

*An analysis and an evaluation
of novelty, contributions and originality of the invention described in the
documents WO2011/078779, PCT/SE/051452, EP2010/0839900,
i.e. in Swedish patent SE 0901600-7.*

Preamble

This paper provides an analysis and evaluation of novelty, originality, contributions and utilization of the invention described in the document WO2011/078779, PCT/SE/051452, EP2010/0839900 and USA patent application No. US 2012/0321531, i.e. in Swedish patent SE 0901600-7.

An evaluation and analysis is taking into account the laws of nature in terms of mechanics (kinematics and dynamics) of solid matter, as well as generally known technical principals that are used within construction and structure of rotating machines and apparatus.

An evaluation and analysis is, however, made especially as a comparison with the following patent documents (further referred to as D1-D10), which I have originated and registered.

- D1: Slovakian (SK) patent No. 279397, (patent application No. PP 282-1997 filed on March 3, 1997)
- D2: International application publication No. WO1998/039368 (claimed priority SK PP 282-1997), and patents granted in Canada (CA), Czech Republic (CZ), Germany (DE), Japan (JP), Norway (NO), RU Russian Federation (RU), Great Britain (GB), USA (US) after entering WO1998/039368 into national phase in above mentioned countries:
- D3: CA patent No. 2,283,138
- D4: CZ patent No. 292493
- D5: DE patent No. 197 82 262
- D6: JP patent No. P4055829
- D7: NO patent No. 324381
- D8: RU patent No. 2181126
- D9: GB patent No. 2337265
- D10: US patent No. 6,165,349

All of the aforementioned patents are currently valid (in force).

1. Introduction

The international application of the invention published as document WO2011/078779 or PCT/SE/051452 and US 2012/0321531 contains in the introduction the fields of techniques which are connected with the invention, the current situation of techniques in this sphere and its weaknesses, i.e. disadvantages are described (in accordance with the rules of the formal structure of an invention application for an patent). Moreover, the advancements and advantages of the new invention are stated in the introduction. The application WO2011/078779 includes the following statements, and I quote:

1.1. Prior Art

US, A, 6 165 349 disclose a reactor comprising a reaction chamber having a rotation mechanism that consists of a shaft to which vanes are symmetrically attached by means of driving discs. The shaft is carried in bearings in both ends of the reaction chamber. An extensive dismantling work is required to release the vanes for service and possible replacement.

Summary of the Invention

A first object of the present invention is to provide a reactor that, with a minimum of dismantling work, allows access to the rotor including occurring vanes for service and/or replacement. A second object of the present invention is to provide a reactor that, with a minimum of dismantling work, allows access to occurring wear surfaces in the reaction chamber/housing for service and/or replacement.

***** The end of quotation *****

The author of this “*An analysis and an evaluation*” is the inventor and the owner of the aforesaid patents (documents D1-D9) and above quoted patent US 6,165,349. The author is also the R&D director of the company Roil Trade Ltd., which carries out the development and production of the device in compliance with the awarded patents. This means, that author knows in detail all theoretical – engineering as well as practical, constructional and operational circumstances connected with the development and usage of the technology built according to the invention. This allows the author to judge and qualify similar, derived and copied technologies, which have found their inspiration in author’s, in principle novelty of chemical process and reactor.

2. An analysis and evaluation

2.1. Process

Derived from the name of the aforementioned and quoted documents D1-D10: **PROCESS FOR THERMAL AND/OR CATALYTIC DECOMPOSITION AND/OR DEPOLYMERIZATION OF LOW-GRADE ORGANIC SUBSTANCES AND DEVICE FOR CARRYING OUT THE PROCESS**, the core subject of the invention and awarded patents is **indivisibly** the process (the method) of processing the organic substances and also the device that is used for this process or method. Abuse of **the process** without the permission of the patent and copyright owners even by ‘modified’ device is violation of the rights of industrial and intellectual property minimally in the part of the patent claims where **the process** is described.

The invention described in document WO2011/078779, i.e. PCT/SE/051452 supposedly technically ‘improves’ the device in the documents D1-D10, but how does the improved device work, what is the new way/principle of the utilization in comparison with our protected solution, and how is this device is being used is not included in patent entitlement nor in the description of the patent. On the contrary...

The fact that in the description of the current state of the technique is stated as *Prior Art* exclusively/solely our US patent 6,165,349, points to the fact that the ‘improved’ device described in WO2011/078779 i.e. PCT/SE/051452 is aimed to execute the process or method that is covered by our patents.

2.2. Devices

2.2.1 Reactor according US 6,165,349 (and D1-D9)

Being the author of the invention protected by the patent US 6,165,349 (and D1-D9) as well as the main constructor of our reactors, which are supposedly having complications with the changing of vanes; I state that the description of a current situation of the technique in Prior Art is **very far from the truth**. In order to change vanes/hammers it is not necessary to invest any extraordinary or remarkable effort, nor extensive dismantling work. The access to vanes/hammers and to inner parts of reactor is fairly simple; the way to do that is to dismantle the divided reactor thermal insulation of the lid/cover of the maintenance opening and thereafter remove the lid/cover of the maintenance opening. This operation takes about 15 minutes when servicing the biggest, 800 kW reactor. The reverse process of installation is equally as simple.

Neither from the description of the patent nor from the patent claims/entitlements stated in our patent US 6.165.349 (and D1-D9) it is not possible to find out, that there is a

technical difficulty with the access of the hammers/vanes. This circumstance is not stated there whatsoever, as this, replacement of vanes/hammers is secondary and irrelevant technical detail. The core subject of the patent is the overall novelty concept and new technological principles.

All our reactors – up until now five (5) of them have been built - have been equipped with the maintenance opening so that the replacement of hammers/vanes is simple. Following photos of some reactors built in compliance with our US patent 6,165,349 (and D1-D9) are the best illustration of *Prior Art* and the true state of the technique.



Picture 1 - 45 kW Blowdec reactor built in 2002 with maintenance opening



Picture 2 - 800 kW reactor built in 2007 with 2 maintenance openings
(and 45 kW reactor in workshop)

Author of the invention described in the document WO2011/078779 was present when the vanes in our R&D 45 kW device were changed. He is/was also familiar with the fact that for the inspection and for the exchange of vanes/hammers a maintenance opening is

being used and no extraordinary difficult/demanding dismantling works are required for entering the inner part of the reactor.

2.2.2. Reactor according WO2011/078779

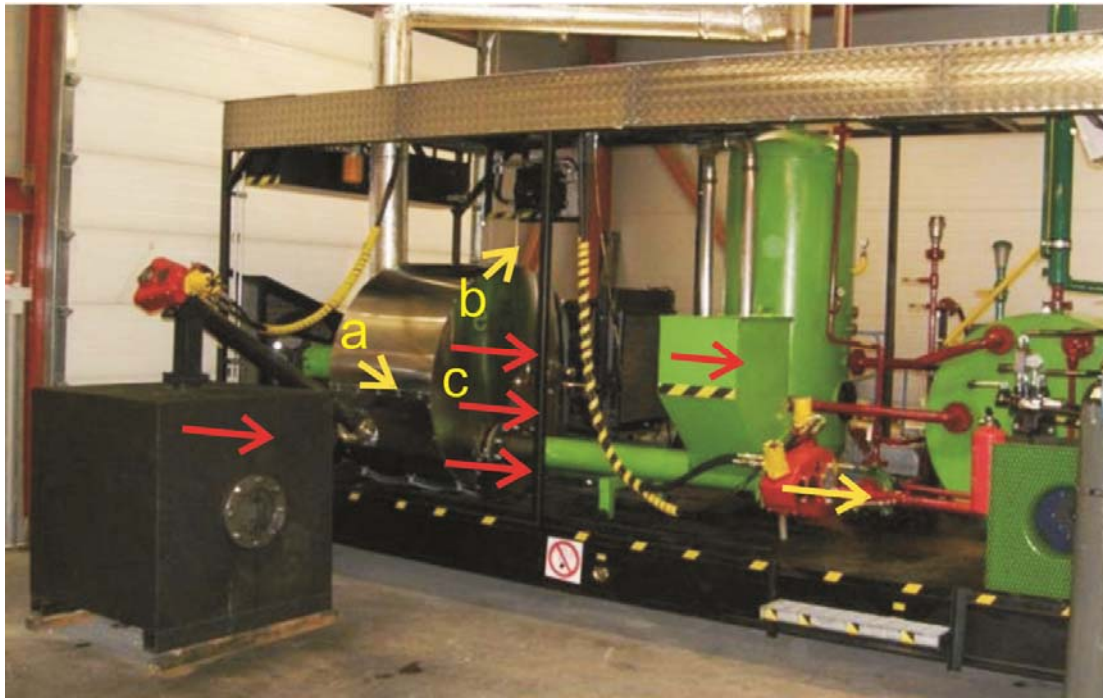
Technical solution described in the document WO2011/078779, on other hand, brings with 'de facto' more complicated access to the vanes/hammers as well as inner parts of the chamber and thus more extensive dismantling works than in the case of our reactors.

In order to replace vanes/hammers in the reactor described in the document WO2011/078779, it is necessary to dismantle the thermal insulation from the cylindrical part of reactor (at least) **6b** (Figures No. 2 and 3 from the application WO2011/078779) to enable access to the screws joining the circular flanges which connect the cylindrical part of the chamber of reactor **6a** and the part **6b**. The screws need to be disassembled and part **6a** needs to be released and moved aside from the fixed part of reactor **6b**.

Furthermore, it is necessary to move aside both feeding conveyors that are connected/mounted to the head wall of reactor **7** and also it's necessary to move aside the conveyor which withdraws so called process powder from the reactor and which is connected/mounted to the cylindrical side/part **6a** of the reactor's chamber. This conveyor is not mentioned in document WO2011/078779 and not displayed in the Figures, but without it the device cannot function. Moreover the picture of 600kW reactor which was published recently on official web site of patent application owner (www.cassandraoil.com) confirms that this emptying conveyor is also part of the whole arrangement (see pictures further).

All parts which are to be moved aside, means reactor parts **7** and **6a**, both feeding conveyors with drivers and inlet material hoppers, the emptying conveyor with driver and the process powder collector/hopper are installed on special carriage/carriages equipped with wheels moveable on rails.

When screws joining the circular flange which connects the fixed and removable cylindrical part of the reactor chamber are released and removed and simultaneously all moveable conveyors with accessories are pushed aside **then** the vanes and inners of reactor chamber are accessible.



Picture 3 - R&D Cassandra Oil Reactor (source www.cassandraoil.com)

- a – thermal insulation joining (coaxial) line to be disassembled
- b – whole insulation from reactor chamber shall be removed
- c – all parts to be pushed aside (red arrows)



Picture 4 - 600 kW Cassandra Oil Reactor (source www.cassandraoil.com)

- a – thermal insulation joining (radial) line to be disassembled
- b – part of reactor insulation to be removed away
- c – parts of the reactor and connected machinery to be pushed aside (red arrows)

The installation of the new vanes/hammers in the case of bigger devices would be quite difficult. Removing of insulation, dismantle of greater number of bolt/screws from the circular flanges of reactor chamber joining fixed and removable parts of chamber and manipulation with greater amount of mass/steel is needed. The dismantling works can take an hour or some hours, while back installation will take even longer.

I claim that the problem that is supposedly being solved by the invention contained in the application WO2011/078779 does not exist and the solution of it with described technique is not improving anything/ not being an improvement.

Actually, it is worsening the existing solution. This claim does not apply only to the issue of access to the vanes/hammers and inner parts of the reactor, it also applies to the entire construction/design of the reactor's concept. That is because the construction suggests the 'hung' rotor without any support on one of the ends with the heavy rotor (carrying vanes/hammers) construction placed on the end which remains unsupported. The consequence of such construction is a huge bending moment of the shaft, resulting in significantly heavier and stronger rotor and bearings construction, what is a more expensive and more complicated variant of our patented device.

Our exerted construction of reactor (WO1998/039368) brings simpler, more logical, cheaper, attested, working and reliable solution.

3. Wording and Claims of Patent Application WO2011/078779

3.1. General notes to the application

How will the goals, contributions and advantages of the invention, which are described in the introduction of the application, be achieved (***to provide a reactor that, with a minimum of dismantling work, allows access to the rotor including occurring vanes for service and/or ...***) is not discussed further in the description of the invention, nor is it adequately explained.

In the part 'Description of Embodiments', page 4, it is stated that some parts of the reactor (lid **7**, part **6a** of the reactor chamber housing) are supposedly easy to dismantle and allow the access to the inner parts of the reactor. However, there is no explanation/documentation as to how these modifications improve the technology in comparison to our existing patented technology.

The access to the inner part of the reactor via the maintenance opening (see Pictures 1. and 2.) which is the technique we have used for 10 years, is the simplest, fastest and cheapest

way of achieving the goal stated in the application. In other words, the construction of the reactor, according to the application, evidently does not bring a better solution than the one we are using for years. With regard to the aforementioned analysis, in part 2.2.1. and 2.2.2., it can be said, that the technical solution does not lead to the described goals. The claimed solution to be an improvement is factually being worsened.

Another weakness of the document is the fact that there is no example of realization of the technical solution according to the application.

On page 6 of application, there is a 15-line-long brief description and explanation of how the reactor can be used. The whole text is brief, chaotic, unclear and inaccurate abridgment/extract from the part 'process and method' of US patent 6.165.349 (and D1-D9). How, what for and why this reactor is being used, or could be used and what are its advantages (during usage) remains unclear and hidden. To explain such complicated manner on 15 lines only is nevertheless, impossible.

Most of the text is focused on the description of the mechanical construction of the rotating machine. In variables stated details of the technical solution are general, not new or original, and are simply a technical result of the chosen concept of the rotating machine with the rotor without support on one side of the shaft. Such (general) solutions can be draughted and developed by any construction office.

3.2. Serious (theoretical) mistakes of the application

An interesting fact is the repeating, elementary wrong explanation of the creation/generation and effect of the force **F2** (Fig. 4) which is stated on page 2, line 33; page 5, line 12 and in patent claim 23 (page 9, line 29). It says in the application, that in relation with operation of the reactor, force **F2** arises, which is proportional to:

- (i) *a mass (m) of said articulated part (4b) of the hammer (4),*
- (ii) *a perpendicular distance (I1) between said first radius (r1) and said axis of rotation (14), and*
- (iii) *a speed of rotation (v1) squared of said centre of gravity (15), as well as inversely proportional to*
- (iv) *an effective length (I2) of the hammer (4), and*
- (v) *a radius (r1) from the centre of said rotor to said centre of gravity (15).*

The aforementioned statement about the creation of force **F2** has no support in Newton laws of generation/creation and effect of forces and of dynamics of mass point. The

aforementioned statement is in fact contrary to these laws. In other words, it is principally wrong.

Force **F2** which has an effect in the rotating direction of the vane/hammer is being created solely as a reaction to the resistance of the environment (mixed material) which has effect as force **F2'** against the rotating direction of vane/hammer. In case, that the chamber of the reactor will be empty, what means the resistance of the mixed material will not exist; force **F2** will not be created ($F2=0$). That is despite the fact that the rotor will be rotating, irrespectively of its speed.

However, the application of the invention states something different. The resistance of mixed material is not taken into account, better said this resistance is not mentioned and force **F2** will according to it exist even if the reactor will be empty.

In reality, force **F2** will be as high as the size of the mixing surface of vanes/hammers **s**, while only the part of hammer/vane which is actually dipped in the mixed material is relevant. Furthermore it is as high as the specific coefficient of the resistance of the mixed material **k_R** and the speed of the (circular) movement of vane/hammer **v**. In order to overcome the resistance **F2'** and keep the rotation of vane/hammer in mixed environment by constant speed, torque **M_T** will be necessary. **M_T** is need to be as high as the multiplication of force **F2** and rotating radius **r2** (Fig 4). It is well-known that the magnitude of force **F2** is the same as magnitude of force **F2'** (action-reaction equilibrium). Since the movement of vanes/hammers is steady on the circle it is possible to summarize the most important aspects which do have impact on the creation and magnitude of force **F2**:

- a) resistance of the environment in which vane/hammer is moving and which is depending upon the properties and amount of the mixed material
- b) the size of the dipped surface of vane/hammers which is in contact with the mixed material
- c) the speed of the movement of vane/hammer, which in the case of circular movement can be expressed by radius of the rotation and revolutions per time unit.

In other words, force **F2** with which vane/hammer effect on the mixed material can be expressed from the torque **M_T**. Torque **M_T** is proportional (function of) to the size of the dipped surface of vane/hammer **s**, to the specific coefficient of the resistance of mixed material **k_R**, radius of rotation **r** (radius **r** is the distance between axis of rotation of the rotor and geometric centre of the dipped part of vane/hammer) and to the speed of rotation of the vane **v**.

Force **F2** is not dependent upon or proportional to the weight (**m**) of the articulated/swinging part of the hammer (4b), not dependent upon the 'effective' length of

the moving part of the hammer (**I2**), not dependent upon the distance (**r1**) centre of gravity of moving part of hammer from the axis of rotation – rotor. Force **F2** is not quadratic function of speed (**v1**) of rotation of the moving part of hammer.

All statements included in application of patent (i, ii, iii, iv, v) about the creation of force **F2** are wrong and erroneous. In no case do these statements and derived patent claims describe the real physical – force/power relations on vane/hammer of the reactor rotor, which is the subject of the patent application.

Accordingly, the following statement on page 5, line 25 is likewise wrong and erroneous; „...*a desired power per hammer can be calculated and set by predetermining the parameters listed above.*” The input power necessary for motion of vane/hammer in mixed material is not possible to calculate from the parameters stated in application of the patent (i, ii, iii, iv, v), taking into account the aforementioned.

3.3. Patent claims

3.3.1. Claim No. 1

The first patent claim as the key and fundamental one, is describing in other words the housing - reactor chamber according to the patent claims 14a, 14b; stated in the US patent no. 6.165.349 (and D1-D9). The common and identical features of this patent and the application are:

- a) reactor chamber with the rotor
- b) inlet and outlet openings for raw materials and products
- c) rotor with shaft which is in the reactor chamber

The fictitious innovation of the claim no. 1 is the extension of the shaft (solely) on one of its ends and its extends from the chamber of the reactor from only one front/side of the chamber of the reactor. Besides the disadvantage of such construction (see aforementioned part 2.2.2), it is nevertheless only a variation of rotor of the reactor which is described in patent claim no. 14 and 15 in the US patent 6.165.349. Here, it is not stated how the shaft of the rotor goes from the reactor's chamber to the outside environment and how the shaft is attached in bearings and how the sealing of the chamber of reactor is solved technically. From the principal description of the reactor, it is a subordinate/secondary technical detail, which has no influence on the function of the described reactor. That is why it is not described, nor claimed in the patent claims 6.165.349 any further.

3.3.2. Claims No. 2, 3, 4, 5, 6 and 7

Patent claims 2, 3, 4, 5, 6 and 7 describe/claim the construction solution of support device of the rotor shaft, which does not have support on both ends, but rather on one end only. Described construction of attachment of the rotor in two bearings which are fixed on a shared base, in not new or original, it is solely a logical result of the chosen concept.

3.3.3. Claim No. 8

Patent claim no. 8 describes/claims the characteristic of the chamber/house of the reactor which is identical with the characteristic of the chamber of the reactor stated in the patent claim 14a (US patent no. 6.165.349). A common characteristic of the patent and the application is cylindrical reactor chamber. Because of this, the claim is not new.

3.3.4. Claims No. 9, 10 and 11

Patent claims no. 9, 10 and 11 state, that the parts of reactor's chamber are dismountable. In technical praxis, it is regular and natural to design the construction of the machine in such way that enables the user to dismantle the parts of it. To design a demountable chamber of a reactor and its main parts is not innovative in any way.

3.3.5. Claim No. 12

Patent claim no. 12 describes/claims the chamber/house of the reactor, which is sealed against the external environment. A fundamental, general condition of operation of machines and devices (in chemical industry) is to hinder/prevent the escape of harming and dangerous substances to the external, ambient environment (to the air). Consequently, there is a request for tightness of the devices. Because of this, this patent claim is useless and inappropriate. The chamber must be tight/sealad against the external environment, as a result of the general claims for the safe, ecological and economic operation of machines and devices.

3.3.6. Claims No. 13, 14, 15, 16, 17 and 18

Patent claims 13, 14, 15, 16, 17 and 18 describe/claim the possible technical/constructional solution of the attachment/support of the remainder part of the chamber (housing) of the reactor on the stand/support of the rotor shaft. They are only a natural consequence of the chosen construction of the reactor.

3.3.7. Claims No. 19, 20 and 21

Patent claims 19, 20 and 21 describe/claim the construction of the rotor of the reactor on which there is at least one (!) hammer/vanes, whilst the hammer/vane comprises of articulated and fixed part. The fixed part of the vane is attached to the shaft of the rotor. Beside the fact that the device will not be working with one (nor two, three, ten) hammer/vane, these claims are merely describing the rotor of the reactor according to

patent claims 14a, 14b, 15 and 20 stated in US patent no. 6.165.349. See the comment on Figures in part **3.4**. Common characteristics of the patent and the application are:

- a) vanes/hammers are a part of the rotor of the reactor (symmetrically arranged)
- b) functional parts of vanes/hammers are movingly, swingingly (on pin) attached to the fixed part which is attached to the shaft of the rotor
- c) vanes/hammers are constructed with the moving part (vane/hammer) and the fixed part (arm, disc).

The application only describes in other words the identical construction solution of the reactor's rotor, on which there are swingingly attached hammers/vanes to the disc (patent) or fixed part of the hammer (application).

3.3.8. Claims No. 22 and 23

Patent claim no. 22 is by an unclear description (Fig.4) formulated in a way it is to be difficult to understand it. In fact (together with Fig.4), it is again no more than a technical description of one of the possible technical solutions of the construction of the reactor which are described in detail in the US patent 6.165.349 on picture Fig. 2, 5, 6 and 8.

Patent claim no. 23 is following the claim no. 22 and describes/claims the creation of force F_2 . Claim no. 23 is physical nonsense which is contradictory with Newton's laws regarding the creation and effect of forces and regarding the dynamics of the mass point. As discussed in part 3.2, this claim is wrong on principle.

3.4. Comments regarding pictures included in the application

Figure 3 in the application WO2011/078779 is misleadingly showing the principal construction of the reactor. The reactor is in axial cut shown with one set/column of vanes/hammers attached to a reactor. Most of the reactor chamber is in coaxial direction empty. The reactor is not functioning in the displayed way. One set/column of vanes/hammers is not sufficient for mixing the content of the chamber of the reactor and/or to create a reaction environment. The correct picture should include all hammers/vanes **4** along the whole cylindrical wall/part of chamber **6a**. From such complete and complex picture would be apparent, however, that it is in fact the same reactor which is displayed in the US patent 6.165.349 on the picture Fig. 7.

Figure 4 in the application WO2011/078779 which displays the radial cut of the rotor in the reactor's chamber is only one of the possible concrete technical solutions of the rotor displayed in the US patent 6.165.349 on pictures Fig. 2, 5, 6 and 8.

4. Conclusion

We believe that the technical solution published in the application WO2011/078779 does not meet the criteria for patent award, for these reasons:

The described device in comparison with the current state of the technique does not bring any advantages - improvements, in contrast, it brings the degradation both in regard of the complexity and cost (price) of the production of the reactor and in regard of the operation but mostly in regard of the maintenance (more time consuming and higher expenses).

The application of the patent includes in its descriptive part as well as in the patent claims theoretic mistakes, which are conflicting with the most basic and fundamental laws of nature in terms of mechanics (kinematics and dynamics) of the solid matters.

Technical solutions of the reactor stated in the patent application are one of the possible construction variations of the reactor, which is generally described in patent claims, the US patent 6.165.349, i.e. documents D1-D9.

Ivan Maďar

Bratislava, February 12th 2013