3 shows a modification of certain elements of my invention.

My device comprises a constant speed motor M, a spinner element S, and a motor support bracket

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B, wherein the several devices M, S and B are secured and supported on a tank (or pipe line) T, as shown.

The stator 10 of the motor is fastened in any suitable manner to a platform 12 which is flanged at 14 and secured as by rivets or bolts 16 to a flange 19 of a rotative collar or quill 21.

Thus the motor stator 10, base 12, and quill 21 are integrally secured; and these elements are oscillatable about the axis of quill 21 by virtue of bearings 25 which are secured to the quill and serve to support it in a housing or cradle 28, which housing is integral with bracket B. Intermediate the outer races of the ball bearings and the cradle 28 is a sleeve 32 having a rotative fit in cradle 28 and terminating in an annular member 35 at one end and having rotative sealing and locating contact with a rigid sealing washer 38 at the other end. Washer 38 is secured in any suitable manner between housing 28 and an end flange 41, as by bolts 43. End flange 41 is provided with labyrinth grooves 47 for impeding dirt, there being clearance provided around quill 21. An additional sealing washer 50 may be used if desired.

The construction is such that the outer races of the bearings 25 may be intermittently manually rotated by grasping the member 35 and rotating it slightly, thus overcoming any static friction within the bearings so as to render the device more sensitive to viscosity changes. Automatic means for constantly actuating member 35 to and fro may also be used.

A rubber cushioned stop member 51 is carried by flanges 14 and 19, swinging between the side walls of bracket B to limit angular motion of the motor stator system in either direction. Suitably carried below the center of gravity of the motor is a balancing weight 52 which tends to maintain a normally upright condition of the motor, i. e., at the center of the oscillatory arc when the motor is not energized.

Housed in the hollow formed by the flanges 14 and 19 is a simple gear reduction device comprising pinion 53 and gear 56; the former being driven by the motor rotor through shaft 58 and the latter serving to drive a shaft 61 rotatively disposed within quill 21.

Quill 21 is composed of bearing bronze or similar material so that when lubricated by means of the insertion of oil at oil hole 60 shaft 61 turns easily inside quill 21.

The shaft and quill extend into the fluid contained in the tank or pipe line T, there being a flexible boot 64 provided to seal against fluid leakage. Boot 64 is bolted at its outer end to the side of T and at its inner end is provided with metallic rings 67 and 69 bonded thereto with 69 in turn bonded or soldered to quill 21. Boot 64 may be provided with flutes 70 so as to increase its torsional flexibility whereby it will tend to twist

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about its own axis during oscillation of quill 21.

Shaft 61 extends outwardly of the quill and is secured by splining to a metallic plug 73 which is integrally secured as by a pin 74 to an end piece 75 of spinning element S; which end piece is bolted to the main body 78 of the spinner. The spinner components may be made of wood and should preferably be ellipsoid in shape since it has been found that such shape is most suitable for my purpose. The irregularities in the spinner caused by inserting the bolts are smoothed off by covering the bolt heads with plastic wood or like material and sandpapered into fairness with the body of the spinner.

The end of quill 21 is provided with a retaining flange 81; and a gland packing 83 and gland 85 are provided around the quill to prevent fluid from becoming entrapped between the quill and spinner; gland 85 rotates with the spinner and has a rotative fit about the quill. A string cutter 88 may be integral with gland 85, such cutter having a sharp or saw-tooth edge 90 for shredding any submerged pieces of string which are sometimes encountered in paper pulp and which might foul the spinner by becoming wedged between it and the quill. Preferably edge 90 should be closely adjacent the inner end of the boot to shield the quill as much as possible and also to enhance shredding of foreign material.

As set forth in detail in my prior patent, it will be apparent that when the motor is energized, constant speed rotation of shaft 61 will cause rotation of the spinner, a certain amount of torque being required to overcome friction with the fluid in which the spinner is immersed. This torque will manifest itself in a swinging movement of the motor stator about the axis of the quill in accordance with well known principles. To counteract this reaction torque a scale pan 91 is carried at the end of a strap 93 which is partially wrapped around flange 14. The scale pan may be suitably weighted to counteract the reaction torque of the motor when energized so as to maintain a normally upright position.

It is understood that various electrical elements, e. g., mercury switches, are required, substantially as shown and described in my prior patent. The arrangement taught therein is such that oscillation of the motor stator, depending on increase or decrease of motor torque as the viscosity of the fluid in tank T changes, serves to close one or the other of the switches to thereby control through a suitable valve arrangement the influx of high or low viscosity fluid to the tank until the original viscosity condition and thus the physical equilibrium of the motor system are restored.

In Fig. 1, certain electrical components, such as a switch mount 95 and a terminal box 97, are shown.

In the light of the foregoing description it will be apparent that I have substantially isolated the mechanical system from extraneous frictional influence by having the quill and shaft substantially co-extensive wherein the torque necessary to overcome frictional resistance of the rotating shaft is exerted between the shaft as part of the motor rotor, and the quill as part of the motor stator. Thus torque reaction resulting from the overcoming of friction between the shaft and its bearing, i. e., the quill, and the spinner cannot manifest itself in a tendency to oscillate the platform 12, which is a highly desirable condition; whereas the construction shown in my prior patent, as heretofore point-

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ed out, caused spurious oscillation of the stator support system due to the necessity of overcoming variations of friction between the fixed or stationary gland and the rotating shaft. Accordingly, the system now proposed is free of frictional effects insofar as such friction may result in unwanted torque reaction between the rotating shaft and any fixed element of the assembly is concerned.

Further consideration will make it apparent that the underlying principle of my present invention resides in providing a quill which houses the rotating shaft and mechanically isolates it from the wall of the tank into which it protrudes. Thus so long as no frictional force is exerted on the shaft by any stationary element, the novel condition is met. It will now be appreciated that the quill need not necessarily extend into the tank if it is not desired to do so, just so long as it provides a bearing through the wall of the tank for the shaft so that no other friction is encountered by the latter.

I prefer, however, to extend the quill as shown so as to eliminate the possibility of grit accumulation between the shaft and quill.

In the form of my invention shown in Fig. 3, a modified combination is disclosed in that no boot about the quill 21 is utilized. Instead the structure contemplates a fixed gland element 100 secured in an aperture of the pipeline T and the vibratory gland element 103 concentric with fixed element 100 and spaced therefrom by a packing member 106 which is compressed by the flange member 109 in a manner which will be readily understood from consideration of the drawing. The element 103 is concentric with quill 21 and spaced therefrom by a packing element 112 maintained in compression by a flanged member 115. A solenoid plunger 118 is secured to the member 115 and a solenoid 120 is utilized to reciprocate plunger 118 whereby a constant axial or rotary vibratory motion of the gland 103 will be effected. It will be appreciated that the packing members 106 and 112 must not be compressed to an extreme degree. In other words, the compression exerted by the elements 109 and 115 requires adjustment so as not to cause undue binding of the vibratory motion of member 103.

This combination of elements serves to maintain a condition of moving friction at all times on that area of quill 21 which passes through the wall of the tank. Thus static friction which is always considerably greater than moving friction is eliminated and any slow oscillatory motion of the quill due to changes of viscosity in the pipeline meets no resistance, thereby rendering operation of the device substantially more sensitive.

In this modification certain other changes have been made in that a bearing 125 is disposed between the internal bore of the spinner element and quill 21. This bearing may be of a plain cylindrical type and fixed preferably to the spinner element. A packing 128 is used which is maintained under compression by gland 130 biased by means of the spring 133, all in the counterbore 135. The end of the spinner is provided with a separable member 136 which may be bolted, as shown, to the spinner body for ease in assembly.

While I have shown a specific embodiment of my invention and certain modifications thereof, it will be appreciated that the novelty and spirit

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of my invention may take many forms. Accordingly, I do not seek to be bound by the particular structures hereinabove described, except as set forth in the following claims.

To claim:

1. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, the combination which comprises a spinner adapted to be supported within the fluid whose viscosity is to be regulated, having a driving shaft attached thereto, a constant speed motor for rotating said shaft and spinner, an oscillatable cradle mount supporting said motor and fixed to the stator thereof, and a quill surrounding said shaft and supporting the same in a freely rotatable manner, said quill being fastened to said oscillating cradle mount and extending therefrom into said spinner, whereby both spinner and quill elements extend into said fluid.

2. Device as defined in claim 1 wherein the spinner element is ellipsoidal.

3. In a device for regulating the apparent viscosity of fluids confined in a stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in the fluid whose apparent viscosity is to be regulated, and a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to the point of contact with said fluid to isolate said shaft from any other frictional contact.

4. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in the fluid whose apparent viscosity is to be regulated, and a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to a point of contact with said fluid to isolate said shaft from any other frictional contact, a flexible resilient boot having one end thereof adapted to be sealingly secured to the walls surrounding an aperture in the container through which said quill extends into said fluid, and the other end attached to said quill for resilient oscillation therewith in a fluid-tight manner.

5. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in a fluid whose apparent viscosity is to be regulated, and a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to a point of contact with said fluid to isolate said

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shaft from any other frictional contact, a flexible resilient boot having one end thereof adapted to be sealingly secured to the walls surrounding an aperture in the container through which said quill extends into said fluid, and the other end attached to said quill for resilient oscillation therewith in a fluid-tight manner, said boot being comprised of flexible rubber-like material and provided with flutes extending substantially the length thereof in a manner to decrease resistance to torsional stress thereon.

6. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in the fluid whose apparent viscosity is to be regulated, a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to the point of contact with said fluid to isolate said shaft from any other frictional contact, and gland means disposed around said quill at the place of entry of said quill into said spinner element.

7. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in a fluid whose apparent viscosity is to be regulated, and a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to the point of contact with said fluid to isolate said shaft from any other frictional contact, said spinner element carrying sharp-edged means adapted for rotation therewith for shredding submerged foreign matter in the fluid in which this spinner element may be immersed.

8. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in the fluid whose apparent viscosity is to be regulated, a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to the point of contact with said fluid to isolate said shaft from any other frictional contact, a boot surrounding said quill and having one end adapted for a fixed sealing engagement with a wall portion surrounding an aperture in the container through which said quill passes into said fluid, and having the other end attached to said quill for resilient oscillation therewith in a fluid-tight manner, a ring-like cutter carried by said spinner element having a sharpened edge closely adjacent the latter end of said boot.

9. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in the fluid whose apparent viscosity is to be regulated, a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to the point of contact with said fluid to isolate said shaft from any other frictional contact, a bearing for said mount adapted to be disposed intermediate said mount and a fixed support and comprising an independently movable sleeve adapted to overcome static friction between said mount and said fixed support.

10. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in the fluid whose apparent viscosity is to be regulated, and a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to the point of contact with said fluid to isolate said shaft from any other frictional contact and gland means disposed about said quill member and oscillatably supporting the same in fluid-tight manner at the point of juncture with said container.

11. In a device for regulating the apparent viscosity of fluids, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in the fluid whose apparent viscosity is to be regulated, and a quill member secured to said mount and oscillatable therewith, said quill member being at least up to a point of contact with said fluid to isolate said shaft from any other frictional contact and gland means disposed about said quill member and oscillatably supporting the same in fluid-tight manner, said gland surrounding said quill member being adapted to be disposed in a wall portion surrounding an aperture in said container, wherein said gland comprises a sleeve intermediate said quill and said aperture and means for rapidly oscillating said sleeve to overcome static friction between said quill and the wall surrounding said aperture.

12. Device as defined in claim 11 wherein packing material is confined between said sleeve and said quill and further means is present for adjustably compressing said packing.

13. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillat-

ably supporting said mount and motor with the spinner immersed in the fluid whose apparent viscosity is to be regulated, a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to the point of contact with said fluid to isolate said shaft from any other frictional contact and gland means disposed about said quill member and oscillatably supporting the same in fluid-tight manner, said gland means comprising two sleeves concentrically disposed around said quill member within an aperture in the wall of said container, the outermost sleeve being adapted to be fastened to the surrounding portion of said container in fluid tight manner, and packing materials disposed both between both sleeves and between the inner sleeve and said quill member to seal the container opening in fluid tight manner and allow said inner sleeve freedom to oscillate between the outer sleeve and quill member and means for oscillating said inner sleeve.

14. In a device for regulating the apparent viscosity of fluids confined in a relatively stationary container, a spinner, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft, an oscillatable cradle mount for supporting said motor fixed to the stator thereof and oscillatable therewith, means for oscillatably supporting said mount and motor with the spinner immersed in the fluid whose apparent viscosity is to be regulated, a quill member secured to said mount and oscillatable therewith, said quill member being disposed about said shaft and supporting the same in freely rotatable manner and extending therealong at least up to the point of contact with said fluid to isolate said shaft from any other frictional contact, said quill being substantially coextensive with said shaft, extending therewith into said spinner, packing means between said spinner and said quill comprising a packing member, a gland for compressing said packing member, and a spring for biasing said gland against said packing member, said gland, packing member and spring being disposed in a counterbore provided in said spinner and surrounding said quill.

15. In combination, a stationary container adapted to contain fluid whose viscosity is to be regulated, a device for regulating the viscosity of the fluid therein mounted through an aperture in the walls of said container comprising a spinner immersed in said fluid, a shaft attached thereto for rotating said spinner, a motor for rotating said shaft drivingly attached thereto, an oscillatable cradle mount supporting said motor and fixed to the stator thereof, a quill surrounding said shaft and supporting the same in a freely rotatable manner, said quill being fastened to said oscillating cradle mount for oscillation therewith and extending along said shaft at least up to the point of contact with said fluid to isolate said shaft from any other frictional contact, and bearing means surrounding said quill and being integrally secured to and carried by said oscillatable cradle.

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