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METHOD OF AND APPARATUS FOR AGITATING

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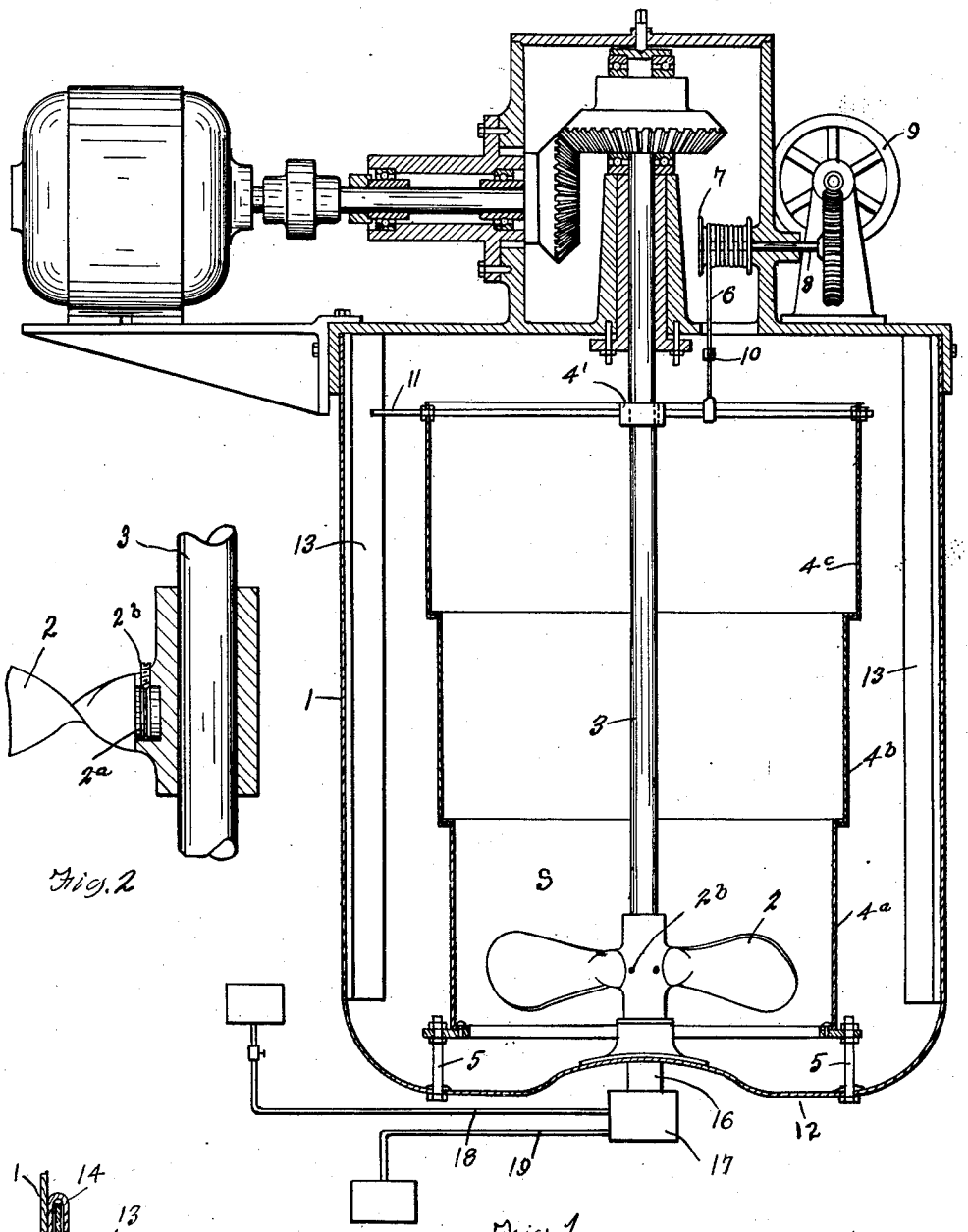

Fig. 1

Fig. 2

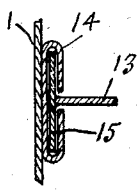

Fig. 3.

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METHOD OF AND APPARATUS FOR AGITATING

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In the agitating or mixing of liquid masses in which there is much tendency to separation of constituents, considerable difficulty is encountered; and where constituents tending not only to settle out but also to cake at the bottom of the container are involved, the difficulties increase, and under such circumstances it has been customary to empty the container on any cessation of operations in order to avoid trouble in restarting. This is inconvenient and interferes with good operating schedules. An agitating system capable of efficient operation without undue power consumption or complicated mechanical construction, and making possible the rapid handling of caked deposits is accordingly highly desirable.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the features hereinafter fully described, and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative construction contemplated in the invention, this being however an exemplification of but one of the various ways in which the principle of the invention may be employed.

In said annexed drawings:

Fig. 1 is an axial sectional view of an embodiment of the invention; and Figs. 2 and 3 are sectional details.

Referring more particularly to the drawings, there is shown a container 1, and an impelling means, advantageously a screw propeller S, carried by a shaft 3 and driven from any suitable source of power. The container may be of shape and dimensions required by particular circumstances, ordinarily a cylindrical shape being most desirable.

The impeller is mounted in the lower portion of the container, and preferably the blades 2 are regulable as to pitch, this being provided by any suitable means, as for instance journalled stems 2*a* and set screws 2*b* for tightening against the respective bladestems to hold them in desired pitch position.

In relation with the impelling means is a current guide in the form of a tubular shell, the cross section of which may be of non-circular form, but which ordinarily is circular. Such current guide is regulable moreover as to its height in the container, whereby it may be readily adapted to various amounts of liquid material under treatment. To such end, the guide is of a telescopic character, being made up of any preferred number of sections 4*a*, 4*b*, 4*c*, these sections nesting closely so as to favor adjustability without material space requirement. In the detail shown, the section adjacent the impeller is held in a fixed position, as by support rods or standards 5, and the sections 4*b*, 4*c* thence are telscopically mounted thereon, the section 4*a* for instance being slightly flanged outwardly at its upper end, while the section 4*b* is correspondingly flanged inwardly at its lower end, and so on. Means for raising and lowering the sections are provided, for instance cables 6 attached to the upper section, and wound on drums 7 operated by shaft 8. The latter may be actuated by a hand wheel 9 through suitable gearing. In this manner, the tubular guide may be extended to whatever length may be desired in view of the requirements at any given time, and the upper edge of the guide may be maintained at all times at a suitable distance below the surface of the liquid so as to allow of circulation. If desired, a tell-tale or indicator 10 may be secured to the cable at a suitable distance above the top of the upper section of the tubular guide to facilitate maintaining proper submergence depth, it being then merely necessary to regulate the cable so that the indicator 10 is at the surface of the liquid.

It will be observed that the tubular guide divides the liquid mass undergoing treatment into two columns, an inner or central column and an outer or peripheral column, the tubular guide making a division therebetween; and accordingly the liquid mass may circulate effectively, as set in motion by the agitating impeller. Moreover, the cross sectional areas within and without the tubular guide are preferably substantially equal, this being readily attained by dimensioning the tubular guide in accordance with the mathematical requirements of the areas of the concentric

circles. In this manner, the area for circulatory action is equal inside and out with respect to the tubular guide, and an even circulation is favored. The same equality of circulatory area at all points may be furthered also by maintaining the distance between the lower edge of the tubular guide and the floor of the container, and the distance between the upper edge of the tubular guide and the surface of the liquid such as to be consistent with the cross sectional circulatory requirements referred to, and thus a circulatory circuit may be had which at all points offers substantially equal freedom of flow.

The floor of the container is preferably recurved, as at 12, the sweep of liquid thus being caused to exert a scouring action upon the bottom; and with absence of eddy currents in dead corner spaces, the direct force of the current stream is made available, and consequently deposited materials are capable of being readily loosened up and put into circulation.

In order to check tendencies towards circular swirl of the entire fluid mass in the zone between the container and the tubular guide, baffle plates 13 may be suitable positioned, a convenient mounting involving for instance channel forms 14 secured to the container walls, and with a baffle plate correspondingly flanged as at 15, such plate may be slid down the channel and into place, to project out into the space between container and tubular guide.

In large size units, it is desirable to make adequate provision for mounting and lubrication of the impeller shaft, and as shown in Fig. 1, this may comprise a stuffing box 16 and a step bearing 17 under the container floor. The bearing box furthermore may be provided with oil inlet and outlet pipes 18, 19, the former leading from a suitable source of oil supply and the latter to a receiver. In this manner, an adequate supply of lubricant to the step bearing may be had under all conditions of usage.

In operation, if it is desired to start with a small amount of material, the telescopic guide is collapsed into its lowest position, the ring sections then nesting closely concentrically at the lower end of the container adjacent the impeller. With the starting material charged into the container, and the impeller in motion, the blades may be set at such pitch as to direct the current flow for example downwardly against the floor of the container, the liquid mass is thus churned and agitated, and with the upper edge of the guide maintained at a spaced distance below the surface of the liquid, a circulatory circuit is had. With an increased amount of liquid under treatment, the tubular guide is raised correspondingly, and by gauging its depth of submergence by reference to the indicator 10, adjustment being had so as to maintain the indicator at the surface of the liquid, the height of the guide may at all times be set to correspond to the amount of liquid to be treated, whether of relatively small amount, or with a container full. As seen, also the churning and agitation proceeds, components which tend to settle out being set into vigorous motion, effecting progressive and thorough intermixture, and the mass circulates as a downwardly directed column inside of the tubular guide, thence impinging with a scouring action on the floor 12 and thence up in the space between the container wall and the tubular guide, and over the top of the latter to the impeller. At the same time, the baffling action of the plates 13 checks circular swirling. One or more arms 11 may be arranged between the tubular section 4c and the container, a convenient form being an extension of the arm of the spider 4′ to engage for instance by a forked end over the plate 13.

Instead of setting the impeller blades to drive the material downwardly, the pitch may be reversed if desired so as to drive the central column upwardly, the material thence flowing downwardly between the tubular guide and the container wall and sweeping over the bottom reenters past the impellers.

Mixtures which ordinarily are difficulty kept in suspension, as for instance cement slurries, pulp mixtures, paint mixtures, etc., are thus readily handled, and by reason of the effective scouring action exerted at the bottom of the container, operations may be suspended if required, and on restarting, material caked at the bottom may be scoured loose and put into uniform admixture. By reason further of the regulable character of the tubular guide, as seen, compositions which include difficultly miscible components and easily miscible components may be readily handled, the difficultly miscible components being put in first, and these being brought to a desired homogeneity, the tubular guide being set for such volume, and with progressive addition of the other constituents, the tubular guide being regulated correspondingly, the entire mass may be brought to final homogeneity. Where desired also continuous-type operation may be as readily had, the components being correspondingly supplied, and draw-off at a bottom outlet being controlled proportionately.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the steps or means stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. A method of agitating liquids, which comprises churning the liquid while moving it in central and peripheral columns in cir-

cuit, and irrespective of the amount of liquid maintaining the separation between central and peripheral portions at substantially constant distances below the surface of the liquid and above the floor of the container for such liquid.

2. A method of agitating liquids, which comprises churning the material while moving it in a central column and a sharply separated peripheral zone with a recurved sweep between, the cross sectional area of the central column and the peripheral zone being substantially equal, and maintaining the separation between central and peripheral portions at substantially constant distances below the surface of the liquid and above the floor of the container for such liquid.

3. In apparatus of the character described, the combination of a container having a recurved floor, an impeller above such floor to propel fluid in the container, and means for equalizing circulation of the propelled fluid, said means including a tubular guide spaced within the container to provide a cross-sectional area within the guide substantially the same as that between the guide and the container.

4. In apparatus of the character described, the combination of an impeller of regulable pitch, a tubular guide, and a container having a floor adjacent the propeller presenting a recurved surface.

5. In apparatus of the character described, the combination of a container, an impeller, a tubular guide, vertical baffles, and means on the container walls to removably hold said baffles.

6. In apparatus of the character described, the combination of a container, an impeller, channel-form supports on the inner wall of said container, and baffle plates having flanges adapted to slide into such channels.

7. In apparatus of the character described, the combination of a container, an impeller at the lower portion thereof, said container having a recurved floor, a tubular guide of a proportion affording a cross sectional area therewithin substantially equal to the cross sectional area between the guide and the container, said guide being supported from the floor of the container at a distance affording substantially the same circulatory section as between the guide and the container wall, and means for maintaining the upper and lower edges of the guide respectively at uniform distances below the surface of the liquid undergoing treatment and above the bottom of such container.

8. In apparatus of the character described, the combination of a container an impeller at the lower portion thereof, a guide comprising a tubular section fixed adjacent the propeller and telescopic sections movable on said fixed section, means for regulating the depth of submergence of the top of such sections, and means for checking rotational swirl between said guide and the container walls.

9. In apparatus of the character described, the combination of a container having a recurved floor, an impeller adjacent thereto, a tubular guide made up of telescopic sections, means for regulating the top of said tubular guide, channel-form supports on said container wall, and baffle plates having flanges adapted to seat in such channels.

Signed by me this 23rd day of February, 1929.

JACOB B. PERKINS.