

Dec. 17, 1957

C. J. PENTHER
JET IMPELLER MIXER
Filed July 16, 1954

2,816,744

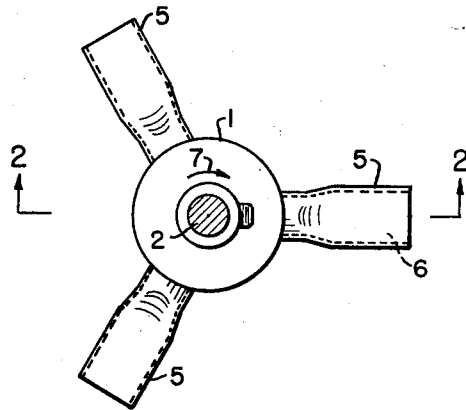


FIG. 1

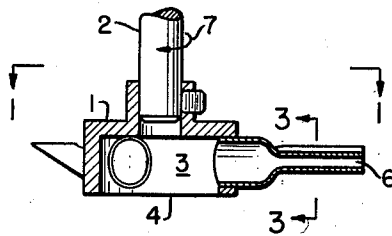


FIG. 2



FIG. 3

INVENTOR:

CARL J. PENTHER

BY:

Oswald H. Milmore

HIS ATTORNEY

1

2,816,744

JET IMPELLER MIXER

Carl J. Penther, Oakland, Calif., assignor to Shell Development Company, New York, N. Y., a corporation of Delaware

Application July 16, 1954, Serial No. 443,744

1 Claim. (Cl. 259—134)

This invention relates to an agitator designed primarily to be immersed in a body of fluid to mix the diverse parts thereof. It finds especial application to stirring liquids, such as temperature baths, wherein it is desired to maintain a highly uniform temperature throughout the liquid, but is also applicable to distributing solids such as powders throughout a liquid or to bringing together different liquids, etc.

Various paddles, screw-propellers, radial impellers, and the like have been used for stirring laboratory thermostats and for other mixing applications. Their effectiveness as measured, for example, by the difference in temperature between spaced points in the body of liquid, has been limited at moderate speeds while operation at high speeds is undesirable because of vortex formation, apart from a waste of energy.

It is an object of the invention to provide an improved rotatable mixing device wherein the fluid currents generated by rotation of the device are more advantageously directed to attain improved mixing efficiencies. A specific object is to provide a rotatable mixing device wherein liquid is propelled both parallel to the axis of rotation and transversely to said axis, whereby the tendency toward vortex formation is greatly reduced.

In summary, the device according to the invention includes a hollow hub mounted on a vertical rotatable shaft, the hub providing a fluid chamber open at one vertical extremity, e. g., at the bottom to provide a fluid inlet, a plurality of screw blades that impart to the surrounding fluid a movement parallel to the axis, and duct means, preferably formed by the blades themselves, providing passages that receive fluid from said fluid chamber and discharge it outwards to provide fluid jets.

The invention will be described further with reference to the accompanying drawing forming a part of this specification and showing one preferred embodiment, wherein:

Figure 1 is a section view taken on the horizontal section line 1—1 of Figure 2 and showing the impeller mixer;

Figure 2 is a section view taken on the vertical section line 2—2 of Figure 1; and

Figure 3 is a transverse section view through one of the blades, taken on the line 3—3 of Figure 2.

Referring to the drawings in detail, the apparatus includes a central hollow hub 1 that is supported from a vertical shaft 2 for rotation therewith at high speed, the shaft being suitably mounted by a bearing and connected to a pulley or coupled directly to an electric motor, not shown. The hub is hollow to provide a fluid chamber 3 and open at the bottom to provide a liquid inlet 4, but closed at the top by the upper wall of the hub and the end of the shaft 2. A plurality of screw blades 5 is

2

fitted into the annular wall of the hub at radial ports therein at uniform intervals, as shown. Each blade is advantageously formed of tubular material providing a passage 6 that is open at both ends, the inner end being in communication with the chamber 3 and the outer end providing a fluid outlet directed generally outwards from the hub. The outer portion of each tube is flattened at an inclination to the horizontal to shape them as screw blades adapted to impart motion to liquid in a direction parallel to the axis of the shaft 2 upon rotation.

In operation, the device is immersed within a body of fluid, e. g., a constant temperature water bath containing a thermostat and heating element, or a tank in which a liquid is mixed with another liquid or with solids, etc., and the shaft 2 is rotated in the direction of the arrow 7 such as to cause the surrounding liquid to move upwards, parallel to the shaft. Rotation causes additional liquid to enter the chamber 3 through the inlet 4 and to be ejected radially from the open ends of the passages 6. The resultant flow pattern is such that fluid near the bottom of the receptacle is rapidly raised and impelled in part toward the top of the liquid body and in part jetted laterally at an intermediate level, setting up thereby two distinct cycles of travel that promote efficient mixing. The tendency toward formation of a vortex at the liquid surface in the vicinity of the shaft from the rotation of the liquid is largely overcome by such a flow pattern.

By way of example, a device constructed as shown in the drawing, having a hub $1\frac{1}{16}$ in. in diameter, blades extending 1 in. beyond the hub made of $\frac{3}{8}$ in. O. D. brass tubing flattened on a plane 20° to the horizontal to a $\frac{1}{8}$ in. external blade thickness, absorbed the full load of a $\frac{1}{80}$ H. P., 1570 R. P. M. shaded pole motor. Operation of this device in a tank 15 in. in diameter by 30 in. high, holding 17 gallons of water and containing heating and heat-absorptive surfaces resulted in a very high degree of uniformity, so that the temperature throughout the tank varied less than 0.004° F.

I claim as my invention:

A jet impeller mixer adapted for immersion in a body of liquid including a vertical supporting shaft adapted for high speed rotation; a hollow hub on said shaft connected for rotation therewith and including a fluid chamber that is closed at the top and freely open at the bottom to provide a liquid inlet communicating with said body of liquid; and a plurality of substantially radial tubular screw-impeller blades on said hub, each of said blades containing a fluid passage in flow communication with said fluid chamber at one end and open at the other end to provide a liquid outlet, and said tubular blades being flattened at an inclination to the horizontal for inducing in said body of liquid currents that move in a common vertical direction.

References Cited in the file of this patent

UNITED STATES PATENTS

950,152	Gaar	Feb. 22, 1910
1,074,043	Breuer	Sept. 23, 1913
1,579,355	Greenawalt	Apr. 6, 1926
1,604,994	Grosso et al.	Nov. 2, 1926
1,645,614	Monahan	Oct. 18, 1927

FOREIGN PATENTS

4,260	Great Britain	of 1894
1,031,150	France	Mar. 18, 1953