(No Model.)

E. R. GABBETT.

APPARATUS FOR MIXING LIQUIDS.

No. 444,345. Patented Jan. 6, 1891.

Fig. 1.

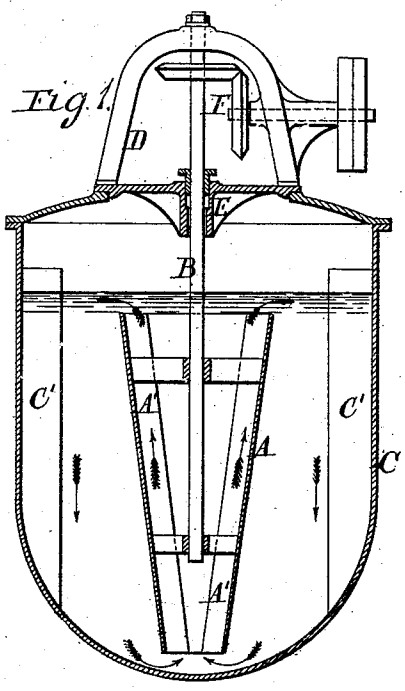


Fig. 9.

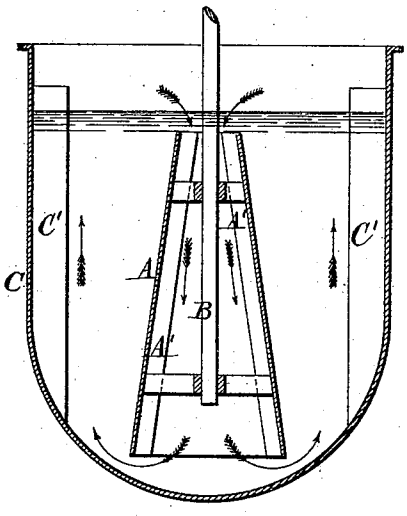


Fig. 2.

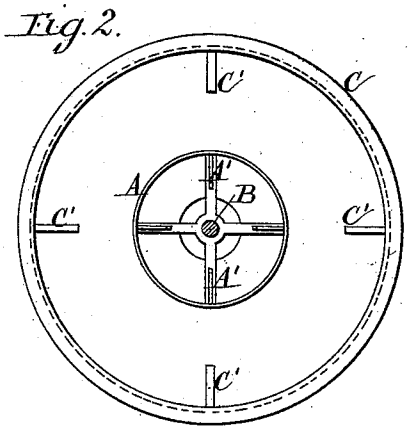


Fig. 3.

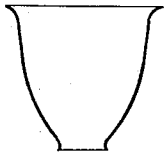


Fig. 4.

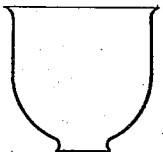


Fig. 5.

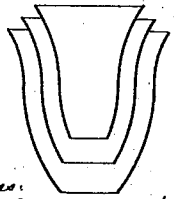


Fig. 6.

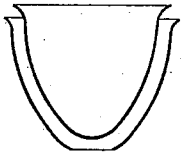


Fig. 7.

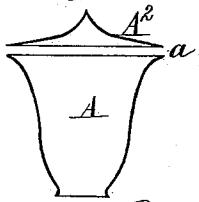
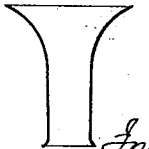


Fig. 8.



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By James L. Norris.
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EDMOND R. GABBETT, OF OLD CHARLTON, ASSIGNOR OF ONE-HALF TO SAMUEL BAGSTER BOULTON, THOMAS BURT HAYWOOD, AND HAROLD EDWIN BOULTON, ALL OF LONDON, ENGLAND.

APPARATUS FOR MIXING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 444,345, dated January 6, 1891.

Application filed July 23, 1890. Serial No. 359 670. (No model.) Patented in England January 16, 1889, No. 840; in Belgium August 17, 1889, No. 87,411, and in France August 12, 1889, No. 200,153.

To all whom it may concern:

Be it known that I, EDMOND RICH GABBETT, a citizen of England, residing at Old Charlton, in the county of Kent, England, have invented new and useful Improvements in Apparatus for Mixing, Incorporating, or Effecting the Circulation of Liquids and Semi-Liquids in Vessels, (for which patents have been obtained in Great Britain dated January 16, 1889, No. 840; in Belgium dated August 17, 1899, No. 87,411, and in France dated August 12, 1889, No. 200,153,) of which the following is a specification.

According to this invention I effect the mixing or incorporation of liquids or semi-liquids or the circulation of a liquid within a caldron or tank by the action of centrifugal force upon part of such liquid or liquids in such manner that a body of liquid is thereby continuously withdrawn from the bottom and delivered at the top, or vice versa, thus producing a continuously ascending or descending column of fluid within the apparatus and a corresponding movement in the contrary direction in the body of liquid outside the apparatus. By thus effecting the mixing or circulation of the liquid entirely by centrifugal action, I avoid in a great measure the loss of power due to the friction of mechanical devices moving in the liquid, such as occur in apparatus with helical propelling-blades and the like, heretofore employed.

The apparatus may be constructed in various ways for operating according to my invention. Thus, according to one arrangement I employ a shell of a conical, conoidal, paraboloidal, hemispherical, or trumpet-mouthed shape, fitted, if necessary, with internal ribs and immersed in a vertical position in the liquid, and having both its upper and lower ends open, the end of larger diameter being situated at top if the circulation is to be in an upward direction through it and at bottom if a downward circulation is required. The shell is fixed by suitable arms to a central strap carried in bearings above the caldron or vat, so that when more or less rapid rotary motion is imparted to it, and consequently to the body of liquid situated within it, the centrifugal force will act in the well-known manner upon such body of liquid, causing it to rise up on the inner wall of the shell and to flow over the upper edge, then into the body of liquid surrounding it, while at the same time fresh liquid will enter the lower end of the shell to replace that which is ejected at top.

The invention is applied in the manufacture of tar products, in sugar-refining, chemical works, distilleries, soap-works, treating ore for the extraction of gold, and for all purposes where liquids and solids require to be brought into intimate contact, or where a constant circulation of liquids is required.

The invention is illustrated by the accompanying drawings, in which—

Figure 1 shows a vertical section of one form of the above-described apparatus, and Fig. 2 shows a plan. Figs. 3 to 8 show modified forms of the shell. Fig. 9 shows an inverted arrangement thereof.

A is a conical shell, having internal ribs A^2 and mounted on a shaft B, by which it is suspended within the vessel or tank C, containing the liquid to be acted upon, the shaft being carried at its upper end by a bracket D and guided by a bush or stuffing-box E on the cover of the vessel C. Assuming this vessel to be charged with liquid to the level indicated and the shell A to be rotated by suitable gearing, such as indicated at F, then the body of liquid within the shell being carried round with the same by means of the ribs A′ the centrifugal force will cause the liquid to rise along the inclined inner surface of the shell and to be ejected into the surrounding liquid when arriving at the upper edge thereof, while at the same time the pressure of the surrounding column of liquid in the vessel C will cause fresh quantities of liquid to enter the lower end of the shell A to make good the quantity discharged at the top. Thus

a continuous circulation and consequent mixing of the liquid will be effected, as indicated by the arrows.

To prevent the carrying round of the body of liquid in the vessel C by its frictional contact with the outer surface of the shell A the vessel may be provided with projecting ribs C′, as shown. This is, however, not absolutely necessary, and such rotation of the liquid may to some extent be prevented by making the vessel C rectangular instead of circular, as shown, or by arranging a set of two or more revolving shells such as A in the vessel, either grouped round a central driving-shaft or arranged in a row; also, instead of rotating the shell or shells A continuously in one and the same direction they may have their direction of rotation reversed after any desired intervals of time. This might be effected by applying two driving-pulleys carrying, respectively, an open and a crossed strap, which are shifted alternately onto a loose pulley, as is well understood. The circulation of the liquid can also be made to take place in the contrary direction to that described by inverting the position of the shell A, so that the centrifugal action will cause the liquid within it to travel in a downward direction, as shown at Fig. 9. The shell A may also, if desired, have an oscillating motion imparted to it, so as to move continuously or intermittently with its lower end to different parts of the vessel C, and thus cause the liquid to be drawn consecutively from such different parts. This might be effected by connecting the lower part of the shaft B, carrying the shell, to the upper part running in fixed bearings by a universal joint and imparting the described motion to and fro thereto by a crank, cam, or eccentric, and connecting-rod or by other suitable means. The shell A may be made to extend above the level of the liquid instead of being entirely immersed, as indicated.

Figs. 3 to 8 show diagram sections of various other forms which may be adopted for the revolving shell. Fig. 3 shows a paraboloidal shape; Fig. 4, a construction with hemispherical lower part and cylindrical upper part, the centrifugal action which drives the fluid upward being confined to the lower part. Fig. 5 shows an arrangement in which there are two or more concentric shells, on each of which a body of liquid will be made to ascend by centrifugal action, or there may be only two concentric shells, as at Fig. 6, forming a narrow annular space in which the liquid ascends, there being no opening in the inner shell. If the shell has its upper end immersed to a considerable extent below the liquid level the arrangement shown at Fig. 7 may be adopted, in which the top of the shell A is covered by a shield A^2, leaving a narrow annular orifice at *a* for the issue of the liquid. By this means the pressure of the column of liquid which would otherwise exist in the center of the shell is prevented from interfering with the centrifugal action. Fig. 8 shows a construction in which the lower part of the shell is made cylindrical, while the upper part is made trumpet-mouthed, the centrifugal action being in this case confined to the upper part, or the entire shell might be made of a trumpet-mouth shape.

If found advantageous to lessen the weight or load on the bearings of the shaft by which the shell is revolved, this can be effected by having an air-tight chamber connected to the shell or shaft. Thus, for instance, the shield A^2, (shown in Fig. 7,) being made hollow, will by its flotation partly carry the weight of the shell, &c., or in that of Fig. 6 if the inner vessel is covered and rendered air-tight the same purpose will be attained.

Although it is preferred to impart the necessary rotary motion to the shell by gearing, as described, yet it will be evident that other means might be employed, such as a turbine fitted on the shaft of the shell and driven by steam or other fluid.

The above-described invention is applicable with particular advantage in cases where the material to be acted upon requires to be maintained at a comparatively high temperature in order to maintain it in a liquid condition, as in such cases the employment of an ordinary circulating-pump within the vessel or caldron would be subject to considerable difficulties.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. An apparatus for mixing or circulating liquids, consisting of a closed tank or vessel for containing the liquid, a rotating conically-shaped shell secured to and suspended by a shaft vertically in the liquid and having upper and lower open ends of different diameters, through the interior of which shell the liquid is caused by centrifugal force to flow in one direction, while the liquid exterior of the shell is caused to flow in a reverse direction, and means for rotating the shell and causing such continuous circulation of the liquid within the tank or vessel and through the shell, substantially as described.

2. An apparatus for mixing or circulating liquids, consisting of a tank or vessel for containing the liquid, a rotating conically-shaped shell having a series of internal ribs immersed and suspended by a shaft vertically in the liquid and having upper and lower open ends of different diameters, and means for rotating the shell and causing a continuous circulation of the liquid within the tank and through the shell, substantially as described.

3. An apparatus for mixing or circulating liquids, consisting of a closed tank or caldron having on its internal surface a series of projecting ribs, the rotating conically-shaped

shell immersed and suspended by a shaft vertically in the liquid, provided on its internal surface with a series of ribs and having upper and lower open ends of different diameters, and means for rotating the shell and causing a continuous circulation of the liquid within the tank and through the shell, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 11th day of July, A. D. 1890.

EDMOND R. GABBETT.

Witnesses:
CHAS. D. ABEL,
JNO. P. M. MILLARD.