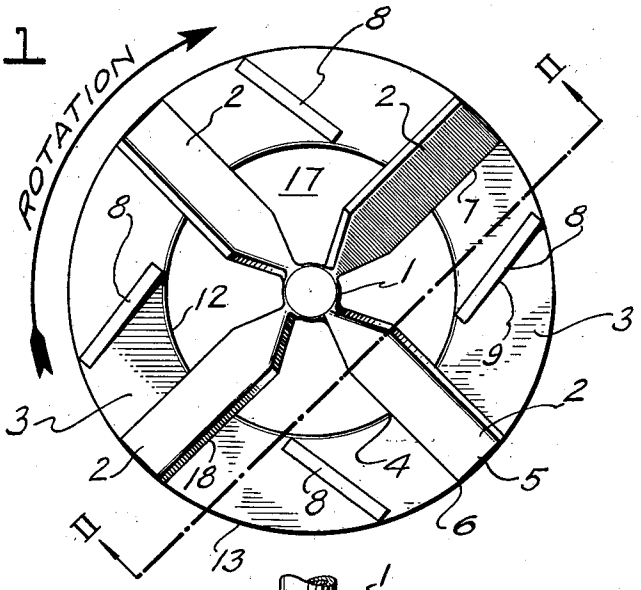
March 18, 1952 F. LAMOREAUX 2,589,558

STIRRER

Filed July 13, 1949

Fig. 1



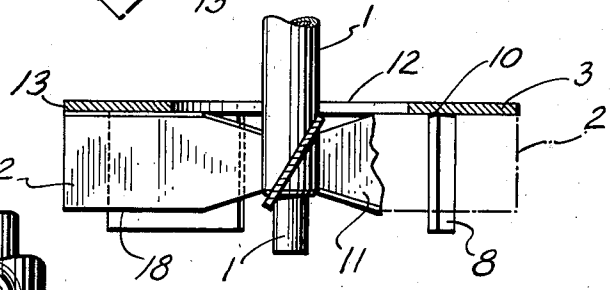


Fig. 2

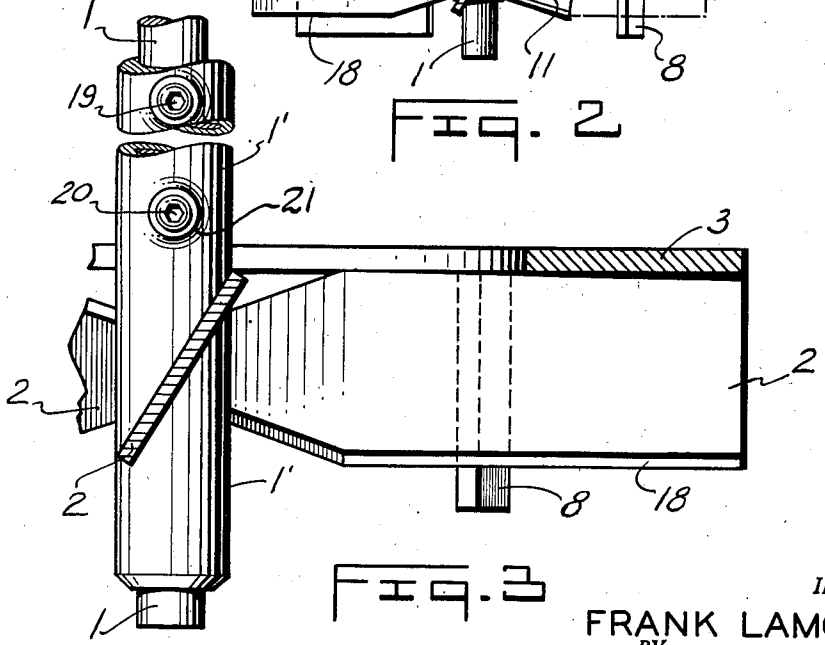


Fig. 3

INVENTOR.
FRANK LAMOREAUX
BY
Peter J. Gaylor
ATTORNEY

Patented Mar. 18, 1952

2,589,558

UNITED STATES PATENT OFFICE

2,589,558

STIRRER

Frank Lamoreaux, Newark, N. J.

Application July 13, 1949, Serial No. 104,459

3 Claims. (Cl. 259—134)

1

This invention deals with an agitator for liquids and more specifically, with an agitator having long agitator blades on which is attached an annular ring on which short blades may be disposed between the long blades.

The invention will be more readily understood by reference to the drawing in which Figure 1 represents a bottom view of a preferred embodiment. Figure 2 shows a cross-sectional side view taken along II—II of Figure 1, while an enlarged partial cross-sectional side view of another modification is illustrated in Figure 3. Similar numerals refer to similar parts in the various figures.

Referring again to the drawing, numeral 1 represents an agitator shaft rotating in a liquid in the direction of the arrow (Fig. 1). Attached radially to the shaft 1 are long blades 2, of which there may be 2, 3, 4, or any desired number, although four or more are preferred, keeping in mind the necessity of minimizing obstruction to liquid flow through the center 17 of ring 3. These long blades extend at right angles from the shaft and are equidistantly spaced. Although any conventional type of blades may be employed, it is preferable and advantageous to employ flat blades having a uniform pitch (preferably about 45°) throughout their effective length, rather than twisted or other types of blades. It will be observed that these long blades are pitched downwardly, with respect to the direction of rotation of the agitator, so that the forward surface of the blades impels most of the liquid downwardly toward the bottom of the container in which the liquid is stored, assuming that the agitator shaft is vertically arranged with respect to the container holding the liquid.

Attached to the upper outer edges ("outer" being considered farther away from the shaft) of long blades 2 is annular ring 3 having a smooth and unbroken upper surface which, as shown, is preferably planar. When blades 2 are rotated in the direction indicated, some slippage occurs, due to static inertia of the liquid being moved, thus forcing some of the liquid upwardly. Annular ring 3 tends to block such slippage, yet it does not impede the flow of liquid downwardly through open central section 17 which results from the rotation of the downwardly pitched blades 2 and, to a lesser extent, to the centrifugal force created. This annular ring 3 may be welded or soldered to the upper edges 7 of the long blades and it may extend outwardly as far as the outer edge 5 or to the farthest part of the straight portion 6 of the blade edge, but not beyond the outwardmost edges of the long blades.

2

Attached to the lower surface 10 of ring 3 are flat short blades 8, each disposed between two long blades and set or raked rearwardly, i. e. the outer edge of each short blade 8 is to the rear of the inner edge, with respect to the direction of rotation, whereby the stream of liquid established by each blade 8 has a relatively high velocity component in a radial direction. The short blades 8 preferably extend from the inner edge 12 to the outer edge 13 of the annular ring 3, and the inner edge of each blade 8 is located approximately midway of the points at which the top edges of the adjacent long blades 2 meet the inner edge 12 of ring 3. The inner edges of the blades 8 are preferably displaced rearwardly, with respect to the direction of rotation, from mid-position between the upper edges of the blades 2 by a small angle which may be, as shown in Fig. 1, about 10°. Each short blade 8 is thus positioned closer to the long blade 2 which follows it, in the direction of rotation, than the preceding blade 2, and is approximately parallel to the forward edge of the following blade 2 but preferably, as shown in Fig. 1, the outer edges of the blades 8 are closer to the following blades 2 than their inner edges, thus throttling radial flow of the liquid streams established by the blades 2 and limiting the direction of such streams primarily to a downward and tangential direction. The short blades 8 are preferably of such height, measured parallel to the shaft 1, to extend downwardly at least to the plane of the lower edges 18 of the blades 2, and preferably below this plane to the extent of about one-fifth of the vertical height of the short blade. The rearward rake of the short blades 8 forces streams of liquid outwardly from the agitator with a high radial component of velocity, and the flow of liquid through the central opening or eye 17 of the annular plate 3 is in greater volume and at higher velocity than could be established by only the long blades 2.

It is preferred to employ long blades having a pitch of about 45° with respect to the ring, and the short blades are preferably disposed at an angle of about 45°, more or less, with the median line between long blade centers. Annular ring 3 is mounted on long blades 2 so that inner edge 12 is roughly between the half-length and two-thirds of the length of the long blades, away from the center of the shaft and the agitator preferably has a diameter about ⅓ to ½ of the diameter of the vessel in which it is mounted, so as to provide space beyond the tips of long blades 2 for liquid thrown from the blades, and to allow for recirculation of liquid from the bottom, back

to the upper section of the vessel, and back through center feed area 17.

As shown in Figure 3, long blades 2 may be attached to a hub 1' provided with threaded holes 19 in which may be disposed set screws 20 screwed into threaded holes made in boss 21 built up in the vicinity of the set screw. Shaft 1 is then inserted inside hollow hub 1' and screws 20 are tightened so as to keep hub 1' and the blades attached thereto securely mounted on shaft 1, and making them readily demountable for repairs or replacement.

It is desirable to employ straight short blades 8 rather than curved ones and the upper surface of ring 3 should be unimpeded. It is also important that the flow of liquid below long blades 2 be unimpeded in the vicinity of said blades.

It is preferred to employ a ring 3 which has flat upper and lower surfaces, although it is possible to use a ring having a flat bottom surface, the upper surface being triangular, semicircular, or the like, the shape being such as to not impede the flow of liquid over ring 3.

The combination of downwardly pitched and of rearwardly raked blades has been found to create an exceedingly heavy flow of liquid along the lower surface of the annular plate 3 which provides a very effective means for drawing in liquid through annular space 17 for agitation without need of additional blades to be mounted at higher points on the shaft. The rotation, suction, centrifugal force and liquid momentum, when imposed upon the liquid in proper sequence according to the present invention, induce the same effect as a tornado on a small scale.

Among the advantages which can be claimed for the agitator of the present invention is the important feature of keeping clean the corners and other "dead"spots at the bottom of the tank in which the liquid is agitated, thus eliminating need for labor to effect occasional stirring of such locations in order to keep them clean. This marked agitating effect is presently believed to result from the development, by the alternately arranged downwardly impelling blades and outwardly impelling blades, of adjacent streams or currents having different radial and vertical components of direction and velocity.

By means of this invention, it is possible to make a light but substantially effective and highly efficient agitator from plain, easily cut shapes which can be fabricated in the average machine shop or plant repair shop. Such an agitator is self-contained and needs no additional propellers or auxiliary equipment above or below the blades. Also, it can be run at either high or low speeds in nearly empty containers without splashing. It may be used in small laboratory beakers or huge industrial vats and will handle light or heavy liquids, pastes and adhesive compositions.

The agitator of the present invention may be fabricated from stainless steel, cast iron, brass, bronze, or any other metal, wood, plastic, ceramic, rubber, or other material possessing sufficient rigidity.

In the present invention, the long blades and the short blades provide a combined angle of about 80° which is all that is required to give the liquid approximately a 90° turn in order to sweep the tank bottom and clean out "dead" spaces in the bottom of the container.

Both the short blades and the ring may be made of thinner stock than the long blades.

It has been found that the agitator of the present invention may be employed for aeration of the liquid, air being introduced into the mixing zone by means of an air line, so that air may be sucked into the mixing stream. Aeration is reduced when the agitator is used in a vertical position and increased when it is employed angularly.

I claim:

1. In an agitator for liquids and suspensions of solids in liquids, a shaft, a plurality of circumferentially spaced long blades secured to and extending substantially radially of said shaft, said blades being flat and each with its upper edge in advance of its lower edge as viewed with respect to the direction of shaft rotation, thereby to impel liquid downwardly, means consisting of a single flat annular plate secured to the upper edges of said blades and coaxial with said shaft determining the paths of the liquid sub-streams established by the respective long blades, the inner diameter of said annular plate being between one-half and two-thirds of its outer diameter and the upper surface of said annular plate being smooth and unbroken, and a second set of flat blades of relatively short length secured to the lower surface of said annular plate and raked rearwardly, thereby to impart a relatively high radially outward velocity to the sub-streams established by said relatively short blades; the outer ends of all of said blades terminating substantially at the outer edge of said annular plate, the inner edges of said relatively short blades terminating substantially at the inner edge of said annular plate, and there being at least one short blade between each adjacent pair of long blades.

2. In an agitator, the invention as recited in claim 1, wherein the blades of one set alternate with blades of the other set, and the inner edge of each blade of said second set is located approximately midway between the upper edges of the adjacent long blades.

3. In an agitator, the invention as recited in claim 1, wherein the blades of said second set have a length, measured parallel to the axis of said shaft, to extend below the lower edges of said long blades.

FRANK LAMOREAUX.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
352,991	Hanson	Nov. 23, 1886
436,015	Currier et al.	Sept. 9, 1890
492,475	Smith	Feb. 28, 1893
1,354,489	Johnson	Oct. 5, 1920
1,756,236	Beers	Apr. 29, 1930
2,258,830	Vollrath	Oct. 14, 1941

FOREIGN PATENTS

Number	Country	Date
517,797	Great Britain	Feb. 8, 1940