United States Patent

[11] 3,559,964

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[21] Appl. No. **788,477**
[22] Filed **Jan. 2, 1969**
[45] Patented **Feb. 2, 1971**

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[32] Priority **Jan. 4, 1968**
[33] **Germany**
[31] **1,632,423**

[54] **DEVICE FOR MECHANICAL GASIFICATION OF LIQUIDS**
3 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **261/91**
[51] **Int. Cl.** **B01f 3/04**
[50] **Field of Search** 261/91, 93

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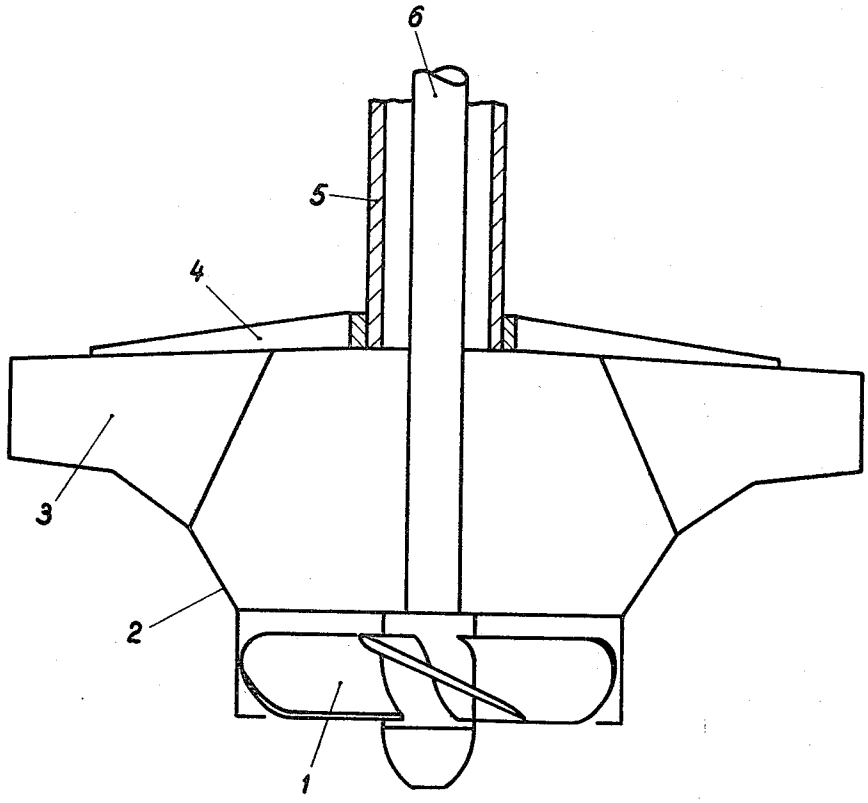
ABSTRACT: A device for the gasification of liquids comprising a radially effective rotatable conveyor disposed on the liquid surface and an axially operating rotatable conveyor within the inlet mouth of the radially effective conveyor, the conveyors being separate from each other and independently driven so that one may be driven at a different rate of speed than the other. The radial conveyor is formed in part with hollow walls which are in connection with the gas phase through apertures in one face wall. In the rotor channel are disposed baffled openings through which gas may be sucked into the liquid.



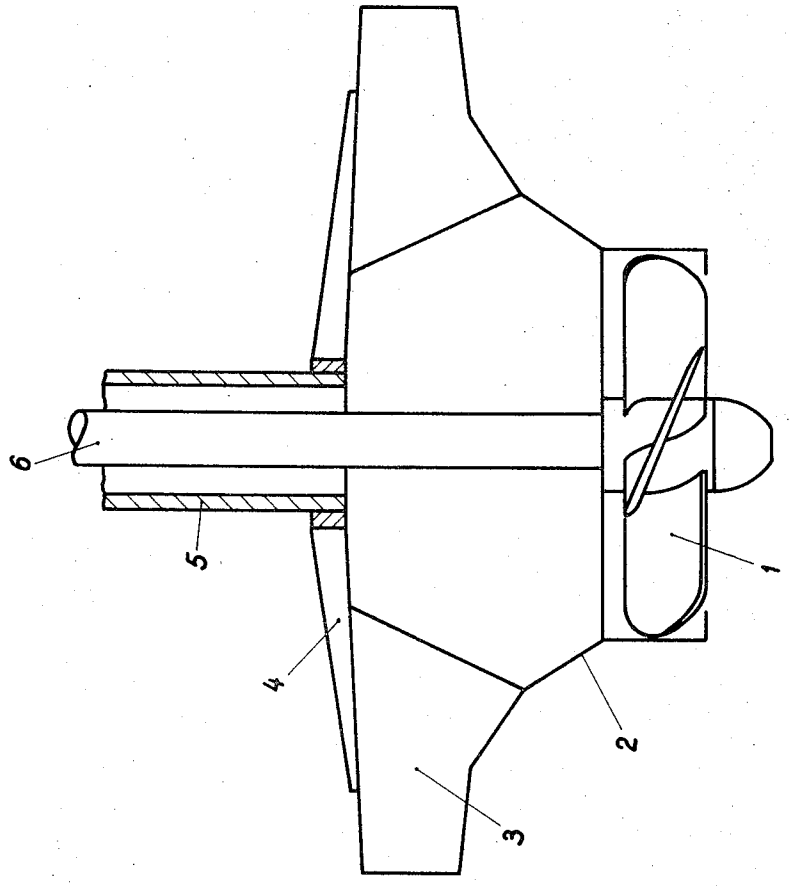


FIG. 1

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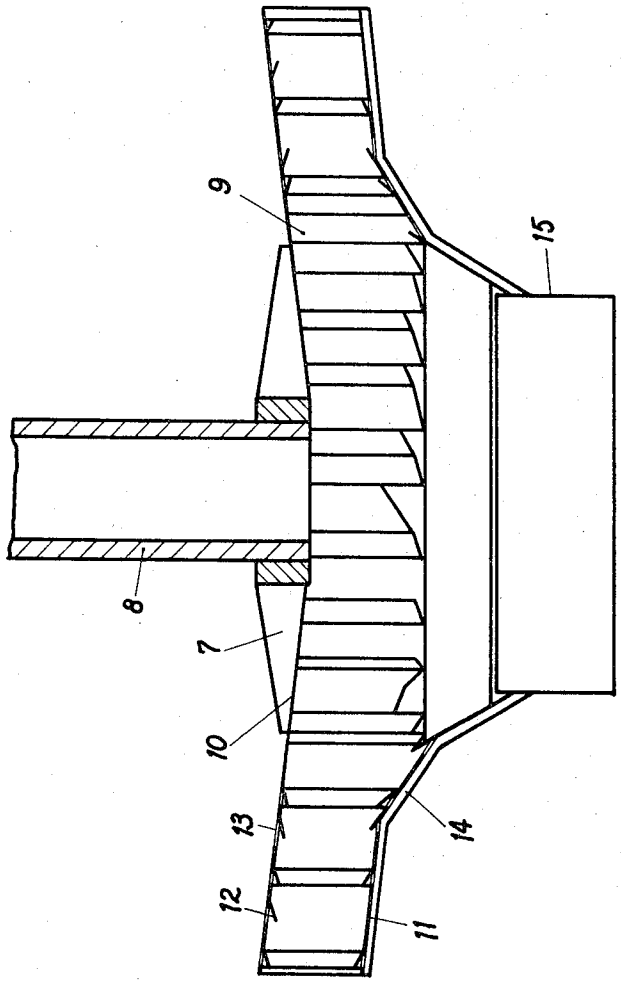

FIG. 2

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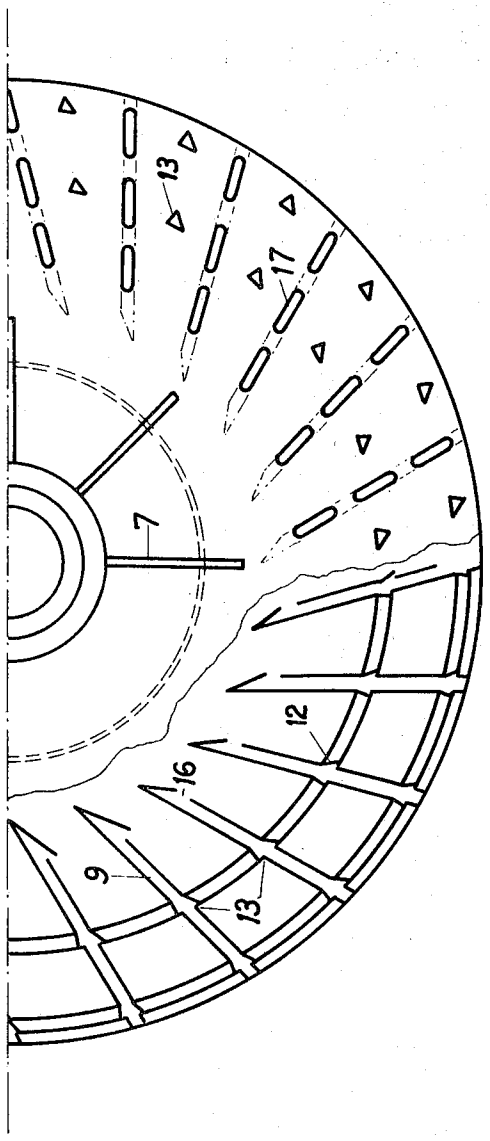

FIG. 3

FIG. 4

FIG. 5

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DEVICE FOR MECHANICAL GASIFICATION OF LIQUIDS

BACKGROUND OF THE INVENTION

Numerous recommendations have been made to convey the liquids to be gasified through radially operating pump rotors and there to bring them through the most turbulent flow possible in intensive contact with the gas phase. For this purpose the radially acting pump rotor is disposed above the liquid level, so that the liquid centrifuged or flung outwardly draws the gas with it. The impingement or impact of the gas-liquid mixture produces a strong movement in the surface and additional insertion of gas, whereby the material exchange is further increased. At the same time, the rotor blades are constructed in such manner as to enhance the turbulence.

With the great quantities of feed aimed at and the circumferential speed determined by experience, there result for aeration devices of this type large inlet diameters and the rotor blades must be pulled far into the suction mouth and curved helically or spirally. The large total diameter thus resulting diminishes the degree of effectiveness, as the losses in yield increase proportionately $n^3 \times D^5$ (n=number of revolutions, D = diameter). Also a lack of doubly-curved blades reduces still further the efficiency, particularly if the radially acting pump rotor than is immersed only little in the liquid. It is, however, more advantageous for the material exchange to move the aeration device above the liquid level, particularly with strongly foaming liquids. A further reduction of the degree of effectiveness results through the form of the radially operating driver or rotor part which is unfavorable for flow characteristics.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatic elevation of a gasification device embodying an axially operating conveyor and a radially operating conveyor;

FIG. **2** is a diagrammatic view in axial section of a radially operating conveyor;

FIG. **3** is a diagrammatic view partly in plan and partly in horizontal section of another form of a radially operating conveyor; and

FIGS. **4** and **5** are fragmentary views of baffles.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The surface aerator, as shown on FIG. **1**, is divided into an axially operating conveyor or feed member **1** and a radially acting feed member **3**, whereby the axially acting feed member **1** is driven by means of a shaft **6** disposed in a tubular shaft **5** of the radially acting feed member **3**. The axially acting part consists of a propeller, which pumps large quantities with low delivery or pressure heads.

The radial blades of the member **3** are surrounded on their lower side by a sleeve **2**, and on their upper side are held by means of sheet metal members **4**. In this embodiment, only the axially effective feed member **1** is required to be immersed in the liquid.

On account of the higher speed of flow, the inlet diameter may be held correspondingly smaller. By means of this advantage, the entire dimension of the aeration device may be decreased. With the same circumferential speed there result less losses in yield at higher rates of rotation. As fluid from the axial pump **1** readily strikes the blades of the radial part **3**, the degree of effectiveness of the device is dependent in less measure on the peak of performance than with the previously known systems.

By means of the separate drives, the two conveyor members **1** and **3** operate at the rate of rotation most favorable at the time. The propeller of the member **1** is a high-speed engine, while the subsequent radial driver or rotor or the member **3** is

a medium or average driver or rotor, in order to impart to the liquid conveyed a high outlet speed. The motion may take place by means of a drive with double outflow (hollow or tubular shaft). A control of the material exchange is possible by means of the change in the rate of rotation and the surfacing height of the members, as well as through exchange of the direction of rotation of the radial conveyor **3**.

This aeration device insures with the same expenditure of energy the conveyance of a greater supply of fluid on the surface and the disposition of the radial part further above the liquid level.

FIG. **2** shows diagrammatically an axial section of a radial rotor in which a hollow or tubular shaft **8** which drives the radial rotor, is rigidly connected to rotor blades **9** by radial rigidifying sheet metal members **7**. The rotor blades **9** are surrounded respectively on their upper side and on their lower side by covering sheet metal members **10** and **11**. With these covering sheet metal members **10** and **11**, the rotor blades **9** form flow channels, in which baffle plates **12** diverted in the direction of flow are disposed in the flow stream. Adjacent the baffle plates are apertures **13**, through which gas may be sucked up from the flow into the liquid. At the upper edges the hollow rotor blades are connected through the suction openings **17** with the gas phase. Other forms of baffle plates are shown on FIGS. **4** and **5**. A lower sheet metal causing **14** is double walled as well as the rotor blades. In this way, gas may be sucked up from the lower side of the flow channels into the liquid stream. The lower sheet metal casing member **14** extends downwardly to a stabilization ring **15**. By means of baffle plates **12** on the blade walls, the flow of liquid produces an under pressure or vacuum, through which gas may be sucked through the apertures out of the cavity.

There is no need for baffle plates at the places at which water flows through the rotor channels, since an underpressure or vacuum is already present. At these places, as indicated on FIG. **3**, by means of apertures **16**, gas may be sucked up through the natural underpressure or vacuum out of the rotor blades into the liquid. These radial rotors may also be driven without a second axially effective rotor part on the inlet side of the liquid. The radial rotor must then in any case be immersed correspondingly deeply in the liquid.

Upon proceeding with great peaks of surfacing, as is insured by the described combination of axial and radial steps, a double walled embodiment of the lower cover disc may be omitted, as the gas phase has direct access hereto.

I claim:

1. Device for gasification of liquids comprising a radially effective rotatable conveyor provided with an upper and a lower cover plate, an axially effective rotatable conveyor having propellerlike blades, a stabilization ring surrounding and spaced from said axially effective conveyor, said lower plate of said radially effective conveyor extending downwardly to said stabilization ring, a vertically disposed tubular driving shaft for said radially effective conveyor, and a driving shaft for said axially effective conveyor disposed within said tubular shaft.

2. Device for gasification of liquids as claimed in claim **1**, comprising means for driving the shaft of the radially effective conveyor and the shaft of the axially effective conveyor at speeds according to the specific coefficient for speed of the radially effective and axially effective conveyors.

3. Device for gasification of liquids as claimed in claim **1**, in which the upper cover plate of the radially effective conveyor is provided with openings, the lower cover plate and the blades of said conveyor being of hollow construction and the hollow spaces being in communication, said hollow blades being arranged to the openings in the upper cover plate and the hollow spaces thereof being in open communication to the atmosphere, and there being openings in the blades and the innerside of the lower cover plate to the channels through which openings gas may be sucked into the liquid.