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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
16 June 2016 (16.06.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/092579 A1

(51) International Patent Classification:
B01F 5/10 (2006.01)

(21) International Application Number:
PCT/IT2015/000299

(22) International Filing Date:
9 December 2015 (09.12.2015)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
MI2014A002103 9 December 2014 (09.12.2014) IT

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

[Continued on next page]

(54) **Title**: METHOD AND DEVICE FOR THE HOMOGENEOUS AND DELIMITED MIXING OF FLUIDS

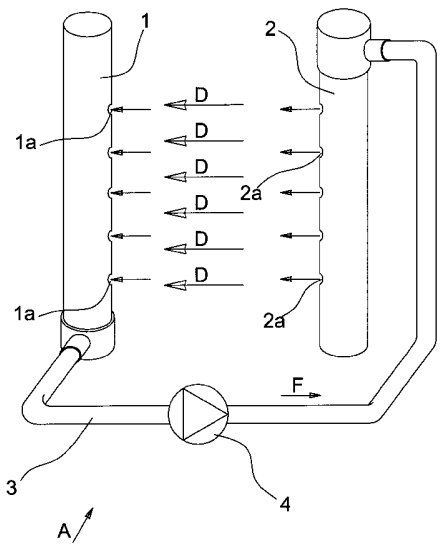

Fig. 1

(57) **Abstract**: Device and Method for the homogeneous and delimited mixing of fluids, both liquid and gaseous, forming part of a fluid mass in motion or in state of rest. The method comprises: • taking part of the material from said fluid mass; • making a vigorous mixing of the fluid material taken; • reinserting the fluid mixed material into said fluid mass; The device (A, B) comprises: •. a first manifold (1, 10), closed at both ends, on which a first plurality of holes (la, 10a) is made, aligned along a generatrix of said first manifold (1,10); •. a second manifold (2, 20), closed at both ends, on which it is made a second plurality of holes (2a, 20a) aligned along a generatrix of said second manifold (2, 20); • · a pipe (3, 3a) that connects said first manifold (1, 10) with said second manifold (2, 20); • · pumping means (4), inserted in said pipe (3, 3a), which cause a movement of a fluid contained in said pipe (3, 3a) by said first manifold (1, 10) towards said second manifold (2, 20);

WO 2016/092579 A1

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

METHOD AND DEVICE FOR THE HOMOGENEOUS AND DELIMITED MIXING OF FLUIDS

DESCRIPTION

This invention refers to a method and to a device for the implementation of said method, for the homogeneous and delimited mixing of fluids, both liquid and gaseous, forming part of a fluid mass in motion or in state of rest, and to a device for the implementation of said method.

It is strongly felt the need to have systems to mix liquid and/or gaseous phases, in various industrial processes, particularly functional to obtain and/or accelerate the production processes or services such as, but not limited to, fermentation, chemical reactions, homogenization and maintenance in suspension. Existing technologies employ various principles of technical physics and chemistry, using articulated installation structures, by resorting to mechanical actions, generally by propellers or blades, in which they are generated vortical motions that, by setting in motion the fluid mass and in interaction the different components, generate the mixing and the suitable homogenization to allow the biological and/or chemical expected processes, but frustrate much of the action imparted by the pushing mechanism with an evident dissipation of the used energy. The devices currently available remedy to this problem by means of complex geometries of "break-vortexes" and/or distributing the motion mechanism in different points of the fluid mass, increasing the plant costs. In other processes, it is necessary to isolate the mixing space in specific volumes, reducing to a minimum the dispersion in neighbouring zones. Also in this case the problem is solved by the use of complicated and expensive systems to stem harmful effects, as vortical and stationary motions. These problems pervade many sectors such as the municipal wastewater treatment plants, the plants for the anaerobic digestion or the microalgae crops. A combination that is not obtainable with the devices currently available is the mixing and simultaneous thrust of a fluid mass with a homogeneous movement and according to a specific plane. This invention constitutes an innovation with respect to the current state of the art, allowing to

overcome these problems in a simple and economical way.

In summary, in the current state it is not possible to mix a delimited part of a fluid mass, without disturbing the surrounding fluid mass.

The object of this invention is to propose a method and a device for the implementation of said method, respectively conform to claims 1 and 4, for the homogeneous and delimited mixing of fluids, both liquid and gaseous.

The method is characterized by:

- taking part of the material from said fluid mass;
- making a vigorous mixing of the fluid material taken;
- reinserting the fluid mixed material into said fluid mass;

said taking and reinsertion causing a flow (D,D1) in said fluid mass.

The device is characterized in that it comprises:

- a first manifold, closed at both ends, on which a first plurality of holes is made, aligned along a generatrix of said first manifold;
- a second manifold, closed at both ends, on which it is made a second plurality of holes aligned along a generatrix of said second manifold;
- a pipe that connects said first manifold with said second manifold;
- pumping means, inserted in said pipe, which cause a movement of a fluid contained in said pipe by said first manifold towards said second manifold;

said first and second manifold being inserted in said fluid mass from which said fluid material is taken and reinserted creating a flow (D,D1) in said fluid mass, said stream (D, D1) being contiguous to said device (A, B).

Other characteristics, such as for example the relative positioning of said first perforated manifold dedicated to the taking and of said second perforated manifold dedicated to the inlet, will be the subject of the dependent claims.

The use of a device according to the invention allows, for example:

- to support the delimited mixing level to hydrolytic portion in the anaerobic digestion;
- to support a gentle excitation to avoid sedimentation phenomena (e.g. microalgae);

• in wastewater conditioners where it is necessary to set in motion a delimited zone and to leave stationary the others.

The invention will now be described for illustrative and not limitative purposes, according to a preferred embodiment and with reference to the accompanying drawings, wherein:

- Figure 1 shows a possible embodiment of the device according to the invention;

- Figure 2 shows a variant of the device according to the invention.

With reference to figure 1, with (A) it is indicated a device according to the invention. Said device (A) includes:

• a first manifold (1), preferably tubular, closed at both ends, on which it is made a first plurality of holes (1a) aligned along a generatrix of said first manifold (1);

• a second manifold (2), preferably tubular, closed at both ends, on which it is made a second plurality of holes (2a) aligned along a generatrix of said second manifold (2);

• a pipe (3) which connects the bottom of said first manifold (1) with the upper part of said second manifold (2);

• pumping means (4), inserted in said pipe (3), which cause a movement in the direction indicated by the arrow (F) of a fluid contained in said pipe (3).

When the device (A), according to the invention is submerged in a fluid, liquid or gaseous, said pumping means (4) create a pressure drop inside said first manifold (1) and an overpressure inside said second manifold (2). The consequence is that the fluid, in which the device (A) is submerged, enters the first manifold (1) through the holes (1a), flows through the pipe (3) and exits from the second manifold (2) through the holes (2a).

Positioning said first (1) and second (2) manifold so that said first plurality of holes (1a) is faced to said second plurality of holes (2a), it is obtained a flow indicated by the arrows (D), that comes out from said second manifold (2) and enters said first manifold (1). In practice, it is obtained a kind of fluid thin layer

that exits from the second manifold (2) and enters the first manifold (1). By appropriately sizing the passage sections, i.e. the number and the diameter of the holes (1a) and (2a), and the flow rate of the pumping device (4), it is obtained a laminar motion, that does not substantially change the state of motion or the state of rest of the external fluid.

However the motion of said thin layer is such as to cause the suction of other material which then enters the first manifold (1) and undergoes a vigorous mixing, due to the passage through the manifolds (1) and (2), the pipe (3) and the pumping device (4). To increase the effectiveness of the mixing, the passage sections can be dimensioned in such a way as to cause accelerations and slowing down of the flow; furthermore the ducts may be internally corrugated to increase the internal turbulence and, therefore, the effectiveness of the mixing.

In practice, it is obtained the effect of mixing vigorously the fluid thus perturbing in a minimum extent the movement or the state of rest of the fluid itself, by performing the following steps:

- to take a flow of fluid material, using means fitted to carry out said taking without causing disturbances into the fluid which change in a substantial way the movement or the state of rest;
- to make a vigorous mixing of the taken flow;
- to reinsert the mixed material into the fluid material, using means fitted to carry out said reintroduction without causing disturbances in the fluid which change in a substantial way the movement or the state of rest.

This feature makes the device (A) according to the invention, suitable to be inserted into a flow of fluid material that is undergoing a reaction (chemical, biological or other) along a given path. The reaction is favoured by an effective mixing of the fluid materials which constitute the fluid and the device (A), according to the invention is suitable to carry out said vigorously mixing, without substantially changing the comprehensive motion of said fluid. Using multiple devices (A) according to the invention and positioning them in sequence along the flow, it is obtained the effect to get an efficient mixing, and therefore a more

rapid completion of the reactions in act, without that the flow of fluid materials is changed in a substantial way, as instead it occurs with the devices of the prior art which carry out the mixing without delimiting the fluid on which they act.

The same device (A) according to the invention is suitable to homogenize locally portions of a fluid mass, without significantly disturb the remaining mass, said mixing occurring on a substantially immobile fluid.

In fig. 2 it is shown a version (B) of the device according to the invention, in which the position of the collectors is reversed, in such a way that the generatrices along which the holes are aligned (10a), on the first manifold (10), and (20a), on the second manifold (20) are opposite to each other. In this case the device (B) according to this version, achieves the effect of causing a homogeneous flow (D1) in the fluid in which it is inserted. Said flow develops in a plane defined by the axis of said manifolds (10, 20) and is oriented according to the direction from the first manifold (10) to the second manifold (20). In the case in which the device (B) is inserted in a pre-existing flow, the flow (D1) is added to said pre-existing flow, whereby there is obtained the effect to increase or reduce the speed of said flow, depending on the mutual orientation of said flows.

The fluid to be mixed enters into the holes (10a) of a first manifold (10), flows along a pipe (3a), the pumping device (4) and is reintroduced into the fluid mass through the outlet holes (20a) of a second manifold (20).

In practice, if the fluid mass is stationary, the device (B) sets it in motion, while if the fluid mass is in motion, the flow (D) is algebraically added to the existing motion of the fluid itself.

In both devices (A) and (B), the described configuration of the connection between the first manifold (1, 10) and the second manifold (2, 20) through said pipes (3, 3a) is such as to achieve a condition of reverse return, resulting in the uniform distribution of loads and therefore, uniform advancement of the flow (D, D1).

Both the device (A) that the device (B) can be inserted in the fluid by arranging the manifolds (1, 2, 10, 20) in horizontal or in vertical or in oblique

position, above and below the reaction space, helping to counteract the effects of sedimentation or to accentuate specific processes.

According to a preferred embodiment, not shown, the two branches of the circuit, that is the branch in pressure drop, comprising said first manifold (1, 10), and the one under pressure, comprising said second manifold (2, 20) may be conveniently used to change the planes of progression of the fluids. This can be simply obtained by suitably positioning the two manifolds (1, 10) and (2, 20) in such a way that the outgoing flow from the second manifold (2, 20) is not complanate with the flow entering the first manifold (1, 10). In practice the axis of said first and second manifold (10, 20) are not in the same plane.

According to another embodiment, not shown, said first and second manifold have a curved shape like an open ring.

The invention has been described for illustrative and not limitative purposes, according to some preferred embodiments. The person skilled in the art could be able to find several other embodiments, all falling within the scope of protection of the enclosed claims.

CLAIMS

1. method for the homogeneous and delimited mixing of fluids, both liquid and gaseous, forming part of a fluid mass in motion or in state of rest, characterized by:

- taking part of the material from said fluid mass;
- making a vigorous mixing of the fluid material taken;
- reinserting the fluid mixed material into said fluid mass;

said taking and reinsertion causing a flow (D,D1) in said fluid mass.

2. Method for the homogeneous and delimited mixing of fluids, according to claim 1, characterized in that said material is taken and reinserted into said fluid mass, using means fitted to carry out said taking and reinsertion without causing disturbances which adversely affect in a substantial way the preexisting movement or state of rest of said fluid mass, said flow (D) being laminar and being directed from said taking means towards said reinsertion means.

3. Method for the homogeneous and delimited mixing of fluids, according to claim 1, characterized in that said material is taken and reinserted into said fluid mass, using taking and reinsertion means arranged in such a way to cause a flow (D1) which disturbs the state of motion or the state of rest of said fluid mass, algebraically adding to said movement or state of rest of said fluid mass.

4. Device (A, B), for the homogeneous and delimited mixing of fluids, both liquid and gaseous, forming part of a fluid mass in motion or in state of rest, characterized in that it comprises:

- a first manifold (1, 10), closed at both ends, on which a first plurality of holes (1a, 10a) is made, aligned along a generatrix of said first manifold (1a, 10a);
- a second manifold (2, 20), closed at both ends, on which it is made a second plurality of holes (2a, 20a) aligned along a generatrix of said second manifold (2, 20);
- a pipe (3, 3a) that connects said first manifold (1, 10) with said second manifold (2, 20);

- pumping means (4), inserted in said pipe (3, 3a), which cause a movement of a fluid contained in said pipe (3, 3a) by said first manifold towards said second manifold (2, 20);

said first (1, 10) and second (2, 20) manifold being inserted in said fluid mass from which said fluid material is taken and reinserted creating a flow (D,D1) in said fluid mass, said stream (D, D1) being contiguous to said device (A, B).

5. Device (A), for the homogeneous and delimited mixing of fluids, according to claim 4, characterized in that said first manifold (1) and said second manifold (2) are positioned in such a way that said first plurality of holes (1a) is facing said second plurality of holes (2a), so as to obtain a flow, indicated by the arrows (D), that comes out from said second manifold (2) and enters said first manifold (1), obtaining a kind of fluid thin layer that exits from the second manifold (2) and enters the first manifold (1).

6. Device (B), for the homogeneous and delimited mixing of fluids, according to claim 4, characterized in that said first manifold (10) and said second manifold (2) are positioned in such a way that the generatrices, along which are aligned the holes (10a), on the first manifold (10), and (20a), on the second manifold (20) are opposite to each other in such a way as to cause a homogeneous flow (D1) in the fluid in which it is inserted, said flow developing in a plane defined by the axes of said manifolds (10, 20) and being oriented according to the direction from the first manifold (10) to the second manifold (20).

7. Device (B), for the homogeneous and delimited mixing of fluids, according to claim 4, characterized in that the axis of said first manifold (10) and said second manifold (20) are not in the same plane in such a way that the outgoing flow from the second manifold (20) is not complanate with the flow entering the first manifold (10).

8. Device (A, B), for the homogeneous and delimited mixing of fluids, according to at least one of the claims from 4 to 7, characterized in that said first manifold (1, 10) and said second manifold (2, 20) are connected between them by said pipe (3, 3a) in such a way as to get a condition of reverse return, in such a way to get the uniform distribution of loads and, therefore, the uniform advancing of

the flow (D, D1).

9. Device (A, B), for the homogeneous and delimited mixing of fluids, according to at least one of the claims from 4 to 8, characterized in that said ducts (3, 3a) are internally corrugated to increase the internal turbulence and, therefore, the effectiveness of the mixing.

10. Device (A, B), for the homogeneous and delimited mixing of fluids, according to at least one of claims from 4 to 9, characterized in that said first and second manifold have a curved shape like an open ring.

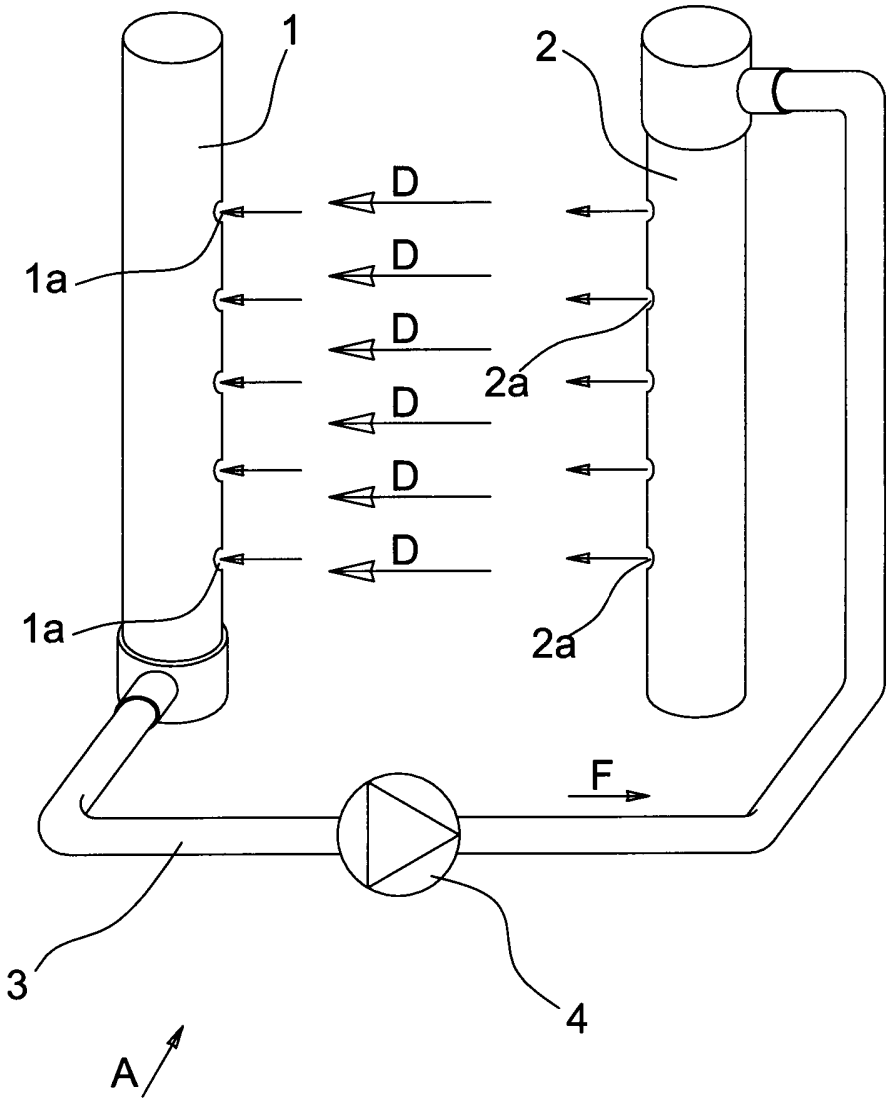

Fig. 1

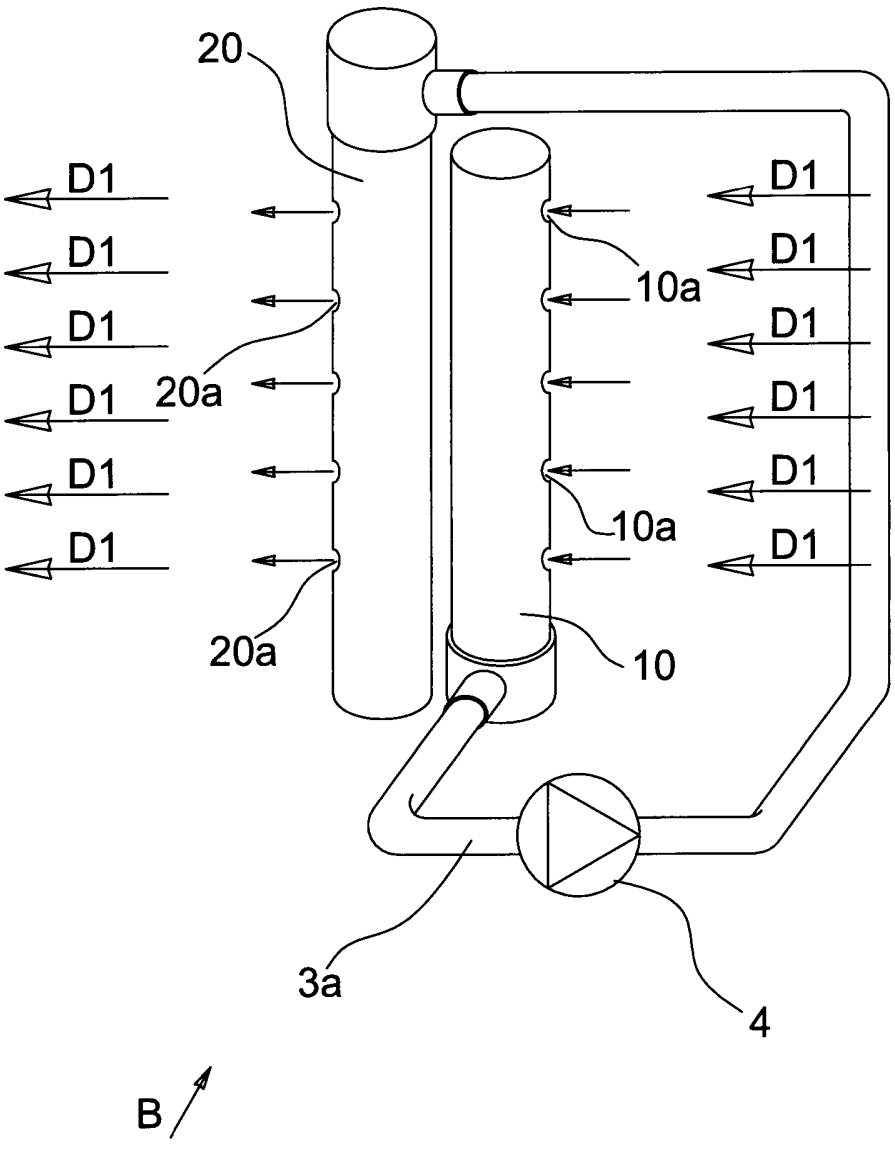

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2015/000299

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01F5/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP S60 34724 A (TOYOTA MOTOR CO LTD) 22 February 1985 (1985-02-22) abstract figures 1,2	1-10

X	FR 1 366 894 A (ETABLISSEMENTS DAUBRON SOC D) 17 July 1964 (1964-07-17) Paragraph "Dans le forme d'execution...."; page 1, column 2 "Les chambres 3 et 7..."; page 2, column 1 figure 1	1-4

X	US 1 355 190 A (FREDERICK TRAUDT WILLIAM) 12 October 1920 (1920-10-12) page 1, lines 48-63 figure 1	1-4

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 May 2016	18/05/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Posten, Katharina

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IT2015/000299

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP S6034724 A	22-02-1985	NONE	
FR 1366894 A	17-07-1964	NONE	
US 1355190 A	12-10-1920	NONE	

⑲日本国特許庁（JP）　⑪特許出願公開

⑫公開特許公報（A）　昭60－34724

⑤Int.Cl.⁴	識別記号	庁内整理番号	㊸公開　昭和60年(1985)2月22日
B 01 F 5/10		6639－4G	
F 02 M 37/00		6657－3G	
F 23 N 1/00	115	8212－3K	審査請求　未請求　発明の数 1　（全3頁）

㊹発明の名称　複数種からなる燃料の混合装置

㉑特　願　昭58－144303

㉒出　願　昭58(1983)8月6日

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明　細　書

1．発明の名称

複数種からなる燃料の混合装置

2．特許請求の範囲

燃料タンクに、一端が内部下方の長手方向に開口し、他端が内部上方の長手方向に開口する循環用パイプを設け、この循環用パイプの上流側にポンプを配設するとともに、下流側にラインミキサを配設したことを特徴とする複数種からなる燃料の混合装置。

3．発明の詳細な説明

本発明は、性状の異なる二種以上の燃料を混合するに好適な混合装置に関するものである。

従来、性状の異なる二種以上の燃料を混合し、分離を防止している装置としては、第2図に示すような混合装置が利用されている。第2図において、21は燃料タンクであって、この燃料タンク21には、一端が内部下方の長手方向に配設され、他端が内部上方の長手方向に配設されている循環パイプ22が設けられており、この循環パイプ22の途中にはポンプ23が設けられている。そして、燃料タンク21の内部下方に配設されている循環パイプ22の上面には複数個の吸引口24が開設されており、内部上方に配設されている循環パイプ22の下面には複数個の吐出口25が開設されている。また、燃料タンク21内には一端が燃焼バーナ（図示せず）に接続されている供給パイプ26の他端が開口されており、この供給パイプ26の途中にはポンプ27が設けられている。

そして、燃料タンク21に収容されている二種以上からなる燃料Fを燃焼バーナに供給する際には、循環パイプ22に設けられているポンプ23を作動させ、循環パイプ22の吸引口24から燃料Fを吸引するとともに、吐出口25から液面Faに向けて吐出させて、燃料を混合するとともに、分離を防止している。

しかしながら、このような混合装置においては、燃料Fの混合が循環パイプ22の吸引口24と吐出口25との間を循環させることのみによって行われているため、連続的に循環させている場合に

は分離という問題が発生することはないが、長期間にわたり循環させずに放置した場合には、複数種の燃料F間において分離という現象が発生し、完全に混合するのに長い時間が必要となる不具合がある。

本発明は、上記の不具合を解消するためになされたもので、その目的は燃料の循環経路中にラインミキサを配設することにより、複数種からなる燃料の均質化の促進を図るとともに、再分離を防止することができる複数種からなる燃料の混合装置を提供することにある。

本発明の上記目的は、燃料タンクに、一端が内部下方の長手方向に開口し、他端が内部上方の長手方向に開口する循環パイプを設け、この循環用パイプの上流側にポンプを配設するとともに、下流側にラインミキサを配設したことを特徴とする複数種からなる燃料の混合装置によって達成される。

以下、本発明の一実施例を添付図面に従って詳細に説明する。

第1図は本発明に係る複数種からなる燃料の混合装置の概略断面図を示す。第1図において、1は燃料タンクであって、この燃料タンク1の上面には複数種の燃料Fを供給するための供給口2が開設されており、その上端には蓋3が設けられている。

また、燃料タンク1の内部下方には長手方向に向けて下部パイプ4が配設されており、その一端は燃料タンク1を貫通して上方に立ち上がっている。一方、燃料タンク1の内部上方には長手方向に向けて上部パイプ5が配設されており、その一端は下部パイプ4と同様に燃料タンク1を貫通して上方に立ち上がっている。この両者のパイプ4、5は燃料タンク1の外部でたがいに対向する側に延びており、下部パイプ4の一端はポンプ6の入口側に接続され、上部パイプ5の一端はポンプ6の出口側に接続されている。さらに、下部パイプ4の上面には複数個の吸引口4aが開設されており、上部パイプ5の下面には複数個の吐出口5aが開設されている。そして、この両者のパイプ4、5によって燃料Fを循環させるための循環パイプ7を形成している。

また、循環パイプ7の途中に設けられているポンプ6の下流側にはラインミキサ8が設けられている。このラインミキサ8は回転部分がなく、燃料Fの流れのみによって混合撹拌されるものが適しており、例えばパイプの内部に縦方向また横方向もしくは両方向に複数個の棒状部材を間隙を有して設けたもの、パイプの内部に捩じり板の端面を互いに直角に交差させた板部材を設けたものがあげられる。

また、燃料タンク1内には一端が燃焼バーナ（図示せず）に接続されている供給パイプ9の他端が開口されており、その途中にはポンプ10が設けられている。

上記のように構成された混合装置において、タンクローリ（図示せず）等から別々に燃料タンク1に供給された複数種の燃料Fを燃焼バーナ（図示せず）に供給する際には、循環パイプ7のポンプ6を作動させ、循環パイプ7の吸引口4aから燃料を吸引するとともに、吸引した燃料Fをラインミキサ8に通過させる。その際、複数種の燃料Fはラインミキサ8によって十分に撹拌されて混合されるとともに、吐出口5aから液面Faに向けて吐出されて、複数種の燃料Fが混合される。そして、混合された燃料Fは循環パイプ7への循環が数回繰り返えされ、燃料Fの分離が防止されるとともに、ポンプ10の作動によって供給パイプ9から燃料バーナへと供給される。

以上説明したように、本発明の混合装置においては、燃料タンク内部の下方と上方の長手方向に循環パイプを開口させ、この循環パイプの燃料の循環経路中にラインミキサを配設したから、燃料タンク内での循環パイプの間で混合が行われるとともに、ラインミキサによって、さらに混合が行われるので、複数種からなる燃料の均質化を短時間に行うことができる効果がある。

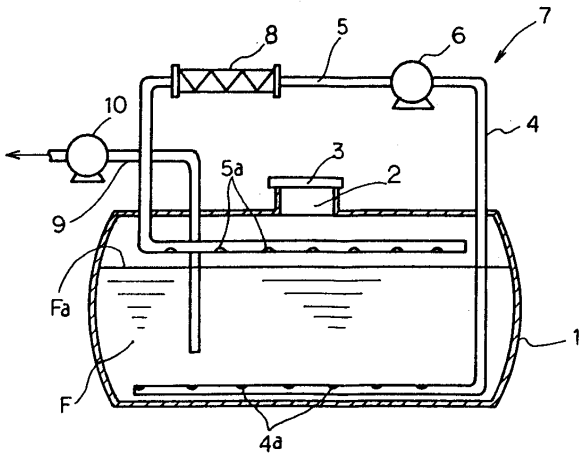
また、本発明においては、ラインミキサによる剪断力的な混合であるために、一旦混合された複数種の燃料は長時間にわたり放置しても、互いに

分離するのが防止される効果がある。

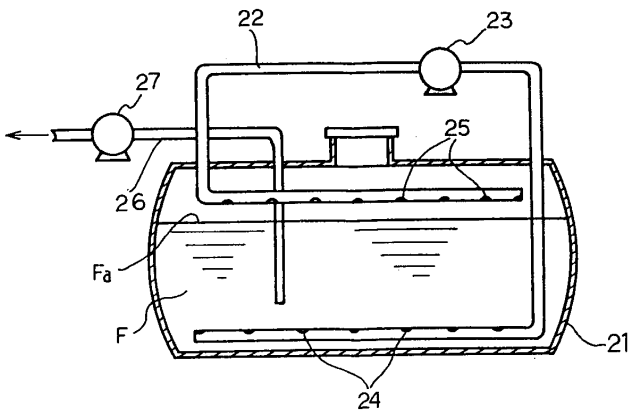
4．図面の簡単な説明

第1図は本発明に係る複数種からなる燃料の混合装置の概略断面図、第2図は従来に係る複数種からなる燃料の混合装置の概略断面図である。

1……燃料タンク
2……供給口
3……蓋
4……下部パイプ
4a……吸引口
5……上部パイプ
5a……吐出口
6……ポンプ
7……循環パイプ
8……ラインミキサ
9……供給パイプ
10……ポンプ



第 1 図



第 2 図

RÉPUBLIQUE FRANÇAISE

MINISTÈRE DE L'INDUSTRIE

SERVICE
de la PROPRIÉTÉ INDUSTRIELLE

BREVET D'INVENTION

P.V. n° 937.006 N° 1.366.894

Classification internationale : 01 *f* — C 12 *g*

Procédé et appareillage de mélange et d'homogénéisation de liquides à densités différentes et leurs applications.

Société dite : SOCIÉTÉ DES ÉTABLISSEMENTS DAUBRON résidant en France (Seine).

Demandé le 5 juin 1963, à 11h 35m, à Paris.

Délivré par arrêté du 8 juin 1964.

(*Bulletin officiel de la Propriété industrielle*, n° 29 de 1964.)

(*Brevet d'invention dont la délivrance a été ajournée en exécution de l'article 11, § 7, de la loi du 5 juillet 1844 modifiée par la loi du 7 avril 1902.*)

La présente invention a pour objet un procédé de mélange et d'homogénéisation de liquides à densités différentes contenus dans un récipient, qui consiste à aspirer les liquides du bas du récipient en plusieurs nappes sensiblement horizontales, limitées en surfae et à une vitesse déterminée, et à refouler ces liquides aspirés au sommet de ce récipient, en des nappes sensiblement horizontales, de même surface limitée que les premières, mais en nombre inférieur et à une vitesse supérieure à la vitesse d'aspiration, la masse liquide séparant les zones d'aspiration et de refoulement agissant comme un piston hydraulique permanent qui supprime toute immobilité des molécules liquides.

L'invention a en outre pour objet un appareillage permettant la mise en œuvre du procédé spécifié ci-dessus et comprenant une cuve contenant les liquides à densités différentes équipée à sa base d'une ou plusieurs chambres verticales d'aspiration obturées à leur partie supérieure, dont les parois latérales sont munies d'une multiplicité d'orifices à sections de passage égales et dont les fonds sont reliés à l'aspiration d'une pompe de brassage dont le refoulement aboutit au sommet d'une ou plusieurs chambres verticales de refoulement à fond fermé, de section sensiblement égale et de hauteur inférieure à celles des chambres d'aspiration et disposées à la partie supérieure de la cuve à distance de ces chambres d'aspiration, la paroi latérale de chaque chambre de refoulement étant munie d'orifices à section de passage en principe égale à celle des orifices d'aspiration, ces orifices noyés dans la masse liquide de la cuve étant respectivement répartis pour les deux types de chambres de la même manière uniforme dans des plans horizontaux à distances égales entre eux.

L'invention a enfin pour objet les application industrielles du procédé et de l'appareillage spécifiés ci-dessus, pour le mélange ou l'unification de tous liquides et, plus particulièrement, pour les traitements œnologiques tels que coupage et collage des vins, ainsi qu'addition de liqueurs et de produits œnologiques.

La description qui va suivre, en regard des dessins annexés à titre d'exemples non limitatifs, fera bien comprendre comment l'invention peut être mise en pratique.

Les figures 1 et 2 sont des coupes schématiques de cuves métalliques et en ciment équipées d'un appareillage simple de mélange et d'homogénéisation de liquides conforme à l'invention.

Les figures 3 et 4 sont des coupes schématiques de cuves métallique et en ciment équipées d'un appareillage multiple de mélange et d'homogénéisation de liquides conforme à l'invention.

Dans la forme d'exécution illustrée aux figures 1 et 2, les cuves 1 métallique et 2 en ciment sont équipées d'un appareillage élémentaire comprenant une chambre verticale 3 d'aspiration, de préférence cylindrique et située dans la partie basse de la cuve. La paroi extérieure 4 de cette chambre 3 est perforée d'une manière uniforme de trous 5 identiques au point de vue section de passage et disposés dans des plans sensiblement horizontaux à des distances égales entre eux. Le fond supérieur 6 est obturé et ne laisse passer aucune veine liquide.

Dans la cuve 1 ou 2 est en outre disposée une chambre verticale 7 de refoulement, de préférence cylindrique et baignant dans le liquide à la partie supérieure de la cuve. La paroi extérieure 8 de cette chambre 7est perforée d'une manière uniforme de trous 9 identiques au point de vue section de passage et disposés dans des plan sensiblement horizontaux à des distances égales entre eux. Le fond inférieur 10 est obturé et ne laisse passer aucun liquide.

Une pompe de brassage 11 dont l'aspiration et le refoulement sont respectivement reliés au fond

64 2191 0 73 428 3 ◆ **Prix du fascicule : 2 francs**

de la chambre 3 et au sommet de la chambre 7 permet de transvaser les liquides de cette chambre 3 à cette chambre 7. Elle possède des caractéristiques adéquates au point de vue pressions et débits en vue de mettre la chambre 3 en dépression et la chambre 7 en pression.

Les chambres 3 et 7 peuvent être réalisées en métal, en matière plastique ou à l'aide de tout autre matériau adéquat. La chambre 7 est, de préférence, moins longue que la chambre 3 de manière que la section totale de passage du liquide à travers la chambre 3 soit plus élevée que la section de passage totale du liquide à travers la chambre 7.

Un cuvon 12 (fig. 2) peut être éventuellement prévu pour permettre l'incorporation de produits dans la masse liquide contenue dans la cuve 1 ou 2, en particulier pour effectuer dans le cas des vins, les opérations suivantes : collages, additions de liqueurs, de produits œnologiques, etc.

Les réalisations des figures 3 et 4 ne diffèrent respectivement de celles des figures 1 et 2 qu'en ce que les cuves 1*a* et 2*a* contiennent une multiplicité d'équipements élémentaires à chambres d'aspiration 3*a*, 3*b*, 3*c* et à chambres de refoulement 7*a*, 7*b* et 7*c*.

L'équipement ainsi décrit fonctionne comme suit :

A la mise en route de la pompe 11, chaque chambre 3 aspire, théoriquement d'une manière uniforme, les liquides dans les différentes couches, en fonction de sa hauteur, mais dans des plans horizontaux en principe sensiblement parallèles.

Chaque chambre 7 maintient un niveau global constant dans la cuve correspondante par réincorporation, à la partie supérieure, du liquide soutiré à travers chaque chambre 3. Théoriquement, les veines liquides émises par la chambre 7 sont égales et se répartissent en toutes directions mais sur des plans horizontaux en principe sensiblement parallèles.

La masse liquide relativement peu turbulée, de par l'orientation des jets, contenue dans la cuve et située entre la partie inférieure de chaque chambre 7 et la partie supérieure de chaque chambre 3 tend à descendre à vitesse réduite constituant ainsi une sorte de piston hydraulique vis-à-vis de la masse liquide inférieure.

Le piston hydraulique en question, toujours descendant, assure un mouvement continu de la masse liquide vers la partie inférieue de la cuve et supprime donc l'immobilité des molécules liquides dans la masse.

Il est à noter par ailleurs que les vitesses des jets ou veines liquides émis par chaque chambre 7 sont supérieures, en principe, aux vitesses d'aspiration à travers chaque chambre 3, la section globale de passage à travers la chambre 7 étant inférieure à la section globale de passage à travers la chambre 3.

D'autre part, la vitesse de descente du piston hydraulique permanent spécifié ci-dessus, est faible relativement aux vitesses de passage à travers les chambres 3 et 7, la section horizontale de la cuve étant bien supérieure dans la pratique aux sections de passage des liquides à travers les chambres 3 et 7.

Il est également à noter que les forces d'aspiration dans chaque chambre 3 sont sensiblement égales et maximales dans les plans horizontaux correspondant aux niveaux des trous 5, d'où une aspiration des liquides en nappes sensiblement horizontales par cette chambre 3.

De même, les forces de refoulement de chaque chambre 7 sont sensiblement égales et maximales dans les plans horizontaux correspondant aux niveaux des trous 9, d'où un refoulement des liquides en nappes sensiblement horizontales par la chambre 7.

La masse liquide, contenue dans la cuve, est tout entière obligée à passer à travers la pompe du fait de la présence d'un piston hydraulique permanent.

Le liquide est en outre prélevé en nappes égales horizontales dans la cuve et est rediffusé en nappes égales horizontales à la partie haute du niveau liquide supérieur.

Cet équipement favorise le mélange et l'homogénéisation des liquides, en particulier ceux des liquides légers et des liquides lourds, lesquels naturellement décantent. Pratiquement, aucune nappe liquide horizontale ne peut rester stationnaire et, normalement, tout est amené à passer par la pompe 11. Les liquides à forte densité descendant plus vite vers le fond de la cuve, du fait des résistances au frottement au sein de la masse liquide, ont tendance à passer plus souvent à travers la pompe 11 ce qui contribue à activer le mélange des liquides. Enfin, le principe hydraulique des débits égaux à travers des orifices noyés, sous une charge donnée, quelle que soit leur position par rapport aux niveaux amont et aval, trouve son application directe dans le présent procédé.

Il est bien évident que, sans sortir du cadre de la présente invention, des modifications pourraient être apportées au procédé et aux modes d'exécution décrits. C'est ainsi que les cuves peuvent être réalisées en ciment, en matière plastique ou en métal. Elles peuvent être de forme généralement quelconque, telle que cubique, parallélépipédique ou cylindrique. Pareillement les trous pourraient être remplacés par des ajutages ou des fentes ayant des sections de passage égales.

Le résumé qui va suivre et qui ne présente aucun caractère limitatif a simplement pour but d'énoncer un certain nombre de particularités principales et secondaires de l'invention, ces particularités étant prises isolément ou en toutes combinaisons possibles.

RÉSUMÉ

La présente invention comprend notamment :

1° Un procédé de mélange et d'homogénéisation de liquides à densités différentes contenus dans un récipient, qui consiste à aspirer les liquides du bas du récipient, en plusieurs nappes sensiblement horizontales, limitées en surface et à une vitesse déterminée, et à refouler ces liquides aspirés au sommet de ce récipient, en des nappes sensiblement horizontales, de même surface limitée que les premières, mais en nombre inférieur, et à une vitesse supérieure à la vitesse d'aspiration, la masse liquide séparant les zones d'aspiration et de refoulement agissant comme un piston hydraulique permanent qui supprime toute immobilité des molécules liquides;

2° Un appareillage permettant la mise en œuvre du procédé spécifié sous 1° et comprenant une cuve contenant les liquides à densités différentes équipée à sa base d'une ou plusieurs chambres verticales d'aspiration obturées à leur partie supérieure, dont les parois latérales sont munies d'une multiplicité d'orifices à sections de passage égales, et dont les fonds sont reliés à l'aspiration d'une pompe de brassage dont le refoulement aboutit au sommet d'une ou plusieurs chambres verticales de refoulement à fond fermé, de section sensiblement égale et de hauteur inférieure à celles des chambres d'aspiration et disposées à la partie supérieure de la cuve à distance de ces chambres d'aspiration, la paroi latérale de chaque chambre de refoulement étant munie d'orifices à section de passage égale en principe à celle des orifices d'aspiration, ces orifices noyés dans la masse liquide de la cuve étant respectivement répartis pour les deux types de chambres de la même manière uniforme dans des plans horizontaux à distances égales entre eux;

3° Les orifices sont constitués par des trous, ajutages ou fentes;

4° Les chambres sont réalisées en métal, en matière plastique ou à l'aide de tout autre matériau adéquat;

5° Les cuves sont réalisées en ciment, en matière plastique ou en métal;

6° Les cuves sont de forme généralement quelconque, telle que cubique, parallélépipédique ou cylindrique;

7° Un cuvon relié à la pompe permet l'incorporation d'ingrédients œnologiques;

8° Les applications industrielles du procédé spécifié sous 1° et de l'appareillage spécifié sous 2° à 7°, pour le mélange ou l'unification de tous liquides et, plus particulièrement, pour les traitements œnologiques tels que coupage et collage des vins, ainsi qu'addition de liqueurs et de produits œnologiques.

Société dite :
SOCIÉTÉ DES ÉTABLISSEMENTS DAUBRON
Par procuration :
MASSALSKI & BARNAY

N° 1.366.894 Société dite : 2 planches. - Pl. I

Société des Etablissements Daubron

Fig.1

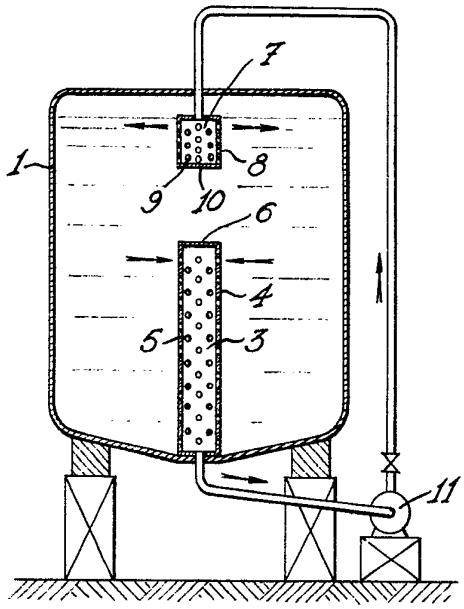
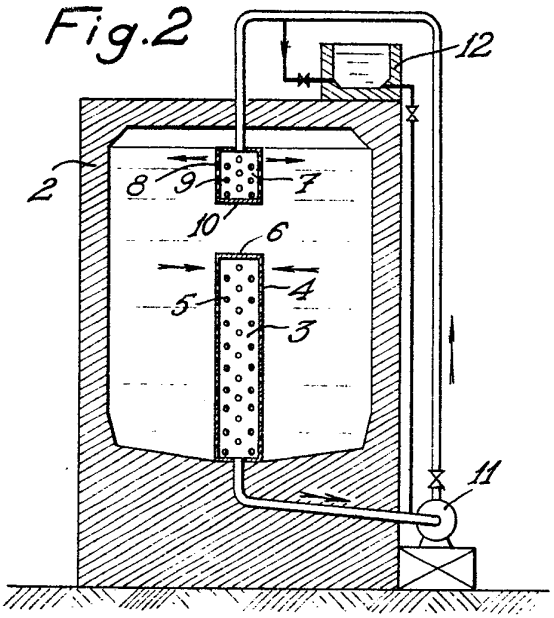


Fig.2



N° 1.366.894 Société dite : 2 planches. - Pl. II

Société des Etablissements Daubron

Fig.3

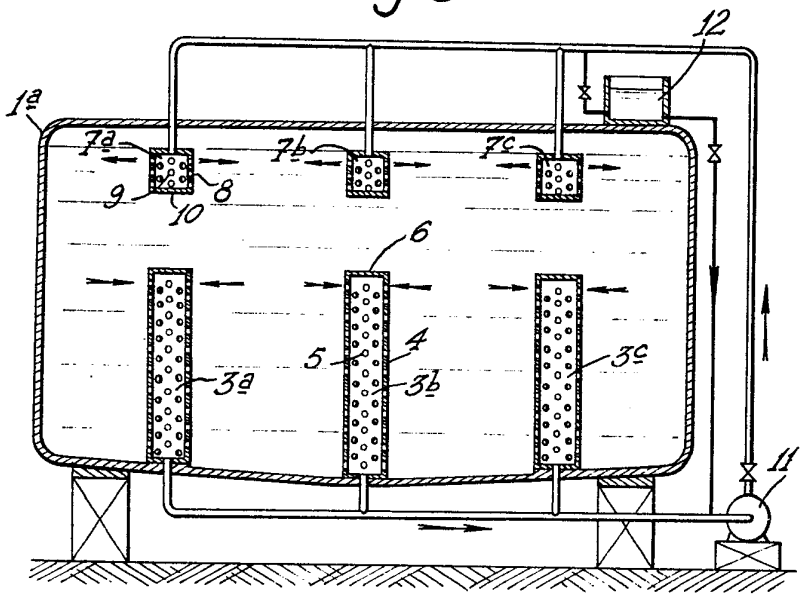
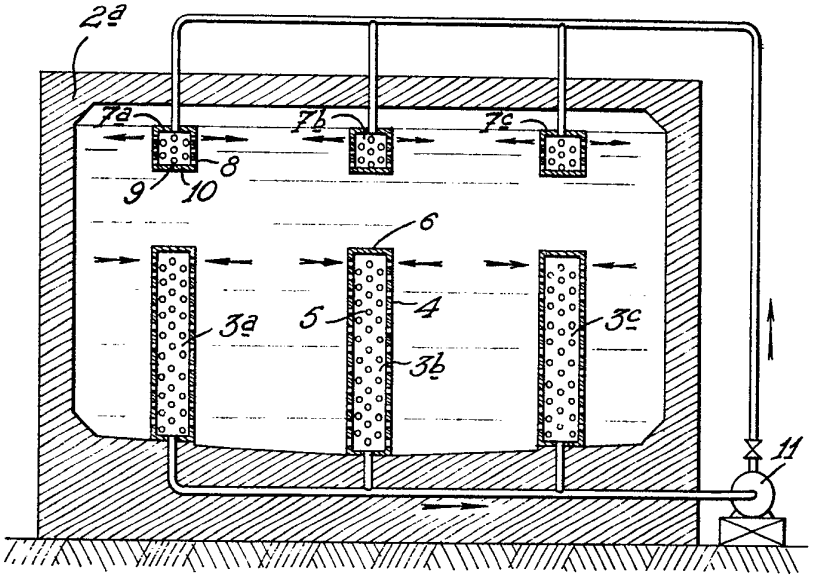


Fig.4



W. F. TRAUDT.

PROCESS FOR MIXING VISCOUS MATERIALS.

APPLICATION FILED OCT. 31, 1919.

1,355,190.

Patented Oct. 12, 1920.

2 SHEETS—SHEET 1.

Fig. 1.

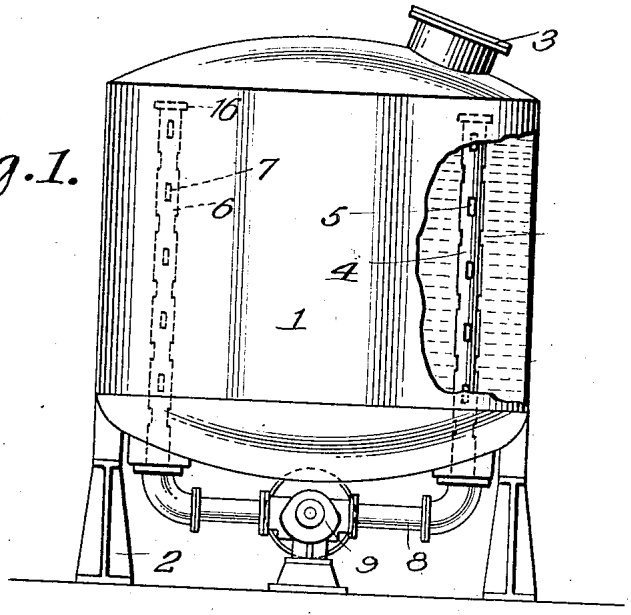
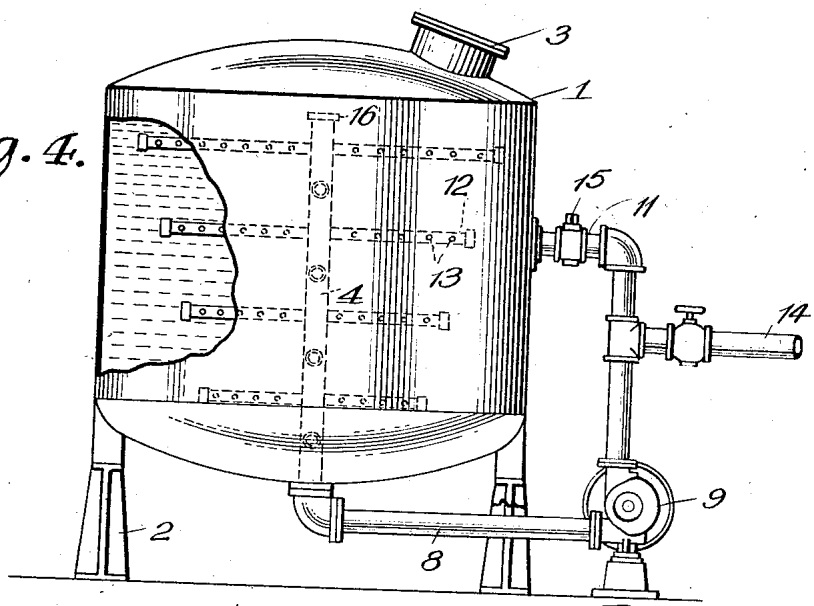


Fig. 4.



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PROCESS FOR MIXING VISCOUS MATERIALS.

APPLICATION FILED OCT. 31, 1919.

1,355,190.

Patented Oct. 12, 1920.

2 SHEETS—SHEET 2.

Fig. 2.

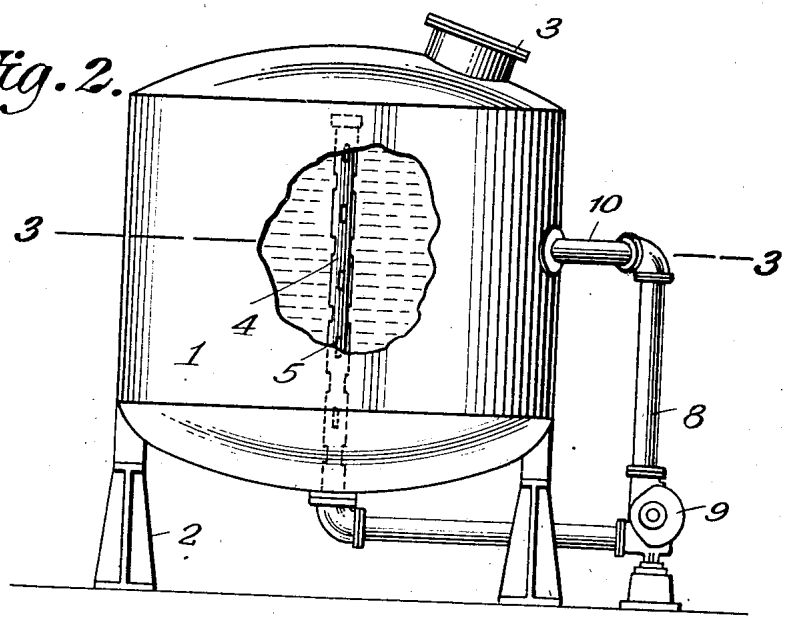
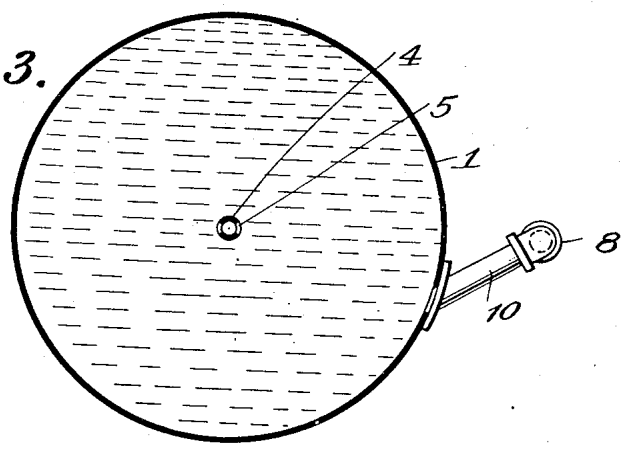


Fig. 3.



Inventor,
William F. Traudt
By A. Paul Rubmuch
Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM FREDERICK TRAUDT, OF BUFFALO, NEW YORK, ASSIGNOR TO TABER PUMP COMPANY, A CORPORATION OF NEW YORK.

PROCESS FOR MIXING VISCOUS MATERIALS.

1,355,190. Specification of Letters Patent. **Patented Oct. 12, 1920.**

Application filed October 31, 1919. Serial No. 334,896.

To all whom it may concern:

Be it known that I, WILLIAM F. TRAUDT, a citizen of the United States of America, residing at Buffalo, county of Erie, State of New York, have invented certain new and useful Improvements in Processes for Mixing Viscous Materials, of which the following is a specification.

My invention relates to the mixing of viscous materials which occur in more or less clearly defined strata of different colors, specific gravities, etc., as is frequently the case in the manufacture of condensed milk. In the ordinary condensed milk factory different batches of milk of differing compositions, colors, and other characteristics are separately concentrated and then collected together in large tanks, each of which may hold as much as 5000 gallons. On account of the viscosity of the material and the differing specific gravities of the numerous superposed strata it is extremely difficult to evenly distribute these into one homogeneous mass. No ordinary stirring or mixing device will do it. I have invented a process which may be carried out in various slightly differing forms of apparatus, and also certain apparatus for carrying out the process which will quickly and cheaply transform any such viscous, stratified mass into a homogeneous body of uniform color and composition, without injuring or modifying the constituent elements. The best form of apparatus at present known to me for carrying out my invention, together with certain modifications thereof, is illustrated in the accompanying two sheets of drawings in which—

Figure 1 is a side elevation of the preferred form of apparatus, parts being broken away;

Fig. 2 is a similar view of a modification;

Fig. 3 is a horizontal section on line 3—3 of Fig. 2, and

Fig. 4 shows another modification.

Throughout the drawings like reference characters indicate like parts.

1, is a tank of considerable depth and capacity supported on legs 2, and provided with a manhole and cover 3. In the form shown in Fig. 1, a vertical standpipe 4, is set in, and passes through, the tank bottom near one wall or side thereof, and a second similar standpipe 6, is located near the other wall or side. Each standpipe has its upper end capped at 16, and has a series of openings 5, or 7, in its walls, spaced approximately evenly along its entire length. The lower, protruding ends of the standpipes 4, and 6, are connected by conduit 8, one to the inlet and the other to the outlet of a rotary or centrifugal pump 9.

In Figs. 2 and 3 but one such standpipe 4, is shown, and this is central in the tank. The conduit 8, leads from the inlet side of the pump to this standpipe in this construction and from the discharge side to a discharge nozzle 10, which passes through the tank wall in a direction substantially tangential thereto.

In the form shown in Fig. 4, the central standpipe 4, has a series of hollow, radial arms 12, 12, provided with equally spaced perforations 13, 13. The portion 11, of conduit 8, is provided with a shut-off valve 15, and with a branch discharge section 14, equipped with shut-off valve 17.

In operation the pump 9, is rotated continuously in either direction, or alternately in both directions, when tank 1, is filled with the stratified mass of condensed milk or other materials, or while it is being so filled. In the apparatus of Fig. 1, this operation draws some from each stratum of the mass out through the perforations in one pipe, as 4, at various levels, mixes these masses in the common mixing devices formed by conduit 8, and pump 9, and returns the commingled masses in a series of fine jets through the openings in the other standpipe at different levels to the various strata. As this process of combination, subdivision and recombination is carried on repeatedly, it soon effectively distributes the various particles of the different strata and produces one homogeneous mass. From time to time the direction of rotation of pump 9, may be reversed.

In the apparatus of Figs. 2, and 3, this action is facilitated by the whirling action set up by the tangential jet from nozzle 10. In Fig. 4, reliance is had on the widely distributed orifices 13, for this combining and dividing action, and the return pipe 11, discharges radially into the tank. In Figs. 2 and 4, also, the pump may, of course, be run in either direction.

If desired the tank may be filled, or emptied, or both, through a branch pipe 14,

this pipe and conduit 11, being controlled by hand-operated valves 15, and 17, and by operating the pump the tank may be filled or discharged through branch 14.

In all the forms of apparatus shown, the underlying principle of operation is the contemporaneous drawing off of small portions from each stratum of the mass, mixing them together in a common mixture device, and returning the mixture so formed to be again operated on by this mixing process.

Having described my invention, I claim:

1. The process of mixing viscous materials assembled in horizontal strata which comprises the following steps: first, collecting said materials in a receptacle of considerable depth, second, simultaneously drawing off the material from each stratum through a suction device located in said stratum and passing the same through a common mixing apparatus, and third, discharging the mixture into a common receptacle.

2. The process of mixing viscous materials of differing specific gravities which comprises the following steps: first, assembling the materials in a receptacle of considerable depth wherein they arrange themselves in substantially horizontal strata; second, drawing off portions of the material from each stratum contemporaneously and passing the same through a common pump; and third, delivering the mixed materials simultaneously through a series of discharge orifices of different heights to a common receptacle.

3. The process of mixing viscous materials assembled in a common container in various more or less clearly defined strata, which comprises simultaneously drawing off portions of the material from each stratum in the container, passing the same through a common mixing device, returning the mixture to the same container simultaneously through a number of discharge orifices located at different levels therein, and continuing the said cycle of operations until a homogeneous mixture is produced in said container.

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