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Attorneys for Plaintiff Earle Refining, LLC

UNITED STATES DISTRICT COURT
DISTRICT OF NEW JERSEY

EARLE REFINING, LLC, Plaintiff, vs.	:	Civil Action No. Jury Trial Demanded
NEW VACUUM TECHNOLOGIES LLC and NORTH JERSEY PETROLEUM OPERATIONS, LLC, Defendants.	:	**COMPLAINT FOR INFRINGEMENT OF UNITED STATES PATENT NO. 10,053,635**

Plaintiff Earle Refining, LLC ("Earle"), having an address at 1800 Route 34, Wall, New Jersey, by and through its undersigned attorneys, files this Complaint for Patent Infringement against Defendants New Vacuum Technologies LLC, of unknown address ("NVT") and North Jersey Petroleum Operations, LLC, f/k/a New Jersey Petroleum Partners LLC ("NJPO"), 534 South Front Street, Elizabeth, New Jersey 07722 (collectively, "Defendants"), and avers as follows:

THE PARTIES

1. Plaintiff Earle is a New Jersey limited liability company with its principal place of business at 1800 Route 34, Wall, New Jersey.

2. On information and belief, Defendant NVT is a limited liability company organized and existing under the laws of Delaware, with a facility in southern New Jersey, and a registered agent, Corporation Service Company, having a place of business at 251 Little Falls Drive, Wilmington, Delaware 19808.

3. Defendant NJPO is a limited liability company organized and existing under the laws of New Jersey, with a place of business at 534 South Front Street, Elizabeth, New Jersey 07722.

JURISDICTION AND VENUE

4. This action arises under the patent laws of the United States of America, 35 U.S.C. §§ 100 *et seq.*, including §§ 271 and 281−85.

5. This Court has subject matter jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338.

6. On information and belief, NJPO has an oil treatment facility in northern New Jersey for increasing the value and quality of low-grade petroleum, and NVT installed and tested this technology in a prototype plant in southern New Jersey (collectively, the "Infringing Processes"). This Court has personal jurisdiction over Defendants because, on information and belief, these acts of Defendants constitute patent infringement that occurred and continue to occur within this District.

7. Venue is proper in this Court as to Defendant NVT under 28 U.S.C. § 1400(b) because it has a regular and established place of business in this District and has committed acts of infringement in this District.

8. Venue is proper in this Court as to Defendant NJPO under 28 U.S.C. § 1400(b) because it has a regular and established place of business in this District and has committed acts of infringement in this District.

GENERAL ALLEGATIONS

The '635 Patent

9. Earle is the owner of United States Patent No. 10,053,635 entitled "Method for the treatment of a liquid, in particular a mineral oil," which duly and legally issued on August 21, 2018 (hereinafter "the '635 Patent"). True and correct copies of the '635 Patent, and the Patent Office record of assignment to Earle, are attached hereto as Exhibits 1 and 2, respectively.

10. Earle purchased the '635 Patent from non-party Pristec AG, formerly an Austrian corporation, pursuant to a Patent Purchase Agreement dated July 3, 2019.

11. Following Earle's purchase of the '635 Patent, Pristec AG's creditors commenced insolvency proceedings against Pristec AG in Austria Commercial Court, Vienna, under Index No. AZ 38 S 64/20v.

12. The Austrian bankruptcy administrator auctioned off Pristec AG's assets, including all of its intellectual property, fixed assets, and legal claims.

13. The bid of RedMax GmbH & Co KG, an Austrian corporation, was accepted at the auction and RedMax and the Austrian bankruptcy administrator entered into a notarized purchase agreement dated July 26, 2021.

14. Following RedMax's purchase of Pristec AG's assets, rights, and claims, RedMax and Earle entered into a Cooperation Agreement dated October 7, 2021 pursuant to which RedMax, among other things, waived all rights to challenge the Earle-Pristec AG patent sale, and confirmed that Earle has "the exclusive rights in the technology in the US and RedMax shall have exclusive rights worldwide (except in the US) . . ." RedMax also agreed that Earle owned the '635 Patent and assigned all rights or claims it obtained from the Pristec AG bankrupt estate in such patent to Earle.

15. The '635 Patent pertains to a technology that can increase the portion of low-boiling fractions in petroleum products using pressure waves with particular frequencies.

16. The '635 Patent is presumed to be valid.

The Strong Evidence of Infringement

17. By press release dated November 30, 2021, CMG Holdings Group, Inc. ("CMG") disclosed a joint venture with New Jersey Petroleum Partners ("NJPP") with regard to Magnetic Vacuum Upgrading (MVU) technology for refining crude oil. NJPP is the prior name of Defendant NJPO. The press release disclosed that NJPP (now NJPO) has an oil treatment facility in northern New Jersey for increasing the value and quality of low-grade petroleum. A true and correct copy of the November 30, 2021 press release is attached as Exhibit 3.

18. The November 30, 2021 press release also disclosed that the MVU technology was owned by NVT.

19. The November 30, 2021 press release also disclosed that the process being used was subject to a pending patent application, and that "NVT successfully installed and tested its MVU technology at a prototype plant in Southern New Jersey during the fall of 2020." The press release also disclosed that there was a "processing facility currently being used by NVT."

20. Prior to the November 30, 2021 press release, on February 18, 2020, NVT LLC had filed United States Patent Application No. 16/793,273 entitled "System and method for cold cracking under a condition of modified density of physical vacuum," which was published as US20200325402A1 on October 15, 2020 (hereinafter "the '402 Publication"). A true and correct copy of the '402 Publication is attached hereto as Exhibit 4.

21. On information and belief, the '402 Publication is the patent application referenced in the November 2021 press release.

22. The '402 Publication discloses a process that, on information and belief, would infringe multiple claims of the '635 Patent. A claim chart comparing the disclosures in the '402 Publication with independent claims 1 and 6 of the '635 Patent is attached as Exhibit 5.

23. The '402 Publication shares two named inventors in common with the '635 Patent, Messrs. Chernikov and Delgado Castillo. On information and belief, Messrs. Chernikov and Delgado Castillo were involved with the Infringing Processes of both Defendants, and at the time of creation of the Infringing Processes both Messrs. Chernikov and Delgado Castillo were well-aware of the '635 Patent and the benefits of its claimed technology.

24. On information and belief, between 2008 and 2018, Messrs. Chernikov and Delgado Castillo worked for Austrian company Pristec AG, the original owner of the '635 Patent, in research and development, and both helped to develop not only the technology of the '635 Patent, but a method to combine the phenomena of resonance technology with vacuum resonance. This approach, using the '635 technology in combination with vacuum resonance, is described in the '402 Publication.

25. The third named inventor of the '402 Publication, Joseph Laura, is the owner, Chairman, Chief Executive Officer, and Managing Director of Pristec America, Inc. (Nevada), a

prior exclusive licensee of the ‘635 Patent in the United States. On information and belief, Mr. Laura was also involved with the Infringing Processes of both Defendants, and at the time of creation of those Infringing Processes he was well-aware of the ‘635 Patent and the benefits of its claimed technology.

26. An earlier press release dated August 26, 2021 (a true and correct copy of which is attached as Exhibit 6), confirmed the Infringing Process was “a multi-patent procedure” and that the “commercial adaption of” this technology was “very close.” On information and belief, the patent rights referenced in this press release included the ‘635 Patent. Thus, on information and belief, this press release was an admission that the ‘635 Patent covered this technology.

27. In another press release dated February 7, 2022 (a true and correct copy of which is attached as Exhibit 7), it was reported that the technology was “just about ready to go commercial.”

28. On April 22, 2022, CMG posted on Twitter regarding its “oil venture.” CMG disclosed its “strategic decision to locate the business to the terminal in southern NJ” and that July 2022 was “a more realistic start date for” the oil project. A true and correct copy of the Twitter post is attached as Exhibit 8. On information and belief, for any July date to go commercial, the process would have been tested significantly ahead of that date, thereby infringing the ‘635 Patent.

The Defendants Do Not Dispute Infringement

29. Prior to bringing this lawsuit, Earle made multiple contacts with Defendants, advising them of the infringement evidence and giving them the opportunity to provide proofs, if any, that they did not infringe. Earle’s many contacts were repeatedly ignored, and no substantive response was ever provided.

30. On May 13, 2022, Earle's counsel electronically transmitted a letter ("the May 13 Infringement Letter") to Mr. Stephen P. Katz, who was then identified as a board member of a known subsidiary of NVT, New Vacuum Technologies USA LLC ("NVT USA"). The May 13 Infringement Letter provided strong evidence of infringement and requested that, no later than June 1, 2022, NVT USA either (1) immediately cease and desist infringement of the '635 Patent and provide proofs thereof; or (2) provide sufficient evidence that the infringement never occurred. The letter was also sent by Federal Express to the registered service agent of NVT USA, Corporation Services Company. A true and correct copy of the letter, without exhibits (as they are already exhibits to this Complaint), is attached as Exhibit 9.

31. By email on May 13, 2022, Mr. Katz responded that he was not a board member of "New Vacuum technologies." Mr. Katz did not respond to a reply email that same day asking for a contact at NVT, a true and correct copy of which is attached as Exhibit 10.

32. On information and belief, personnel associated with both Defendants, including Mr. Laura and Laura's counsel Kevin O'Connor of the law firm Peckar & Abramson P.C., received the May 13 Infringement Letter on or about May 13, 2022.

33. Although the May 13 Infringement Letter requested a response by June 1, 2022, no response was provided.

34. On June 10, 2022, counsel for Earle emailed a copy of the May 13 Letter to Mr. O'Connor. A true and correct copy of the June 10, 2022 email is attached as Exhibit 11. Mr. O'Connor was known to represent Mr. Laura and his related companies in connection with other ongoing disputes.

35. The June 10 email asked Mr. O'Connor to advise if he did not represent Mr. Laura and his companies (including the NVT companies and NJPO) in connection with the issue

of infringement of the ‘635 Patent, and it expressed the assumption that Mr. O’Connor, with Mr. Laura and his entities, had been aware of the May 13 Infringement Letter for about four weeks at the time. The June 10 email also asked for a prompt substantive response to the May 13 Infringement Letter. Mr. O’Connor never responded to the June 10 email or disputed the assumptions therein.

36. On June 21, having received no response from Mr. O’Connor, counsel for Earle made a telephone call to Mr. O’Connor, and were told that Mr. O’Connor was on the phone, but the message would be provided to Mr. O’Connor.

37. Later on June 21, counsel for Earle sent a follow up email to Mr. O’Connor, confirming the call to his office and asking to arrange a time to speak. A true and correct copy of the June 21 email is attached as Exhibit 12. According to the email: “Can we please set up a time tomorrow for a call? We are interested in amicably discussing the situation and, if there are any responses to our infringement claims, we would like to hear them. If we do not hear from you by COB on June 23, we will assume that you are not representing any of Mr. Laura, NVT USA, NVT LLC, NVT of New Jersey, or NJPP in connection with this infringement issue, and we will proceed to contact them directly.”

38. Mr. O’Connor never responded to the June 21 email.

39. On June 24, counsel for Earle sent a letter by Federal Express directly to the Defendants, with copies by Federal Express to the home of Mr. Laura and Mr. O’Connor (a true and correct copy of which is attached as Exhibit 13). The letter informed the recipients that they should immediately forward the letter to their counsel if they were represented, it enclosed the prior correspondence, and provided in part: “As it has now been six weeks without response to any of our correspondence, we are coming to the conclusion that the NVT companies and NJPO

do not intend to respond to any of our inquiries. While we respect your right to make that decision, we ask that you please reconsider and provide substantive responses to our inquiries within the next ten calendar days."

40. No response was provided to the June 24 letter from any entity.

41. On information and belief, no substantive or other response was provided to any of the foregoing correspondence, at least in part, because there is no reasonable basis to dispute that the Infringing Processes employ the inventions described and claimed in the '635 Patent.

COUNT I: Patent Infringement of the '635 Patent, 35 U.S.C. §§ 100 *et seq.*

42. Earle realleges and incorporates by reference paragraphs 1 to 41 above as if fully set forth herein.

43. At all times herein mentioned, the '635 Patent was and is valid and fully enforceable.

44. On information and belief, NVT and NJPO have and continue to directly infringe one or more claims of the '635 Patent, at least by using the technology claimed the '635 Patent within New Jersey.

45. For at least the reasons stated herein, NVT and NJPO's acts of infringement of the '635 Patent have been and continue to be willful and deliberate.

46. At no time has Earle granted either Defendant permission to utilize the technology claimed in the '635 Patent.

47. Defendants' infringement of the '635 Patent has injured Earle, and Earle is entitled to recover damages adequate to compensate for such infringement.

48. Defendants' infringement of the '635 Patent has irreparably harmed Earle and will continue to injure Earle, unless and until this Court enters an injunction prohibiting

Defendants from committing further acts of infringement by enjoining the further use of the technology claimed in the ‘635 Patent.

PRAYER FOR RELIEF

WHEREFORE, Earle prays for judgment as follows:

A. For an order finding that the ‘635 Patent is valid and enforceable;

B. For an order finding that Defendants have infringed the ‘635 Patent in violation of 35 U.S.C. § 271;

C. For an order temporarily, preliminarily and permanently enjoining Defendants, their officers, directors, agents, servants, affiliates, employees, subsidiaries, divisions, branches, parents, attorneys, representatives, privies, and all others acting in concert or participation with any of them, from infringing the ‘635 Patent;

D. For compensatory damages in an amount to be proven at trial;

E. For an order finding that Defendants’ conduct alleged herein was willful and intentional and in conscious disregard of Earle’s rights, and awarding Earle triple damages due to willful infringement;

F. For an order declaring this case exceptional and awarding Earle all fees and costs; and

G. For such other and further relief as the Court may deem just and proper.

Respectfully submitted,

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By: s/ Katherine M. Lieb
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Attorneys for Plaintiff Earle Refining, LLC

Dated: July 7, 2022

DEMAND FOR JURY TRIAL

Earle demands trial by jury on all issues so triable.

Respectfully submitted,

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Attorneys for Plaintiff Earle Refining, LLC

Dated: July 7, 2022

CERTIFICATION PURSUANT TO LOCAL CIVIL RULE 11.2

Pursuant to Local Civil Rule 11.2, I hereby certify to the best of my knowledge, information and belief that the matter in controversy is not the subject of any other action pending in any court or administrative proceeding. Earle Refining LLC ("Earle") states that it is a party to an arbitration styled, *Pristec Refining Technologies USA, LLC, et al. v. Pristec America, Inc. (Nevada), et al.*, American Arbitration Association, Case No. 01-22-0000-7497 (the "Arbitration"). The Arbitration involves various claims against Joseph Laura, who is believed to be the principal of defendants New Vacuum Technologies LLC and North Jersey Petroleum Operations LLC (the "Defendants"), along with other entities controlled by Mr. Laura. Mr. Laura has asserted a counterclaim in the Arbitration that the sale of the '635 Patent to Earle was invalid under Austrian law. The Arbitration does not involve the pending claims for infringement, nor are the Defendants to this action parties to the Arbitration.

I certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements made by me are willfully false, I am subject to punishment.

Respectfully submitted,

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Attorneys for Plaintiff Earle Refining, LLC

Dated July 7, 2022

EXHIBIT 1

US010053635B2

(12) **United States Patent**
Castillo et al.

(10) **Patent No.: US 10,053,635 B2**
(45) **Date of Patent: Aug. 21, 2018**

(54) **METHOD FOR THE TREATMENT OF A LIQUID, IN PARTICULAR A MINERAL OIL**

(75) Inventors: **Jose Miguel Delgado Castillo**, Vienna (AT); **Anibal Luis Veneciano Rivera**, Vienna (AT); **Ruediger Uwe Nuerk**, Vienna (AT); **Fedor Chernikov**, RUS-Moscow (RU)

(73) Assignee: **PRISTEC AG**, Vienna (AT)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1098 days.

(21) Appl. No.: **13/640,932**

(22) PCT Filed: **Apr. 14, 2011**

(86) PCT No.: **PCT/AT2011/000184**
§ 371 (c)(1),
(2), (4) Date: **Nov. 15, 2012**

(87) PCT Pub. No.: **WO2011/127512**
PCT Pub. Date: **Oct. 20, 2011**

(65) **Prior Publication Data**

US 2013/0048486 A1 Feb. 28, 2013

(30) **Foreign Application Priority Data**

Apr. 14, 2010 (AT) .... A 596/2010
Apr. 14, 2010 (AT) .... A 597/2010

(51) **Int. Cl.**
C10G 15/00 (2006.01)
C10G 15/08 (2006.01)
C02F 1/36 (2006.01)

(52) **U.S. Cl.**
CPC ***C10G 15/08*** (2013.01); *C02F 1/36* (2013.01); *C10G 2300/805* (2013.01)

(58) **Field of Classification Search**
CPC C10G 9/24; C10G 15/00; C10G 15/08; C10G 15/10; C10G 15/12
(Continued)

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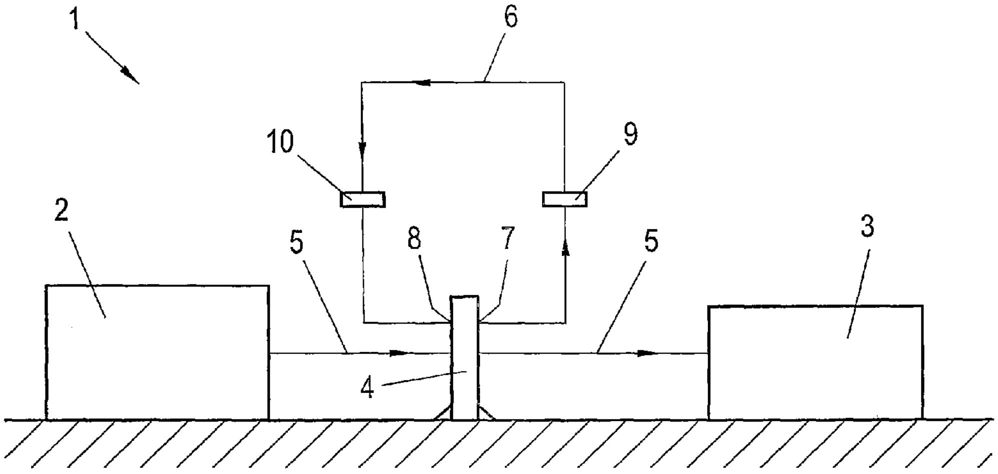
Primary Examiner — Michelle Stein
(74) *Attorney, Agent, or Firm* — Fitch, Even, Tabin & Flannery, LLP

(57) **ABSTRACT**

A method is disclosed for the treatment of a liquid, in particular a mineral oil, for increasing the portion of low-boiling fractions. The treatment comprises generating pressure waves having a first frequency, subjecting the liquid to said pressure waves in a region of application and feeding the so-treated liquid to a tank. At least one pipe flowed through by the treated liquid and immediately following said region of application is excited to oscillations of a second frequency, which is the resonance frequency of the excited system.

9 Claims, 5 Drawing Sheets



(58) **Field of Classification Search**
USPC 208/402
See application file for complete search history.

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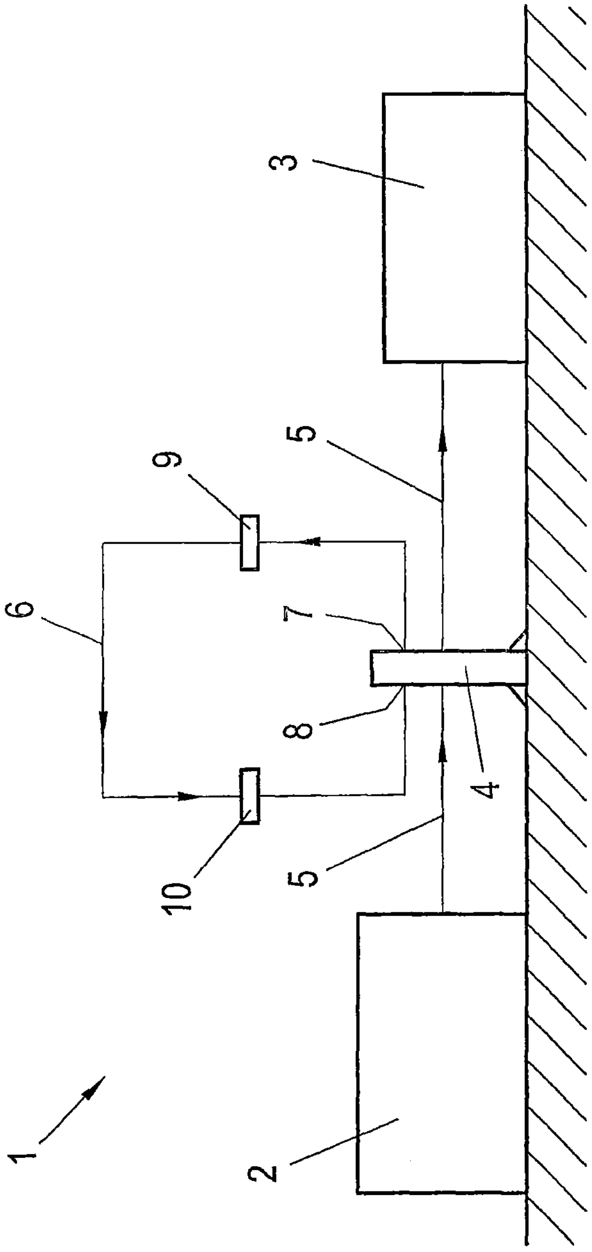


Fig. 1

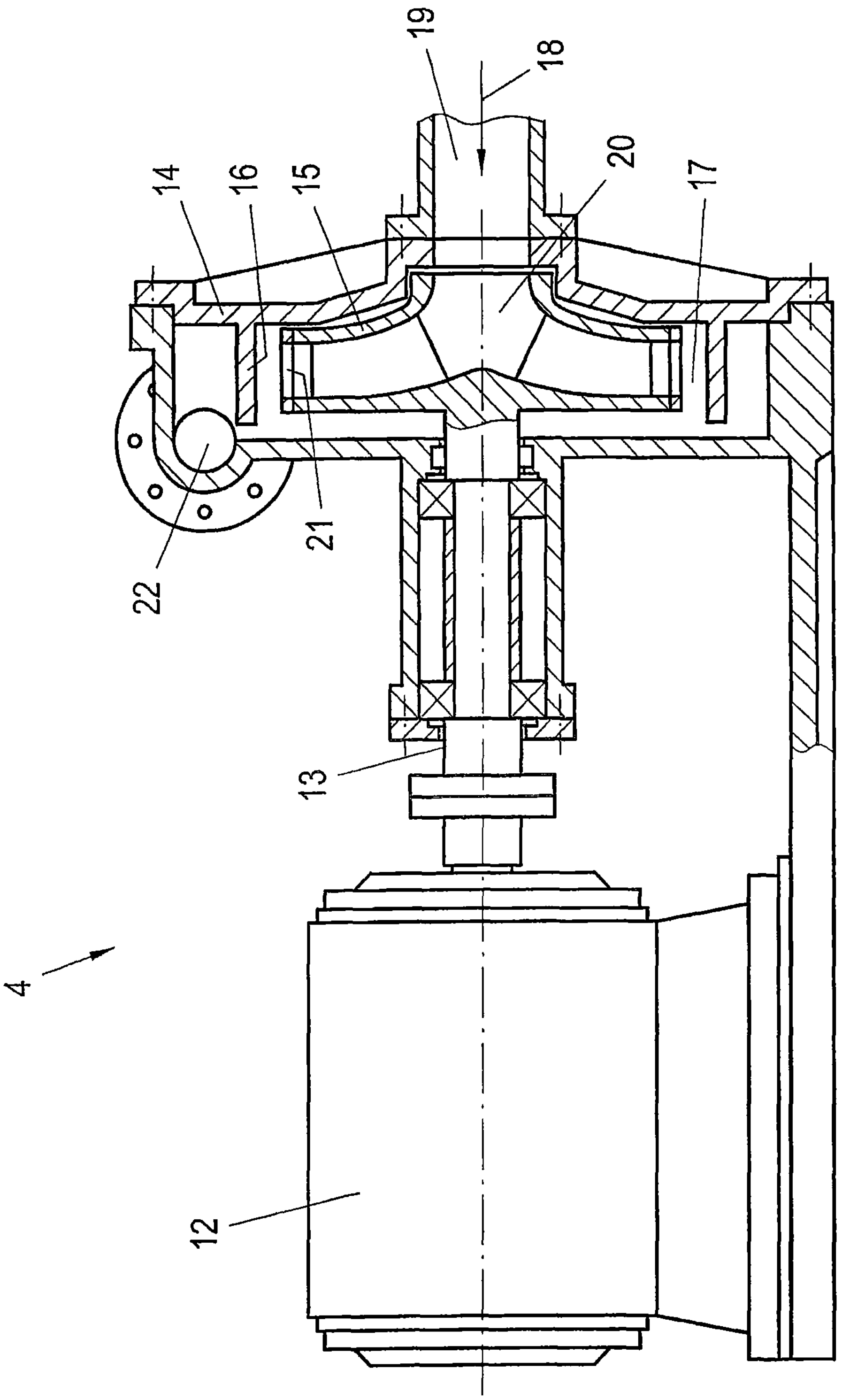


Fig. 2

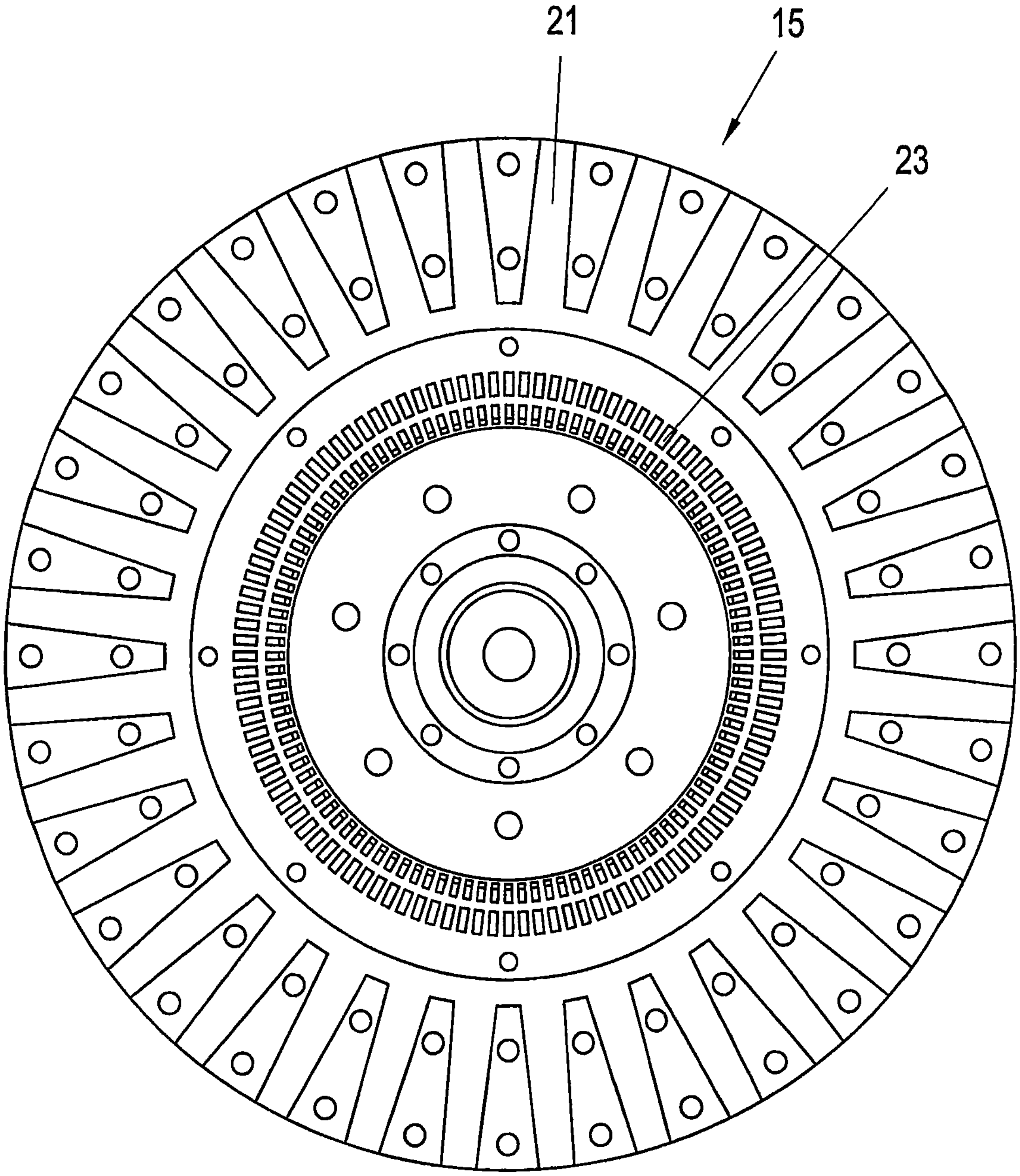
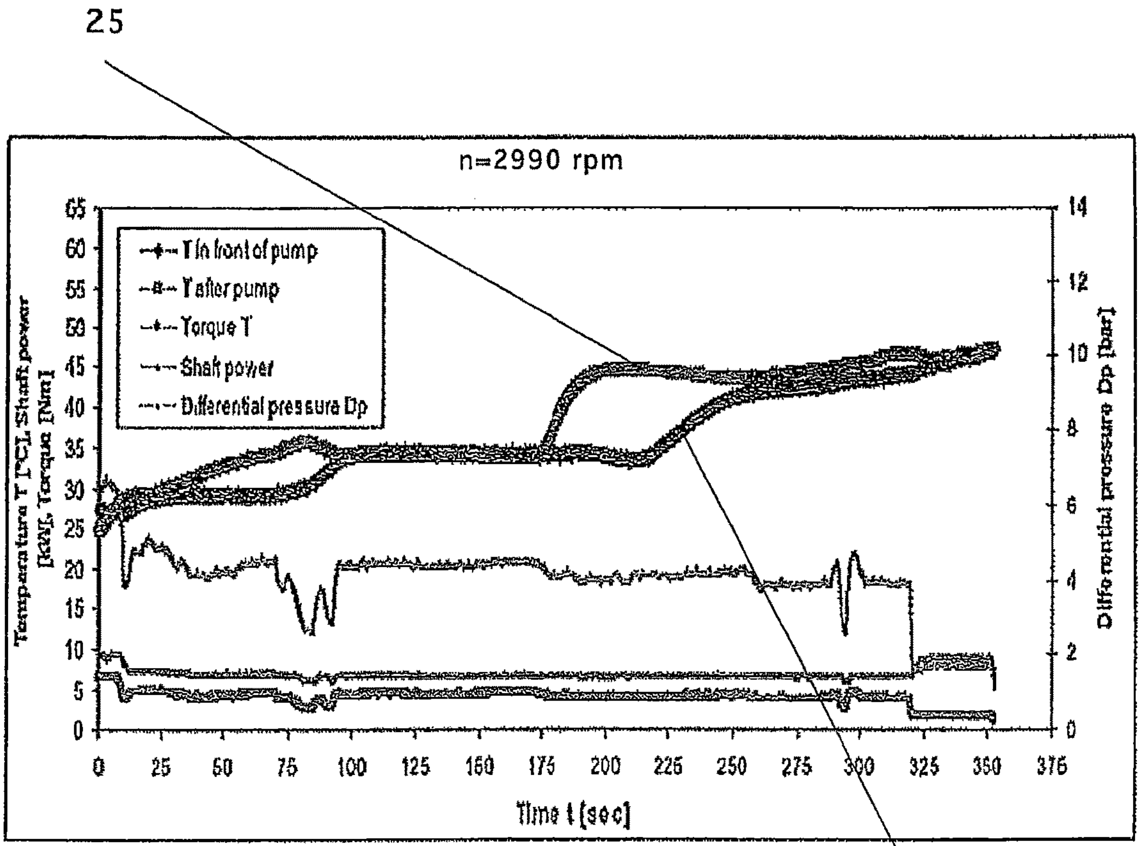


Fig. 3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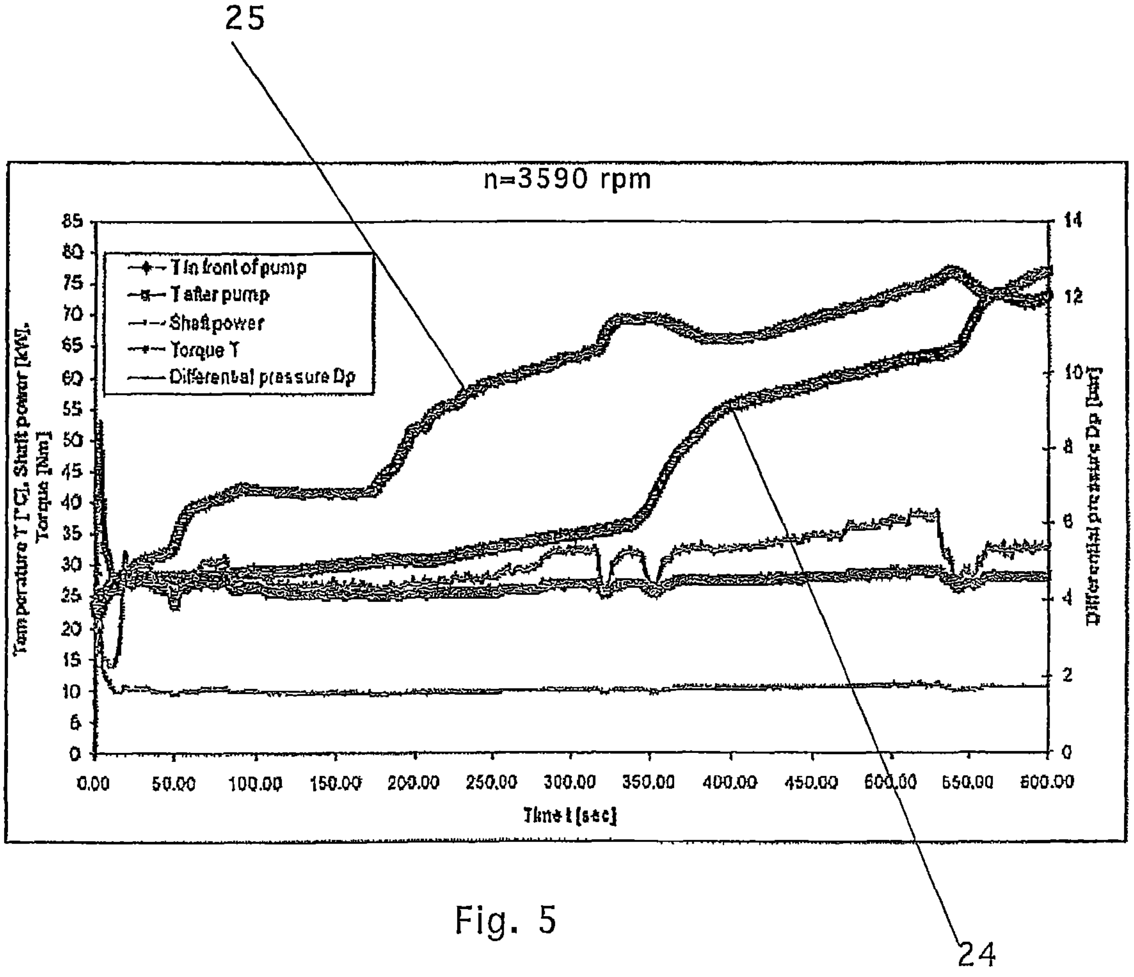
n=2990 rpm
T in front of pump
T after pump
Torque T
Shaft power
Differential pressure Dp
Temperature T [°C], Shaft power [kW], Torque [Nm]
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Differential pressure Dp [bar]
14
12
10
8
6
4
2
0
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
Time t [sec]
24

Fig. 4


25
n=3590 rpm
T in front of pump
T after pump
Shaft power
Torque T
Differential pressure Dp
Temperature T [°C], Shaft power [kW], Torque [Nm]
Differential pressure Dp [bar]
85
80
75
70
65
60
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12
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150.00
200.00
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350.00
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Time t [sec]
24

Fig. 5

METHOD FOR THE TREATMENT OF A LIQUID, IN PARTICULAR A MINERAL OIL

CROSS-REFERENCE TO RELATED APPLICATIONS

This Application is a U.S. National Stage Application filed under 35 U.S.C. § 371 of International Application PCT/AT2011/000184, filed Apr. 14, 2011, designating the United States, which claims priority from Austrian Patent Application A 596/2010, filed Apr. 14, 2010, and Austrian Patent Application A 597/2010, filed Apr. 14, 2010, the complete disclosures of which are hereby incorporated herein by reference in their entirety for all purposes.

The invention relates to a method for the treatment of a liquid, in particular a mineral oil, for increasing the portion of low-boiling fractions, wherein said treatment comprises generating pressure waves having a first frequency, subjecting the liquid to said pressure waves in a region of application and feeding the so-treated liquid to a tank. Further the invention relates to a method for adjusting the operating point of a pressure wave generator for treating a liquid.

Further, the invention relates to a device for the treatment of a liquid, in particular a mineral oil, for increasing the portion of low-boiling fractions, in particular for carrying out the inventive method, comprising a pressure wave generator for generating a pressure wave having a first frequency, said pressure wave generator being arranged to subject the liquid to said pressure waves in a region of application

A method of this kind and a corresponding device have become known for example from European patent application EP 1 260 266 A1 and serves to destabilize and brake up chemical bonds in liquids such as mineral oils and like substances in order to obtain an increased portion of short-chain and hence low-boiling fractions in the course of refining. For this purpose mechanical oscillation energy is brought into the liquid in the form of pressure waves which leads to a destruction of chemical bonds and hence to the chain-brake of long-chained, high-boiling molecule fractions. Although the molecular processes that actually occur are not yet completely understood, it is certain that with an appropriate treatment of crude oil and other mineral oils with pressure waves having a specific frequency the distillation profile is favourably shifted towards short-chain, low-boiling fractions so that the yield of high value products from crude oil and mineral oils can be increased. Currently it is assumed that due to the oscillation energy a resonance excitation occurs in the liquid with an appropriate choice of the oscillation frequency, which is responsible for said chain-break.

In EP 1 260 266 A1 a rotor is described as the source of mechanical oscillation, in which rotor the liquid to be treated is directed into a hollow of a rotatably mounted member in which the liquid flows radially outwards and from which the liquid is directed through radial openings in the rotor into an annular gap, the radial openings being arranged in an even manner on the outer surface of the rotor. By the fast rotation of the rotor the liquid in the gap is subjected to oscillating pressure waves having a frequency that is a function of the rotational speed and the number of openings on the outer surface of the rotor so that considerable energy quantities are brought into the liquid and the chemical bonds are destabilized or broken.

It is an object of the present invention to improve a method of the initially mentioned kind so that an even more effective pretreatment of the liquid is carried out in order to further increase the portion of low-boiling fractions. Furthermore it is an object of the present invention to provide a device for carrying out the method.

To solve this object the method of the initially mentioned kind according to the invention is devised such that at least one pipe flowed through by the treated liquid and immediately following said region of application is excited to oscillations of a second frequency, which is the resonance frequency of the excited system.

FIG. **1** illustrates a device for carrying out a present method for treating a liquid, for example mineral oil.

FIG. **2** illustrates a rotor which can be used in carrying out a present method.

FIG. **3** illustrates another embodiment of the rotor.

FIG. **4** shows test data and the temperature measured at a site upstream of the oscillator and at a site downstream of the oscillator.

FIG. **5** shows test data and the temperature measured at a site upstream of the oscillator and at a site downstream of the oscillator.

Departing from the above mentioned state of the art applicant has observed that an even more effective pretreatment of the liquid or an even further destabilization of the chemical bonds in the liquid occurs if, in addition to application of said pressure waves having the first frequency, the whole system, which consists of or comprises the pressure wave generator and the pipings leading to and leading away from the pressure wave generator and, of course, containing the liquid flowing through the system is excited to vibrations of a second frequency. This second frequency is a resonance frequency of the entire system, which frequency depends not only on the length, strength, weight and geometry of the pipings, in particular of the recirculation pipe, and all other appliances but also on the damping properties of the ground on which the installation is built. When it is succeeded in performing the application of pressure waves with a particular first frequency that is considered favorable and at the same time excite the whole system to vibrations of a second resonance frequency a particularly effective pretreatment of the liquid occurs and a particularly high portion of the desired low-boiling fractions is obtained in the subsequent distillation or rectification step. The resonance state of the overall system with said second frequency, however, does not in all cases occur offhand and the parameters of operations have to be kept within certain limits during the treatment in order to maintain a resonance state that has been achieved depending on the amounts of liquid to be treated being delivered through the pipings and the oscillator and its density and viscosity.

Preferably said pressure waves having the first frequency are brought into the liquid by the aid of a pressure wave generator connected with the liquid to be treated via flowed through pipings and the system consisting of the piping and, as the case may be, the pressure wave generator is excited to vibrations of the second frequency. The first frequency together with the second frequency act to destabilize chemical bonds in the liquid to be treated, which leads to a distillation profile, which is shifted towards low-boiling fractions of mineral oil.

In order to reliably achieve the resonance state, the method according to the invention is preferable devised such that a portion of the liquid is withdrawn after passing said region of application and before reaching the tank and that said withdrawn portion of the liquid is refed to said region of application via a recirculation pipe, the pressure in the recirculation pipe being adjusted by the aid of at least one adjustable throttle valve. In the inventive method the application of pressure waves having the first frequency is carried out at frequencies of oscillation known per se from the state of the art, wherein normally no resonance of the overall system occurs. However, by recirculating a portion of the liquid after it has passed the region of application of pressure waves and by varying the pressure in the recirculation pipe by the aid of at least one adjustable throttle valve, which leads to appropriate overpressures and underpressures at the site of withdrawal or the site of refeed, it is accomplished to vary the pressure waves emitted by the pressure wave generator into the overall system in such a way that a resonance of the overall system occurs which remains stable over a certain range of operation parameters as have been mentioned already above. In addition to the mentioned overpressures and underpressures it seems that also the actual pressure of the liquid within the pressure wave generator may be critical for establishing the resonance state, so that the at least one adjustable throttle valve can also be seen as a means to adjust the exact pressure in the pressure wave generator in order to achieve the resonance state. This particular pressure depends on various factors as already mentioned above. In the resonance state the throughput and the physical properties of the liquid to be treated can hence vary within certain limits without loosing the resonance state. Also in the resonance state refeeding of the liquid to be treated via the recirculation pipe can be discontinued or shut down. The inventive mode of operation is again necessary only when the resonance state has been lost due to overly important changes of the parameters of operation and this state has to be induced anew. On the other hand it can be useful to keep a certain flow through the recirculation pipe. As a consequence a part of the liquid to be treated passes the pressure wave generator several times thereby being subjected to the pressure waves of the first frequency not only once, which leads to an even more intense destabilization of the chemical bonds in the liquid.

The first frequency preferably is chosen in the region between 2 kHz and 150 kHz, in particular between 2 kHz and 20 kHz, which has been found as a range of frequency where destabilization of chemical bonds is maximum. The second frequency normally is different from the first frequency and may well be as high as 10^{15} Hz. According to a preferred embodiment of the present invention, the second frequency is applied to the excited system by the aid of an auxiliary oscillator. By the aid of the auxiliary oscillator the second frequency can be deliberately induced to the entire system in order to reliably and quickly achieve the resonance state.

In principle mechanical, electromechanical, piezoelectric and other acoustic emitters can be used as the pressure wave generator. According to a preferred embodiment of the present invention the method, however, is devised such that the pressure wave generator comprises a rotor flowed through by the liquid to be treated and mounted in a housing, whereby such rotors can also be seen in the mentioned state of the art according to EP 1 260 266 A1. A more detailed description is provided below.

In practice a mode of operation has turned out to be particularly preferable in which the pressure in the recirculation pipe is adjusted by the aid of two continuously adjustable throttle valves. The two continuously adjustable throttle valves are arranged in the direction of flow in the recirculation pipe consecutively so that the pressure in the recirculation pipe at the site of withdrawal after the pressure wave generator can be adjusted separately from the pressure at the site of refeed. This offers utmost properties of manipulation so that the resonance state can quickly be achieved by experienced personnel.

The inventive device for the treatment of a liquid, in particular a mineral oil, for increasing the portion of low-boiling fractions, in particular for carrying out the inventive method, comprises a pressure wave generator for generating a pressure wave having a first frequency, said pressure wave generator being arranged to subject the liquid to said pressure waves in a region of application, and is characterized in that at least one pipe is arranged to be flowed through by the treated liquid and arranged to immediately follow said region of application, wherein means for exciting said pipe to oscillations of a second frequency are provided, which is the resonance frequency of the excited system.

According to a preferred embodiment a recirculation pipe is provided for withdrawing a portion of the treated liquid downstream of the pressure wave generator at a site of withdrawal and for refeeding the treated liquid to the pressure wave generator at a site of refeed upstream of the pressure wave generator, whereby at least one adjustable throttle valve is arranged in the recirculation pipe for adjustment of pressure.

According to a preferred embodiment the device is further embodied such that the pressure wave generator is connected via flowed-through pipings with the liquid to be treated, in particular mineral oil.

Preferably the device is embodied such that the pressure wave generator takes the form of a rotor flowed through by the liquid to be treated and mounted in a housing, the rotor being mounted for rotation with its axle and is embodied as a disc with a ring-shaped wall, in which a plurality of openings is arranged at even distances from each other along the ring-shaped wall and a stator arranged coaxially to the rotor is mounted to form an annular gap between the stator and the ring-shaped wall of the rotor.

For some applications it can be useful to generate not only one first frequency but an additional frequency to destabilize chemical bonds that are generally not affected by the frequency generated by the interaction between the ring-shaped wall of the rotor and stator. To this end the invention is advantageously devised such that the rotor has a disc arranged coaxially with and inside the ring-shaped wall, the disc having a plurality of openings at even distances from each other. If desired the disc can additionally be mounted rotatably against the ring-shaped wall. In this case the disc and the ring-shaped wall of the rotor, by their relative rotatability form an additional system that acts just as the ring-shaped wall of the rotor and the stator. Either way, by choosing an appropriate distance between the evenly spaced openings on the disc a desired additional frequency can be generated. This additional frequency is not to be confused with the second frequency, which is the resonance frequency of the excited system.

An inventive method for adjusting the operating point of a pressure wave generator for treating a liquid, in particular a mineral oil with pressure waves of a first frequency for increasing the portion of low-boiling fractions in the liquid is carried out in that the pressure wave generator is communicated with a liquid, in particular water via flowed-through pipings and the frequency of application is varied and the operating point is determined as a maximum in temperature rise of the liquid after passing the pressure wave generator as a function of the frequency of application.

Applicant unexpectedly has made the observation that when the pressure wave generator is operated at a frequency that induces a sudden increase of the temperature of the water communicating with the pressure wave generator then also the actual treatment of the mineral oil is carried out particularly effective. Hence the inventive method affords an especially simple possibility of calibration of the pressure wave generator.

In Table 1 data are represented of test runs performed with crude oil and two different types of pressure wave generators. The values for density and API° represent the density of the crude oil. In addition to the viscosity of the sample, Wt % shows the portion of light, low-boiling fractions.

Line **1** shows the data for an untreated sample of crude oil. Lines **2** and **3** show that after treatment with two different types of pressure wave generators, Line **2** representing treatment with the rotor as described in FIG. **2** and line **3** representing treatment with the rotor described in FIG. **3**, a significant increase in the portion of light fractions of the mineral oil was obtained, so that from a sample of crude oil high-value fractions can be obtained.

TABLE 1

Description	Density (15° C.)	API°	Viscosity	Wt %
1 Reference sample (fresh crude)	0.9282	20.64	254.96	33.69
2 Treated sample with hydrogen activator	0.9187	22.37	121.79	46.98
3 Treated sample with carbon activator	0.8890	26.50	30.47	56.99

In the following the invention will be described in more detail in the drawing by way of a schematically illustrated embodiment.

In FIG. **1** a device for carrying out the inventive method for treating a liquid, for example a mineral oil is denoted by **1**. The device comprises a crude oil tank **2** and a product receptacle **3**. The crude oil or mineral oil is pumped or flows from the tank **2** into the receptacle **3** and in doing so passes a pressure wave generator or an oscillator **4**, for example in the form of a rotor. Corresponding pipings are denoted by **5**. For establishing the resonance state a recirculation pipe **6** is provided which withdraws a portion of the liquid at the site of withdrawal **7** from the oscillator and refeeds this portion of liquid to the oscillator at the site of refeed **8**. The pressure at the site of withdrawal **7** can be adjusted via an adjustable throttle valve **9**. Irrespective of the pressure drop at the adjustable throttle valve **9** the pressure can further be reduced over the adjustable throttle valve **10** in order to adjust a desired pressure at the site of refeed **8**. Depending on the throughput through the pipings **5** and the oscillator **4** and further depending on the physical properties of the conveyed liquid to be treated a propagation of pressure waves emitted by the oscillator **4** into the system of pipings **5** occurs with certain adjustments of the adjustable throttle valves **9** and **10** so that a resonance state is achieved in the whole system which causes the desired destabilization of the chemical bonds in the liquid to be treated.

In FIG. **2** a rotor is depicted which can be used for carrying out the inventive method. The oscillator **4** in addition to a drive **12** and an appropriate power transmission **13** comprises a rotor housing **14** and a rotor **15** that cooperates with a stator **16** mounted to the rotor housing **14**. Between the rotor **15** and the stator **16** an annular gap **17** is formed. The liquid to be treated is guided into an inlet opening **19** in the direction of arrow **18** and comes into the interior **20** of the rotor. Due to the centrifugal forces that occur with rotation of the rotor **15** the liquid to be treated in

the interior **20** is conveyed towards the stator **16** and can flow into the annular gap **17** via the openings **21** in the rotor **15**, the openings **21** being arranged at even distances along the circumference of the rotor **15**. The annular gap **17** in FIG. **2** is depicted very large in relation to the rotor **15** and in fact the gap between the rotor **15** and the stator **16** is only a few millimeters, so that in this region due to the rotation of the rotor **15** and the arrangement of the openings **21**, pressure waves having a certain frequency are produced so that a considerable energy amount is brought into the liquid to be treated for destabilizing the chemical bonds. The pretreated liquid can be withdrawn via an opening **22** and be conveyed into a product receptacle. The recirculation pipe is connected to the rotor housing **14** at appropriate sites, which in FIG. **1** are denoted by **7** and **8**. This kind of rotor is used particularly for destabilizing chemical bonds between neighboring carbon atoms in molecules contained in a liquid to be treated and the rotor of this type is hence termed “carbon activator”.

In FIG. **3** an alternative embodiment of the rotor **15** is depicted. On the rotor **15**, an additional disc **23** is mounted to the rotor **15** By this measure, an auxiliary frequency is generated that serves to destabilize chemical bonds that are generally unaffected by the frequency generated between the rotor **15** and the stator **16**. Both of these frequencies, however, are to be considered first frequencies within the terminology of this invention, since the second frequency is a resonance frequency of the entire system. This kind of rotor is used particularly for destabilizing chemical bonds between carbon atoms and hydrogen atoms in molecules contained in a liquid to be treated and the rotor of this type is hence termed “hydrogen activator”.

FIG. **4** shows data from a test run and the temperature measured at a site upstream of the oscillator is denoted by **24** and the temperature measured downstream of the oscillator is denoted by **25**. The rotary speed in the test run was fixed at 2990 rpm which brought about a maximum rise in the temperature of the water between the two curves after about 200 seconds of operation, the maximum temperature difference amounting to at about 10° C. In FIG. **5**, the same test equipment was run at 3590 rpm. Here, a maximum rise in the temperature of the water between the two curves occurred after about 300 seconds amounting to at about 35° C. These parameter of operations where hence determined to be optimum for the treatment of the mineral oil.

The invention claimed is:

1. A method for the treatment of a liquid consisting essentially of mineral oil to increase the portion of low-boiling fractions, wherein said treatment comprises

(a) feeding the liquid through an application region of a pressure wave generator so as to subject the liquid to pressure waves having a first frequency in the application region, wherein the pressure wave generator comprises a rotor mounted in a housing,

(b) withdrawing a portion of the liquid that was subjected to the first frequency in (a) before that portion of liquid reaches a tank for collection, and refeeding said withdrawn portion of liquid in a recirculation pipe so as to pass through said application region, and

adjusting the pressure of the withdrawn liquid in the recirculation pipe by the aid of at least one adjustable throttle valve as needed so as to achieve or maintain a resonance frequency of a system comprising the pressure wave generator and piping leading to and piping leading away from the pressure wave generator and the liquid contained therein,

whereby the resonance frequency of the system occurs at a second frequency, and wherein the liquid has a lower temperature of before (a) than after the resonance frequency is achieved or maintained; and

(c) collecting the thus treated liquid in the tank, the thus treated liquid having an increased portion of low-boiling fractions.

2. The method according to claim **1**, wherein the first frequency is chosen to be between 2 kHz and 20 kHz.

3. The method according to claim **1**, wherein the method further comprises attaining or maintaining resonance of the system at the second frequency by the aid of an auxiliary oscillator.

4. The method according to claim **1**, wherein in (b) the method further comprises adjusting pressure in the recirculation pipe by the aid of two continuously adjustable throttle valves.

5. The method according to claim **2**, wherein said second frequency, which is different than said first frequency, is up to 10^{15} Hz.

6. A method for the treatment of a liquid consisting essentially of mineral oil to increase the portion of low-boiling fractions, wherein said treatment comprises

(a) feeding the liquid through an application region of a pressure wave generator so as to subject the liquid to pressure waves having a first frequency in the application region;

(b) withdrawing a portion of the liquid treated in (a) before that portion of liquid is collected as treated liquid in (d), and recirculating the withdrawn liquid and refeeding said withdrawn liquid portion back through said application region of the pressure wave generator in (a),

(c) adjusting the pressure of the recirculating withdrawn portion of liquid in so as to attain or maintain a resonance frequency of a system comprising the pressure wave generator and piping leading to and piping leading away from the pressure wave generator and the liquid contained therein,

wherein the resonance frequency is at a second frequency that is different from the first frequency; and

(d) collecting the thus treated liquid, the thus treated liquid having an increased portion of low-boiling fractions.

7. The method according to claim **6**, wherein adjusting the pressure comprises throttling flow of the recirculating withdrawn portion of the liquid.

8. The method according to claim **7**, wherein the throttling is in sequential stages.

9. The method according to claim **7**, wherein, after withdrawing the portion of the liquid, the throttling in (c) includes

(i) an initial throttling stage comprising throttling the flow of the recirculating withdrawn portion of the liquid so as to adjust the pressure of the recirculating liquid being withdrawn from the application region, and

(ii) allowing the recirculating withdrawn portion of the liquid to flow to a subsequent throttling stage comprising throttling the flow of the recirculating withdrawn portion of the liquid again so as to adjust the pressure of the liquid being recirculated before refeeding the withdrawn portion of liquid back to said application region.

* * * * *

EXHIBIT 2

502130078 11/15/2012

PATENT ASSIGNMENT

Electronic Version v1.1
Stylesheet Version v1.1

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
Jose Miguel Delgado Castillo	11/05/2012
Anibal Luis Veneciano Rivera	11/05/2012
Ruediger Uwe Nuerk	11/05/2012
Fedor Chernikov	11/05/2012

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PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	13640932

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CH $40.00 13640932

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For inventions made outside USA
executed with or after application
Atty. Dkt.: **8529/101835**

USA Patent Appln.
Sole or Joint

NONPROVISIONAL **NONPROVISIONAL**

ASSIGNMENT OF NONPROVISIONAL APPLICATION

In consideration of the sum of Ten Dollars ($10.00) and other good and valuable consideration paid to each of the undersigned, to wit:

INSERT NAME(S) OF INVENTOR(S)
(1) Jose Miguel Delgado CASTILLO
(2) Anibal Luis Veneciano RIVERA
(3) Ruediger Uwe NUERK
(4) Fedor CHERNIKOV
(5)
G x box if continued on page 2

the receipt and sufficiency of which are hereby acknowledged by the undersigned who at the request of, hereby sell(s), assign(s) and transfer(s) unto:

INSERT NAME(S) OF ASSIGNEE(S) & ADDRESS(ES)
Pristec AG
Tech Gate Vienna Science and Technology Park, Donau-City-Strasse 1
A-1220 Vienna, AT

(hereinafter designated AASSIGNEE@) the entire right, title and interest for the United States of America as defined in 35 U.S.C. 100, in the invention and all applications including any divisions, continuations, substitutes, and reissues thereof; and all resulting patents, known as:

for which the undersigned executed an application for Letters Patents of the United States of America:

NOTE½½ (Complete line A, B and/or C)
(A) G even date herewith
(B) G on
(C) G in U.S. Appln. No. 13 1640932 **filed** 10/12/2012

AND the undersigned hereby authorize(s) and request(s) the United States Commissioner of Patents and Trademarks to issue said Letters Patent to the said ASSIGNEE, for its interest as ASSIGNEE, its successors, assigns and legal representatives; the undersigned agree(s) that the attorney of record in said application shall hereinafter act on behalf of said ASSIGNEE;

AND the undersigned hereby agree(s) to testify and execute any papers for ASSIGNEE, its successors, assigns and legal representatives, deemed essential by ASSIGNEE to ASSIGNEE=S full protection and title in and to the invention hereby transferred.

NOTE½½The undersigned hereby authorize(s) Fitch, Even, Tabin & Flannery of the above address to insert hereon any further identification necessary or desirable for recordation of this document.

INVENTORS	DATE SIGNED	WITNESSES
1) Name: Jose Miguel Delgado CASTILLO	5.11.2012	
2) Name: Anibal Luis Veneciano RIVERA	5.11.2012	
3) Name: Ruediger Uwe NUERK	5.11.2012	
4) Name: Fedor CHERNIKOV	5.11.2012	
5) Name:		

505559520 07/08/2019

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT5606317

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
PRISTEC AG	07/03/2019

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PROPERTY NUMBERS Total: 3

Property Type	Number
Application Number:	16017651
Application Number:	16017725
Patent Number:	10053635

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SIGNATURE:	/TOD MELGAR/
DATE SIGNED:	07/08/2019
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 3
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source=Patent_Purchase_Agreement_732019#page3.tif

UNITED STATES PATENT ASSIGNMENT

This PATENT ASSIGNMENT (this "Assignment") is made by and between Pristec AG, a joint stock company organized under the laws of the Republic of Austria ("Assignor"), and Earle Refining LLC, a New Jersey limited liability company ("Assignee"), and is being entered into pursuant and subject to the PATENT PURCHASE AGREEMENT executed and effective as of July [illegible] 2019 (the "Agreement").

WHEREAS, Assignor has acquired ownership of all of the right, title, and interest in and to U.S. Patent No. 10,053,635 and U.S. Patent Application Nos. 16/017,651 and 16/017,725, together with reissuances, continuations, continuations-in-part, revisions, extensions and reexaminations thereof (collectively, "**United States Patents**; and

WHEREAS, it has been and is the intention of Assignor and Assignee, that Assignee own all of Assignor's right, title and interest in and to all of Assignor's United States Patents, including all rights to claim, sue, and collect for all alleged infringement, including for any and all past damages, and be applicant for all United States Patents, wherever so permitted by law;

NOW, THEREFORE, for good and valuable consideration, the receipt, sufficiency, and adequacy of which are hereby acknowledged:

1. Assignor hereby sells, assigns, conveys, transfers, and sets over to Assignee and Assignee's successors and assigns, and Assignee acknowledges and receives from Assignor, all of Assignor's rights, title, and interest, and all of the rights, title, and interest of any of Assignor's affiliates, in and to the United States Patents on and as of the Effective Date, including United States patent applications, utility models and design registrations, and all rights to claim priority thereto, including priority under the Paris Convention, the Patent Cooperation Treaty and any and all applicable treaties and conventions of like purpose, and including all United States provisional, non-provisional, continuation, divisional, reissue, national phase and extension applications and patents thereof in the United States, along with any and all rights of renewal, maintenance, abandonment, disposition and enforcement with respect thereto, and the right to sue and/or recover for past, present, and future infringement thereof in the United States, and any and all causes of action related thereto. Assignee, its successors and assigns, or any entity it may properly designate, may apply for and receive patents therefor in its own name in the United States.. Assignor represents and warrants to Assignee, and to Assignee's successors and assigns, that Assignor has not and will not execute any writing or do any act that conflicts with this Assignment.

2. Assignor does not retain, whether expressly, by implication, estoppel or otherwise, any right, title, or interest in and to the United States Patents. For the avoidance of doubt, as of the Effective Date, Assignee shall solely and exclusively have the right and be entitled, in its sole discretion, in and/or under the laws of any country and jurisdiction, to initiate and/or continue any action, suit, litigation, arbitration or other proceeding of any kind, and seek, enforce, and benefit from any right, remedy and/or award, for any infringement or violation of the United States Patents. Assignee does not and shall not have any obligation to account for,

Pristec AG

report, or share any such remedy or award to Assignee with Assignor, or make any other payment for the United States Patents.

3. Upon Assignee's request, Assignor shall provide any assistance, including, without limitation, providing any information and documents, executing any documents and affidavits, providing any testimony, and/or rendering any other assistance, as is reasonably requested for Assignee to secure, perfect, and record sole and exclusive ownership of, and obtain registrations in the name of Assignee or a third party designated by Assignee, for the United States Patents and/or any part thereof, and to otherwise fully effect and implement the provisions in this Assignment. Assignor represents and warrants to Assignee that Assignor will promptly record transfers of all of the United States Patents to Assignor, and Assignor will promptly deliver to Assignee copies of all such recordings.

4. Should any section, or portion thereof, of this Assignment be held invalid by reason of any law existing now or in the future in any jurisdiction by any court of competent authority or by a legally enforceable directive of any governmental body, such section or portion thereof shall be validly reformed so as to approximate the intent of Assignor and Assignee as set forth herein as nearly as possible and, if unreformable, shall be deemed divisible and deleted with respect to such jurisdiction; this Assignment shall not otherwise be affected. This Assignment shall be binding upon Assignor and all of Assignor's successors and assigns, and shall be binding upon and inure to the benefit of Assignee and its successors and assigns.

5. Assignor authorizes the United States Patent and Trademark Office to issue any and all patents resulting from the United States Patents, to Assignee according to this Assignment. The right, title and interest is to be held and enjoyed by Assignee and Assignee's successors and assigns as fully and exclusively as it would have been held and enjoyed by Assignor had this assignment not been made.

6. This Assignment, but not the Agreement or any part thereof, may be publicly disclosed, and will be publicly recorded in various countries.

Assignor and Assignee have executed this Assignment, each through its authorized representative, to be effective as of the Effective Date.

Assignor:	**Assignee:**
Pristec AG	Earle Refining LLC
Name: RUEDIGER NUERK	Name: Thomas J. Earle
Title: CHAIRMAN & CEO	Title: Manager
Date: July 3rd, 2019	Date: 7-3-19

Pristec AG

6082374 v2

EXHIBIT 3

CMG Holdings Group Invests In New Disruptive Green Technology That Helps Eliminate Pollutants In Crude Oil

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NEWS PROVIDED BY
CMG Holdings Group, Inc. →
Nov 30, 2021, 09:00 ET

CHICAGO, Nov. 30, 2021 /PRNewswire/ -- CMG Holdings Group, Inc. (OTC:CMGO) today announced it has entered into a joint venture with North Jersey Petroleum Partners LLC (NJPP) a provider of groundbreaking eco-friendly "upgrading" technology that increases the value and quality of low-grade petroleum by removing impurities and reducing sulfur at profits of approximately $ 6 to $10 per barrel. NJPP anticipates its new Magnetic Vacuum Upgrading (MVU) technology will quickly be seen as a disrupter in the oil treatment market; rivaling thermal and catalytic cracking methods currently used for upgrading crude/fuel in refineries today, which are highly pollutive and costly to build. This patent pending, cost efficient "green technology" is owned by New Vacuum Technologies, LLC (NVT) and is sub-licensed to NJPP by New Vacuum Technologies USA LLC, a subsidiary of NVT. Terms of the JV include a CMG investment in the form of a one million-dollar loan for 10% of the joint venture in NJPP's oil treatment facility, located in northern New Jersey. NVT successfully installed and tested its MVU technology at a prototype plant in Southern New Jersey during the fall of 2020. Research is currently underway to determine if MVU technology qualifies for carbon credits, which would add significantly to profitability, as NVT works toward its goal of rolling out its environmentally friendly, cutting-edge technology to upgrade crude oil on a commercial scale in Q1 2022.

"With new regulations limiting pollutants - especially sulfur – we anticipate the emerging proprietary treatment technology market for petroleum products to be very profitable," said CMG CEO Glenn Laken "enhancing the value of lower priced, low grade petroleum feedstocks with MVU technology to produce a higher quality product that can be sold at a premium using environmentally sensitive, more cost-effective technology is a win-win for everyone." He explains, "When upgrading heavy and sour fuel oil to a medium to low sulfur fuel, the spread between the price of the crude before and after treatment determines profit. Assuming potential profits per barrel in the range of $ 6 to $10 per barrel the JV should realize a net profit margin between $900,000 and $1.5 million dollars per month. As a 10% member of the LLC, CMG's share should equate to between $1,080,000 and $1,800,000 annually." He adds, "In the short term during the next 12 months the JV plans to install 1 to 3 more processing units, enabling 10,000 to 20,000 bpd in production. If we reach the goal of 4 units CMG can earn approximately $3.6 million to $7.2 million annually. Assuming the JV can achieve its goal of installing 8 units – the maximum number that can be installed at the processing facility currently being used by NVT - processing capacity can reach 40,000 bpd and achieve profit levels of approximately $7,200,000 to $18,000,000 per month ($86,400,000 to $216,000,000 annually). CMG's share as a 10% member would be from $8,600,000 to $21,600,000 annually."

NVT's partners combine over 75 years of technology, business development and management skills with over 50 years of oil industry upgrading experience in North America, South America and Europe. The Company's principals led a state sponsored research institute specializing in petrochemical technologies for over a decade and a half before creating NVT. Their research into physical vacuum and quantum tunneling on viscosity and other physical properties of fluids, resulted NVT's technology to upgrade crude oil quality.

CMG Holdings has signed a $500,000 financing agreement with an institutional investor, with use of proceeds targeted to fund the NJPP venture, in addition to our previous loan. Terms include a junior note with 10% interest rate, a one-year maturity, and a modest redemption premium. It is currently contemplated for the loan to be repaid by end of Q1 2023. "We are very excited about this venture and the creation of the JV. I'd like to thank all of our CMGO shareholders for their interest and loyalty and view this as a watershed event for our organization," Glenn Laken said. For further information, contact CMG for A non-disclosure agreement with NJPP and NVT, which must be signed before additional technical information can be shared. To access the NDA, go to https://www.cmgholdingsinc.com/.

Disclosure Statement Statements in this press release about our future expectations, including without limitation, the likelihood that CMG Holdings Group, Inc. will meet minimum sales expectations, be successful and profitable, bring significant value to its stockholders, and leverage capital markets to execute its growth strategy, constitute "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, Section 21E of the Securities Exchange Act of 1934, and as that term is defined in the Private Litigation Reform Act of 1995. Such forward-looking statements involve risks and uncertainties and are subject to change at any time, and our actual results could differ materially from expected results. The Company undertakes no obligation to update or release any revisions to these forward-looking statements to reflect events or circumstances after the date of this statement or to reflect the occurrence of unanticipated events, except as required by law. CMG's business strategy described in this press release is subject to innumerable risks, most significantly, whether the Company is successful in securing adequate financing and materially decreases its convertible debt. No information in this press release should be construed in any form shape or manner as an indication of the Company's future revenues, financial condition or stock price.

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SOURCE CMG Holdings Group, Inc.

EXHIBIT 4

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(43) **Pub. Date: Oct. 15, 2020**

(54) **SYSTEM AND METHOD FOR COLD CRACKING UNDER A CONDITION OF MODIFIED DENSITY OF PHYSICAL VACUUM**

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(21) Appl. No.: **16/793,273**

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Publication Classification

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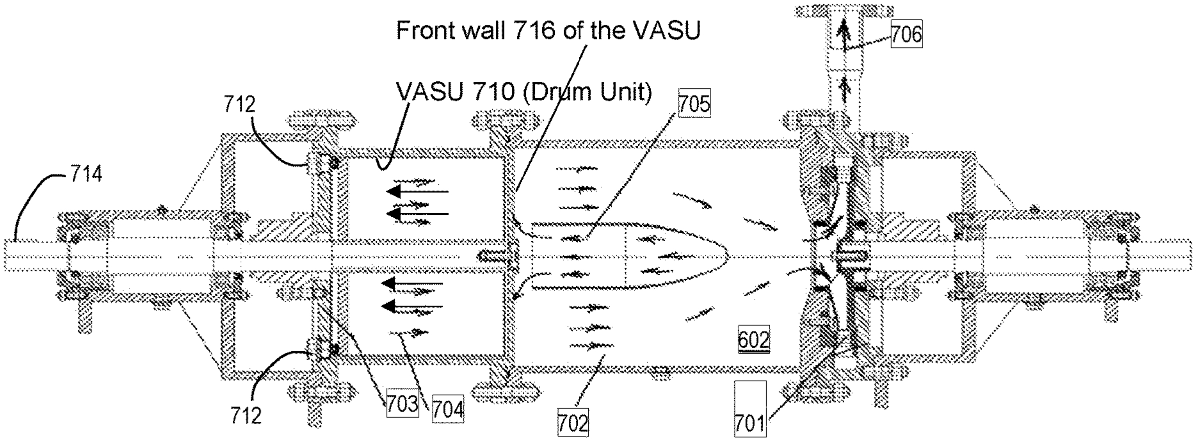
C08J 7/18	(2006.01)

(52) **U.S. Cl.**
CPC ***C10G 15/08*** (2013.01); *C10G 2300/10* (2013.01); ***C08J 7/18*** (2013.01)

(57) **ABSTRACT**

Method to change the molecular composition of a target medium under a condition of modified physical vacuum structure, includes introducing into an exposure chamber the target medium having a Raman spectrum with a predetermined target spectral resonance; rotating a source hydrocarbon medium in a drum adjacent to the exposure chamber, to produce a vacuum and magnetic influence; propagating the vacuum and magnetic influence to the target medium in the exposure chamber; applying a mechanical vibration to the target medium to vibrate the target medium on a molecular scale, to create colloidal molecular vibrations; transferring energy from the colloidal molecular vibrations to an electron system of atoms in molecules of the target medium until at least a portion of the molecules of the target medium cracks into shorter molecular hydrocarbon products; and withdrawing the shorter hydrocarbon molecular products from the exposure chamber.



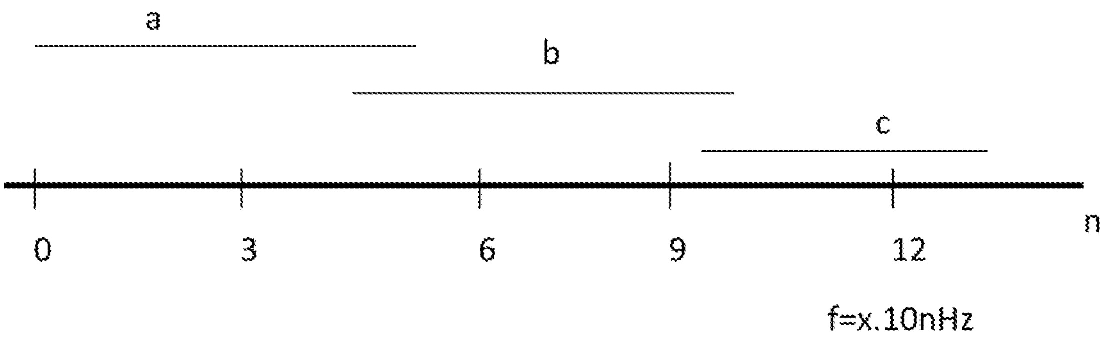


FIG. 1

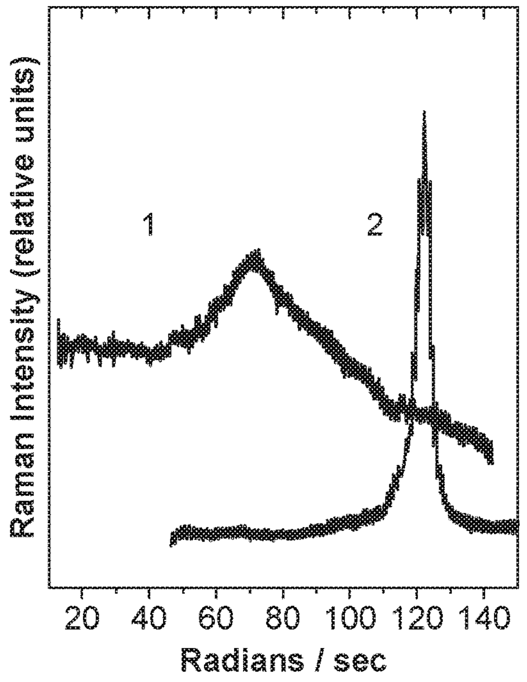


FIG. 2A

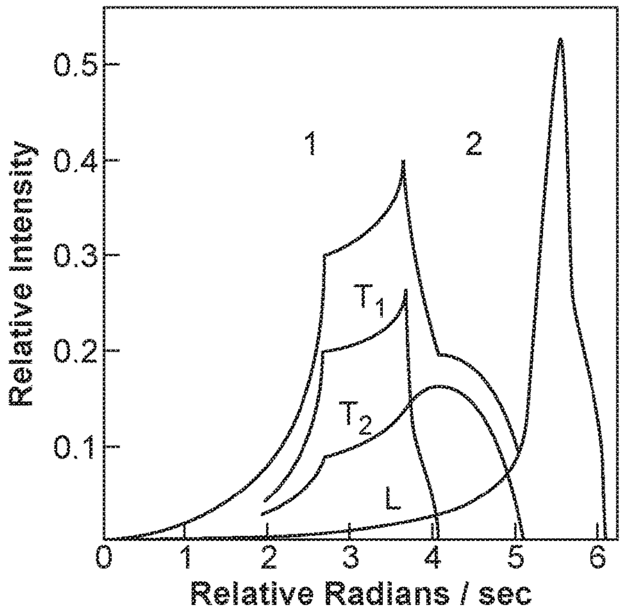


FIG. 2B

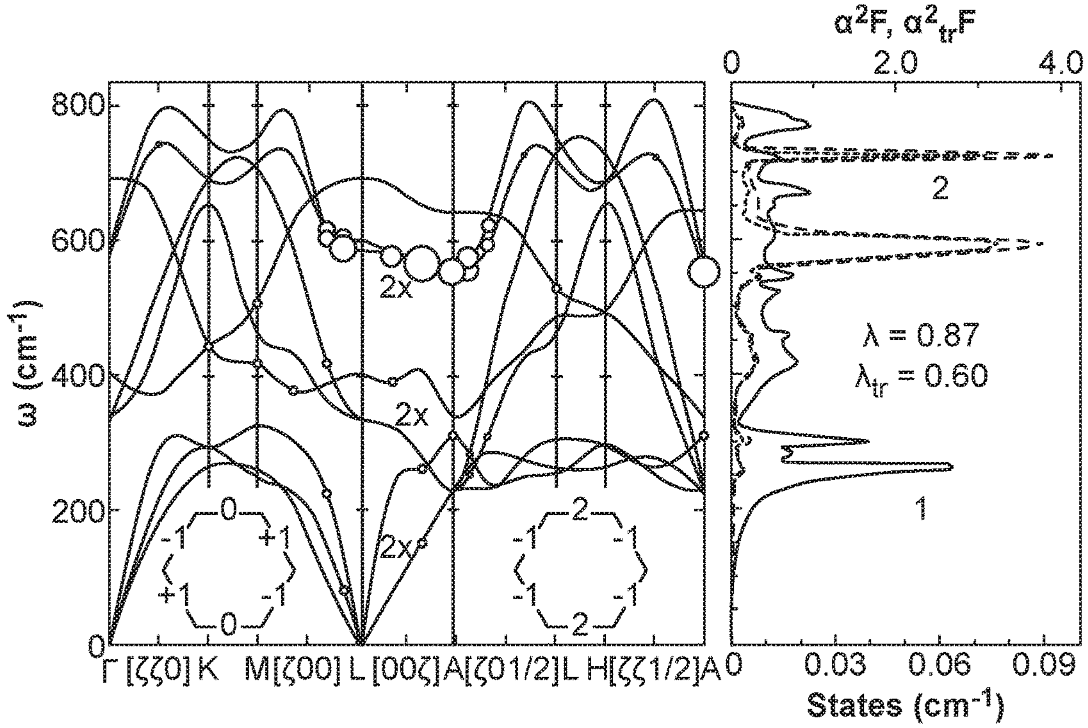


FIG. 2C

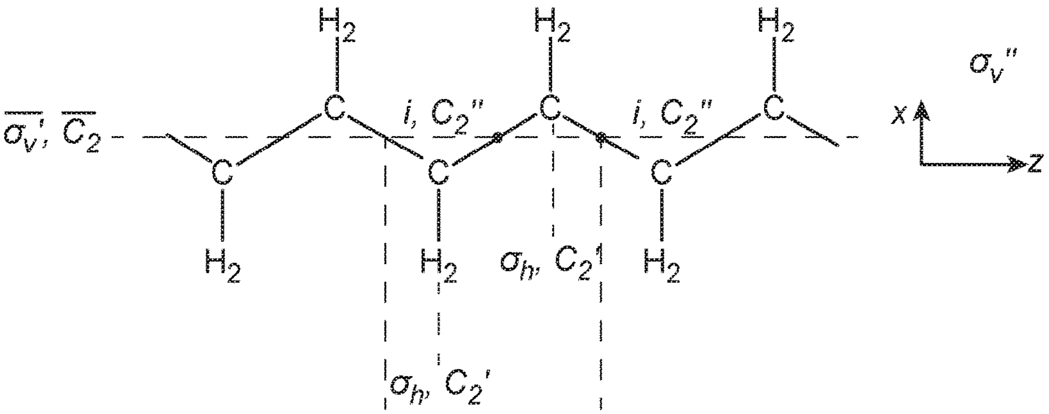


FIG. 3A

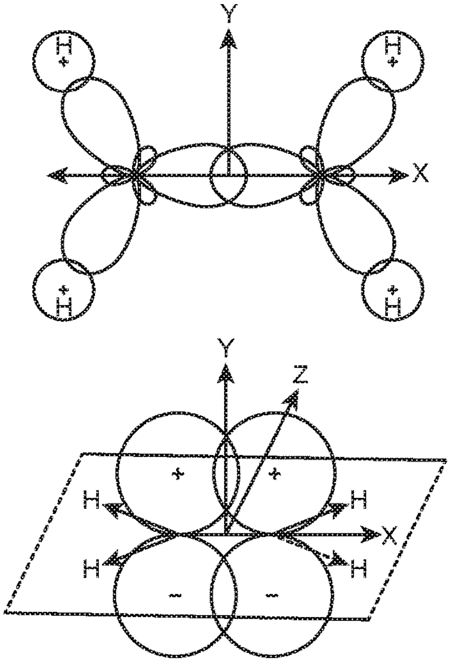


FIG. 3B

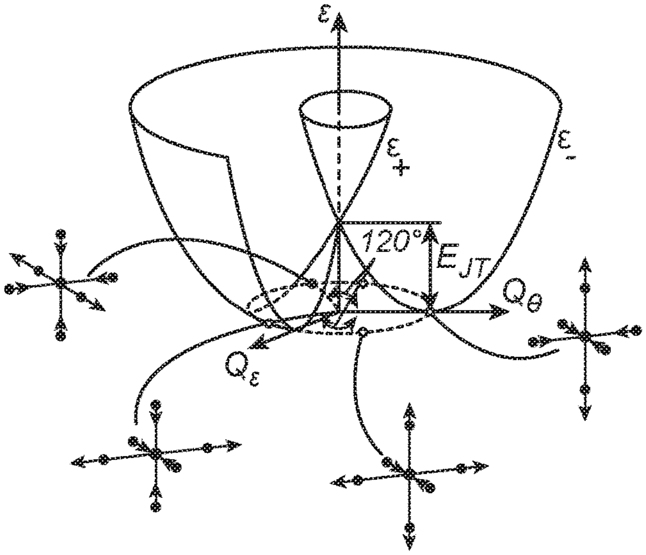


FIG. 3C

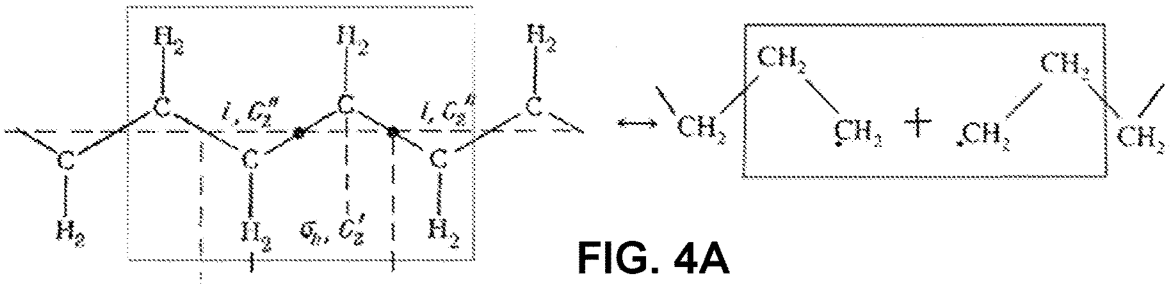


FIG. 4A

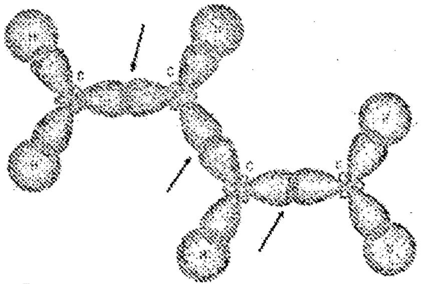


FIG. 4B

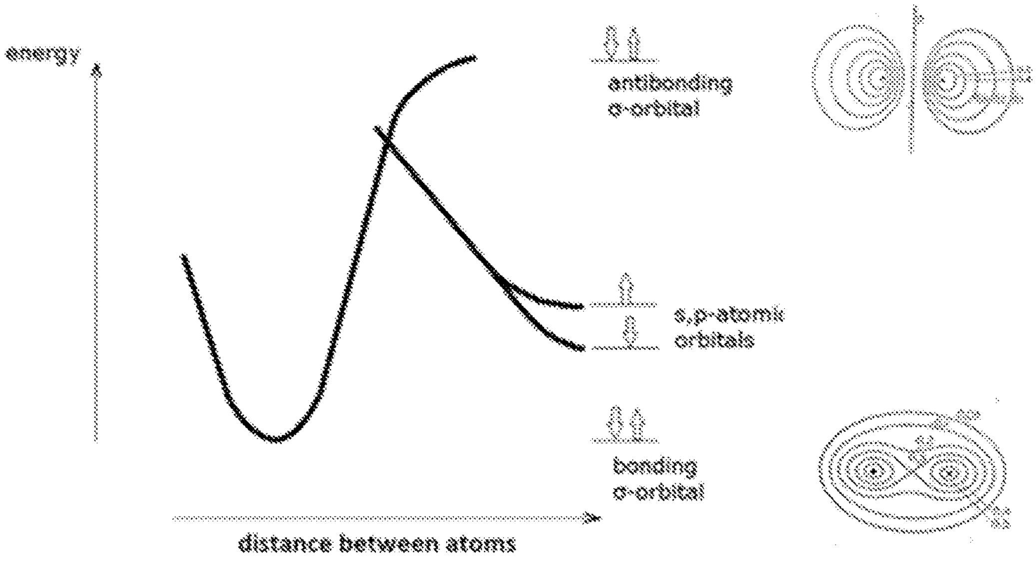


FIG. 4C

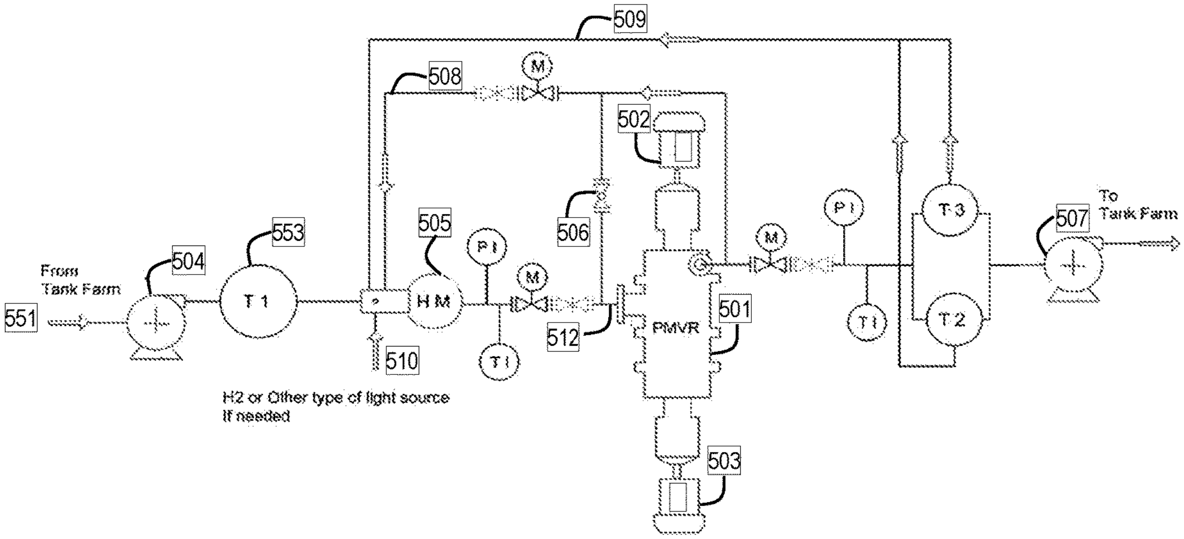

509
508
M
502
506
505
553
504
P I
M
P I
M
507
To
Tank Farm
T 3
From
Tank Farm
551
T 1
H M
PMVR
501
T I
T 2
512
510
T I
H2 or Other type of light source
If needed
503

FIG. 5 500

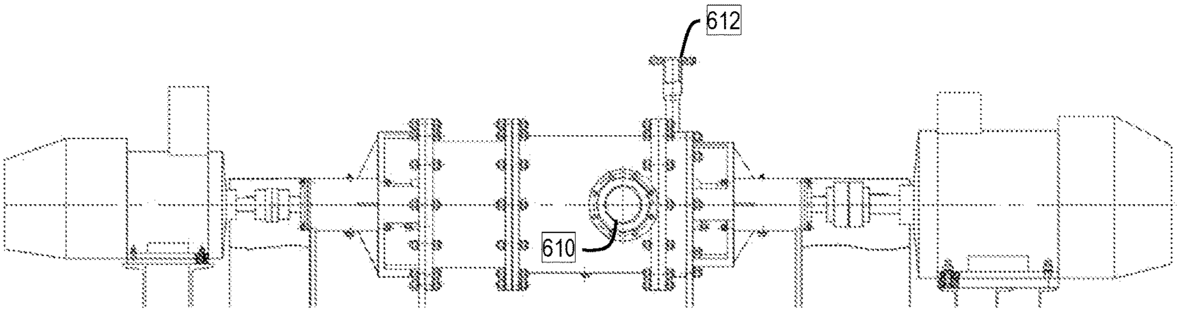


FIG. 6A 600

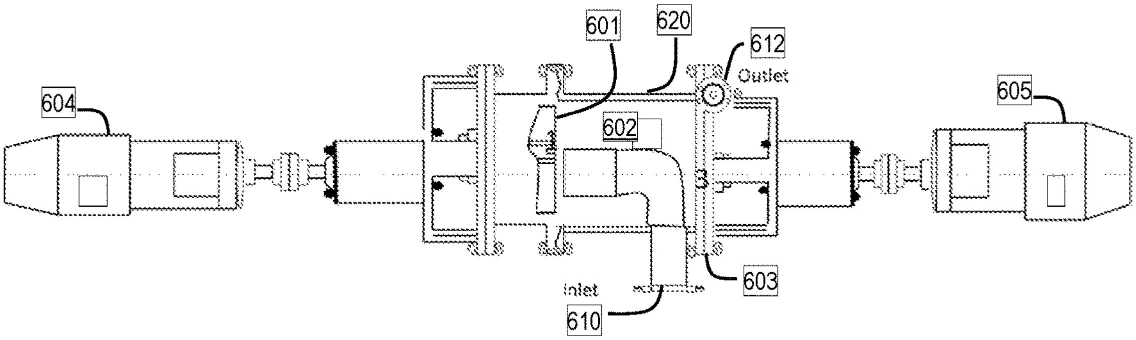


FIG. 6B 600

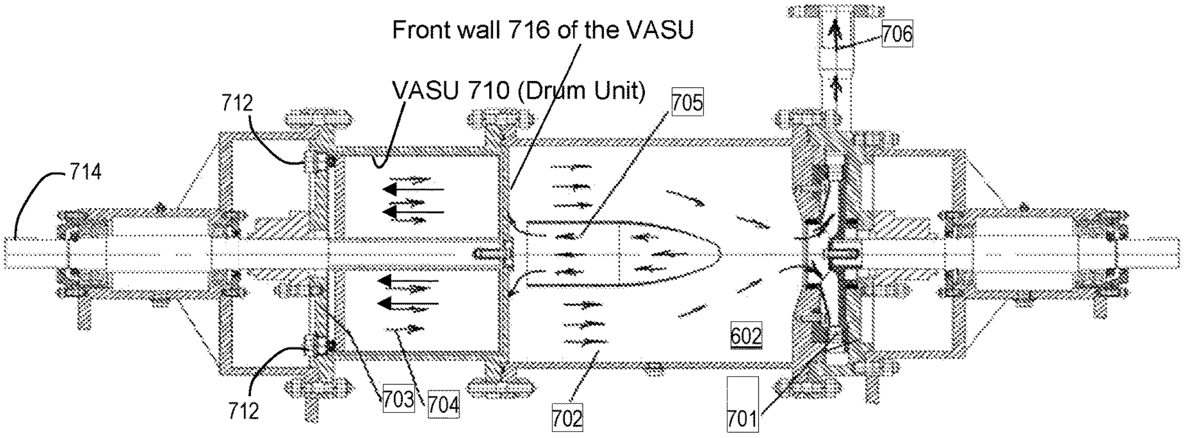


FIG. 7

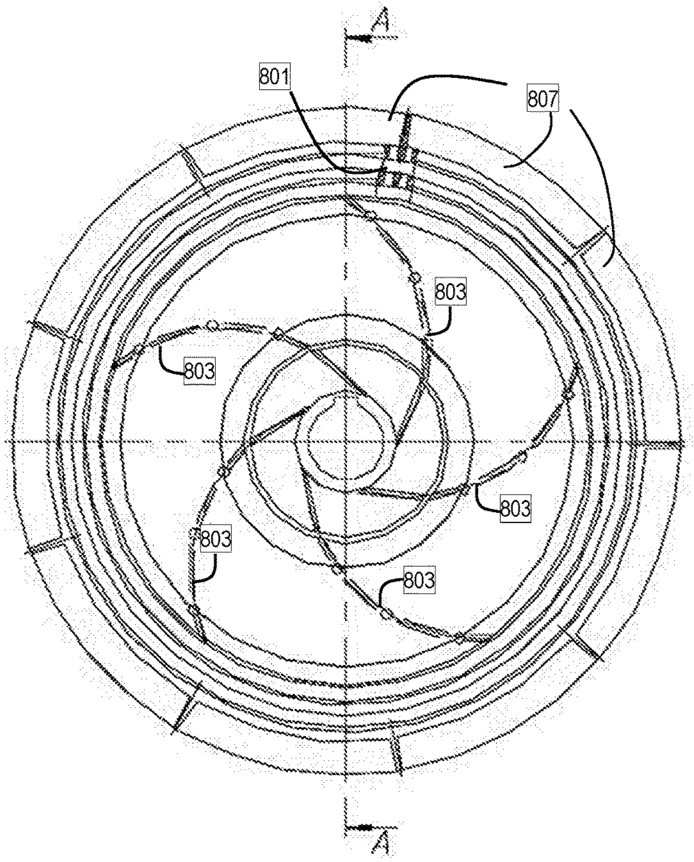


FIG. 8A 800

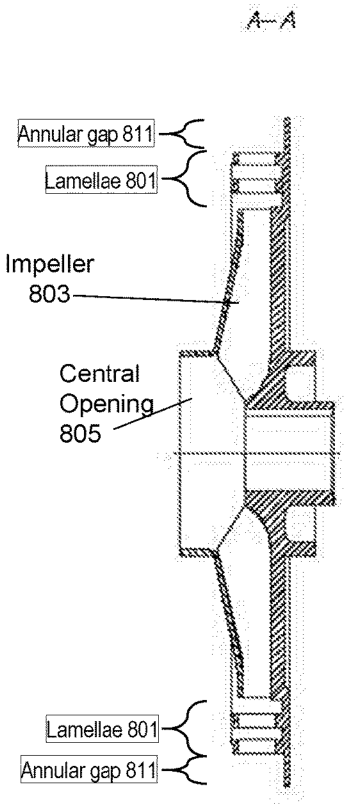


FIG. 8B

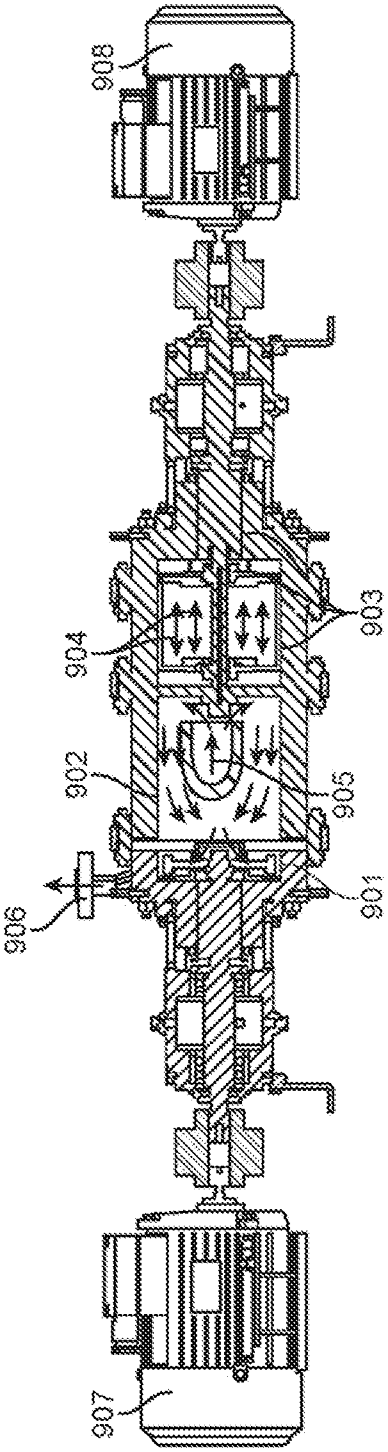


FIG. 9

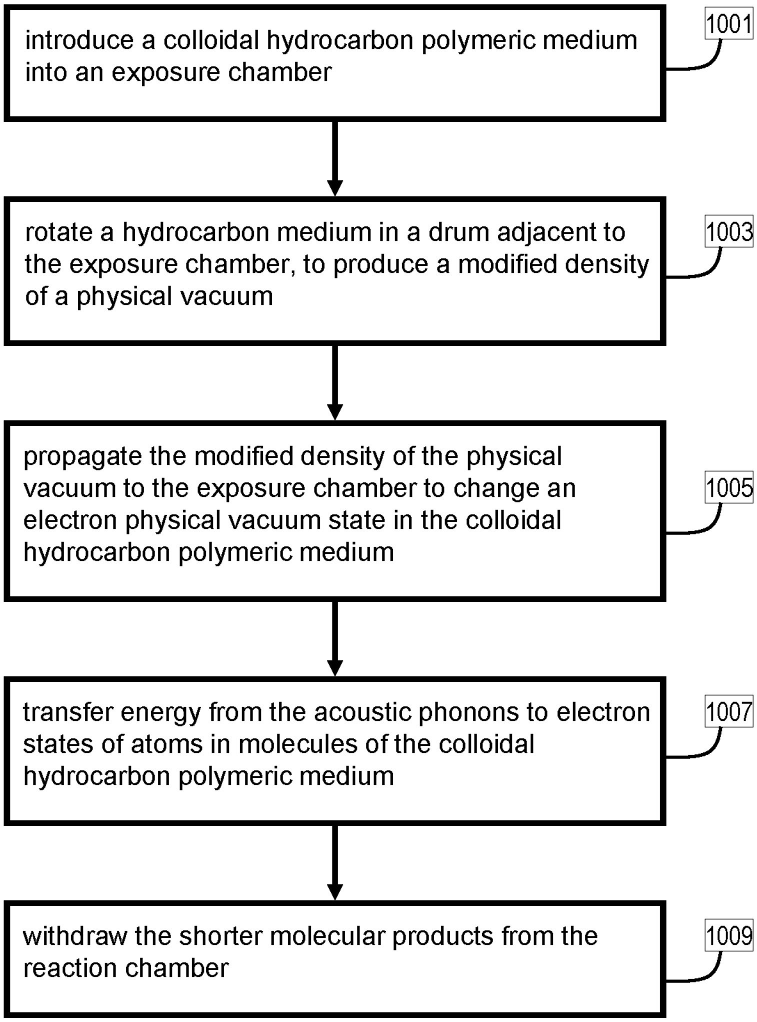

introduce a colloidal hydrocarbon polymeric medium into an exposure chamber
1001
rotate a hydrocarbon medium in a drum adjacent to the exposure chamber, to produce a modified density of a physical vacuum
1003
propagate the modified density of the physical vacuum to the exposure chamber to change an electron physical vacuum state in the colloidal hydrocarbon polymeric medium
1005
transfer energy from the acoustic phonons to electron states of atoms in molecules of the colloidal hydrocarbon polymeric medium
1007
withdraw the shorter molecular products from the reaction chamber
1009

FIG. 10 1000

SYSTEM AND METHOD FOR COLD CRACKING UNDER A CONDITION OF MODIFIED DENSITY OF PHYSICAL VACUUM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation in Part of U.S. patent application Ser. No. 16/378,999, filed on Apr. 9, 2019, the entire content of which is hereby incorporated by reference in its entirety.

BACKGROUND

Field of the Invention

[0002] Embodiments of the present invention generally relate to a system and method of processing hydrocarbon liquids with a colloidal structure, or mineral oils containing ferromagnetic components, using mechanical processing under conditions of a modified density of physical vacuum and carrying out a chain free-radical chemical reaction. The technological purpose is to change a hydrocarbon structure of the liquids, and increase a proportion of lighter molecular weight components.

Description of Related Art

[0003] Heavy crude oil or extra heavy crude oil is any type of crude oil which does not flow easily. It is referred to as “heavy” because its density or specific gravity is higher than that of light crude oil. Heavy crude oil has been defined as any liquid petroleum with an American Petroleum Institute (“API”) gravity less than 20°. Extra heavy oil is defined with API gravity below 10.0° API (i.e. with density greater than 1000 kg/m^3 or, equivalently, a specific gravity greater than 1).

[0004] In contrast, light crude oil is liquid petroleum that has a low density and flows freely at room temperature. It has a low viscosity, low specific gravity and high API gravity due to the presence of a high proportion of light hydrocarbon fractions. Light crude oil receives a higher price than heavy crude oil on commodity markets because it produces a higher percentage of gasoline and diesel fuel when converted into products by an oil refinery and after the transportation cost of petroleum products.

[0005] Sweet crude oil is a type of petroleum that contains less than about 0.5% sulfur, compared to a higher level of sulfur in sour crude oil. Sweet crude oil contains small amounts of hydrogen sulfide and carbon dioxide. High quality, low sulfur crude oil is commonly used for processing into gasoline and is in high demand, particularly in the industrialized nations. “Light sweet crude oil” is the most sought-after version of crude oil as it contains a disproportionately large amount of these fractions that are used to process gasoline (naphtha), kerosene, and high-quality diesel fuel.

[0006] The amount or volume of light crude products naturally present in crude oil worldwide is not sufficient to cover the worldwide consumption of various fuels. Therefore, technologies referred to as “cracking” have been developed and are necessary to maximize the light product yield from crude oil. Cracking is the process whereby complex organic molecules (heavy hydrocarbons) are broken down into shorter molecules (light hydrocarbons), predominantly by the breaking of carbon-carbon bonds by the use of mechanical action and catalysts.

[0007] Shortfalls of conventional cracking processes used in refineries include a relatively low yield of hydrocarbons having a short chain length, and a relatively high combination of temperature and pressure needed to realize the process at a commercially feasible rate. Cracking transfers energy to all degrees of freedom of the molecular compounds in a liquid medium such as crude oil. Conventional cracking processes can be separated into two categories of cracking processes: thermal cracking and catalytic cracking. Thermal cracking is expensive and is based on heating the entire volume of the liquid medium to a high temperature (e.g., above 350° degrees C.). Catalytic cracking requires the use of expensive catalysts, requiring large amount of energy for the production and regeneration of the catalysts.

[0008] Thus, there is a need for a cracking process that is able to produce relatively higher yields of hydrocarbons having short chain lengths, restructuring the colloidal structure of oil materials with a decrease in viscosity and at a relatively lower combination of temperature and pressure in order to realize the process at a commercially feasible rate.

SUMMARY

[0009] Embodiments of the present invention generally relate to a system and procedure for treatment of liquids, in particular a colloid hydrocarbon medium mineral oil or a hydrocarbon polymer, in order to the increase the content of light, low-boiling range fractions with a decrease in viscosity. The energy needed to crack the liquids is derived from acoustic fields induced by a rotor of a pump acoustic field generator (PAFG) and having a wide acoustic spectrum in the range up to hundreds of kHz by the mechanism of a two stage stochastic resonance, this effect under conditions of a moderate temperature increase and a modified density of physical vacuum created by a physical vacuum action source unit (VASU) dissociates C—C bonds with the launch of a free-radical chemical chain reaction breaking chemical bonds underlying the cracking process of hydrocarbons.

[0010] Embodiments change the hydrocarbon structure of the colloid hydrocarbon medium, including an increase of a proportion of lighter molecular weight components due to: (1) breaking of carbon-carbon bonds due to frequency processing, under conditions of modified density of physical vacuum; (2) chemical free radical chain reaction; and (3) decrease in viscosity due to reorganization of the colloidal hydrocarbon medium.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] So the manner in which the above recited features of the present invention can be understood in detail, a more particular description of embodiments of the present invention, briefly summarized above, may be had by reference to embodiments, which are illustrated in the appended drawings. It is to be noted, however, the appended drawings illustrate only typical embodiments of embodiments encompassed within the scope of the present invention, and, therefore, are not to be considered limiting, for the present invention may admit to other equally effective embodiments, wherein:

[0012] FIG. **1** depicts a difference in scale of resonant frequencies between a mechanical system, a micelle of colloids, and a polymer molecule in accordance with an embodiment of the invention;

[0013] FIGS. **2**A, **2**B, **2**C illustrate spectra of acoustic phonons and optic phonons as known in the art;

[0014] FIGS. **3**A, **3**B illustrate symmetry of a carbon chain in which Jahn-Teller effects occur, in accordance with one embodiment of the present invention;

[0015] FIG. **3**C illustrates a common potential surface overlaid with a potential surface of a symmetric molecular system from molecules of different dynamic structure and with a degenerated electron subsystem in accordance with one embodiment of the present invention;

[0016] FIG. **4**A illustrates a change in level of high symmetry of a fragment of a CC-chain at dissociation of CC-bonds;

[0017] FIG. **4**B illustrates electron density of CC-bonds of a carbon chain in accordance with an embodiment of the present invention;

[0018] FIG. **4**C illustrates a change of energy of electron orbitals of C-atoms in accordance with an embodiment of the present invention;

[0019] FIG. **5** illustrates a schematic of a system **500** in accordance with an embodiment of the present invention;

[0020] FIG. **6**A illustrates an external view of a Pump Magnetic Vacuum Reactor (“PMVR”) in accordance with an embodiment of the present invention

[0021] FIG. **6**B illustrates a cutaway view of the PMVR, at right angle to the view of FIG. **6**B;

[0022] FIG. **7** illustrates cross-sectional detail of a material mixing chamber of the PMVR, in accordance with an embodiment of the present invention;

[0023] FIG. **8**A illustrates a front plan view of a lamella disk, in accordance with an embodiment of the present invention;

[0024] FIG. **8**B illustrates a sectional view of the lamella disk of FIG. **8**A along axis A-A; and

[0025] FIG. **9** illustrates cross-sectional detail of another PMVR, in accordance with an embodiment of the present invention; and

[0026] FIG. **10** illustrates a process in accordance with an embodiment of the present invention.

[0027] The headings used herein are for organizational purposes only and are not meant to be used to limit the scope of the description or the claims. To facilitate understanding, like reference numerals have been used, where possible, to designate like elements common to the figures.

DETAILED DESCRIPTION

[0028] As used throughout this application, the word “may” is used in a permissive sense (i.e., meaning having the potential to), rather than the mandatory sense (i.e., meaning must). Similarly, the words “include”, “including”, and “includes” mean including but not limited to.

[0029] The modifier “about” when used with a range (e.g., “about X to Y”) should be understood to apply to both ends of the range (i.e., equivalent to “about X to about Y”) unless a different meaning is clearly indicated explicitly or by the context of usage.

[0030] Embodiments of the present invention generally relate to a procedure for the treatment of a liquid, in particular a colloid hydrocarbon medium, mineral oil or the like (generically, “hydrocarbon liquid” or “colloidal hydrocarbon liquid”), in order to increase the content of light fractions having a lower boiling point, and to change the colloidal structure of the hydrocarbon liquid including a decrease in viscosity.

[0031] Embodiments provide a method and system designed to destabilize, weaken, shear or even crack up molecular bonds in liquids, for example, a colloid hydrocarbon medium, mineral oils or related substances, in order to thus receive, in the course of the subsequent refining process, an increased portion of short chains and low-boiling point fractions. Weakening or destabilizing the molecular bonds may mean, for instance, that the molecular bonds enter an unstable energy state, i.e., a state higher than the minimum energy. At such a higher energy state, the molecular bonds are susceptible to breaking upon addition of a lesser amount of energy compared to molecular bonds not at the higher energy state.

[0032] In quantum-mechanical analysis, a predetermined volume of hydrocarbon liquid (e.g., crude oil, fuel oil, etc.) may be analyzed as a quantum-mechanical system that behaves as a single molecule having molecular bonds that are tightened by strong covalent bonds. In this analysis, the quantum-mechanical system is not describable using exact chemical formulas, nor by constants like melting and boiling points, dielectric permittivity, dipole moment, loss angle, electrical conduction, heat content (enthalpy) ΔH°, ΔS, and so forth.

[0033] If this quantum-mechanical system is excited by imparting an intensive energy in substantially any form, then the quantum-mechanical system becomes unstable, and various processes will occur like destruction, breakage and re-forming/redistribution of molecular bonds, division of the quantum-mechanical system into low-molecular and high-molecular compounds. Characterizing the resulting compounds as linear, cyclic, aromatic etc., is not meaningful because, under the quantum analysis, it is the state of the quantum-mechanical system under conditions of force fields of the environment that is meaningful, rather than the compositions of the various compounds within the quantum-mechanical system.

[0034] Crude oil or fuel oil is not a physical mixture, and the processing of it is not a physical process of reforming, remixing, and the like. Rather, processing of crude oil or fuel oil is a chemical reaction which can be represented by Equation (1) below:

$$\text{Primary hydrocarbon liquid}=\text{Light fractions}+\text{Heavy residue}+\Delta H \tag{1}$$

[0035] where ΔH is a change of the heat content in the system (i.e., an enthalpy or a reaction energy). A positive change in heat content may be released as thermal energy and/or other forms of energy (e.g., photons). A negative change in heat content is accounted for by an infusion of an external source of energy.

[0036] Embodiments utilize technology based on a free radical chemical chain reaction, which causes the cold cracking of hydrocarbon polymers in a liquid (e.g., crude oil) and the restructuring of the liquid (i.e., changing the molecular compound composition) due to excitation of vibrational degrees of freedom of molecules, while modifying the physical vacuum density inside the reactor. The cold cracking is operable at least within a temperature range of 70 degrees Celsius or lower to 150 degrees Celsius or lower. In some embodiments, the cold cracking is operable within a temperature range of at least 70 degrees Celsius to 100 degrees Celsius or lower. Embodiments result in improved quality as indicated by composition, viscosity, and density, achieved by processing the liquid.

[0037] The physical basis for the types and sequences of processes operating on the liquid is a one-stage or two-stage stochastic resonance ("SR") between and among: (1) the apparatus and system performing the process steps as a single oscillatory system, and (2) the molecular components in the liquid. The single oscillatory system refers to components that are coupled such that they respond in a "normal mode" to oscillatory vibrations described herein. The single oscillatory system includes the PMVR plus its physical support and bracing, a hydrodynamic mixer and mixing chamber, associated piping between components, pumps to move around the hydrocarbon liquid during processing, and hydrocarbon feedstock.

[0038] The stochastic resonance is under conditions of a modified energy density of a physical vacuum, produced by a circularly-operating mechanical vibrator according to the Unruh effect discussed herein, within a pump magnetic vacuum reactor ("PMVR") that acts on polymer macromolecules. A hydrocarbon liquid of polymer macromolecules may be referred to as a polymeric system. The area of a polymeric system operated upon by frequency fluctuations will be approximately four orders of magnitude smaller than the area of a polymeric system operated upon by a mechanical system, therefore direct resonant interaction is not feasible for a stochastic resonant system. FIG. **1** illustrates a difference in scale of resonant frequencies between a mechanical system (a), a micelle of colloids (b) and a polymer molecule (c).

[0039] FIGS. **2**A-**2**C illustrate the spectra of acoustic phonons (curve "1") and optical phonons (curve "2"). Acoustic phonons pump energy into optical phonons in this mechanism, leading to "heating" of an electron subsystem of polymers and dispersion electrons, i.e., the acoustic phonons reduce electron correlation in polymeric molecules. Electron correlation in this context refers to interaction among electrons in the electron structure of a quantum system. Correlation energy is a measure of how much the movement of one electron is influenced by the presence of all other electrons in the quantum system.

[0040] FIGS. **3**A and **3**B illustrate symmetry of a carbon chain. FIG. **3**C illustrates a common potential surface overlaid with a potential surface of a symmetric molecular system from molecules of different dynamic structure and with a degenerated electron subsystem.

[0041] Dissociation of carbon bonds occurs due to the Jahn-Teller effect. Interaction of ultrasound fields and acoustic phonons in the carbon chains leads to generation of optical phonons and to excitation of an electron subsystem. Shortly thereafter, the excited electron subsystem decays to release correlation energy of electrons and, hence, decreases correlation in the excited electron subsystem. This causes high anharmonicity in the excited electron subsystem.

[0042] Anharmonic electron potential (i.e., a fluctuating average field of electrons) in the carbon-chain ("CC"), depending on oscillations of nuclei, has a high level of symmetry in its nuclear system, leading to formation of vibronic states of a degenerate system (i.e., equal energy) of electron terms of covalent CC-bonds. Such electron-oscillatory states of molecules, having a different configuration of dynamics, lie on one potential surface, i.e., has identical energy as illustrated in FIG. **3**C.

[0043] The received raised electron states of these bonds with low electron correlation form antibinding a-orbitals instead of binding a-orbitals (FIG. **4**C). These raised vibronic states turn on repulsive states and further move according to the Jahn-Teller effect.

[0044] FIG. **4**A illustrates a change in level of high symmetry of a fragment of a CC-chain (left side) at dissociation of CC-bonds (right side). FIG. **4**B illustrates electron density of CC-bonds of a carbon chain. FIG. **4**C illustrates a change of energy of electron orbitals of C-atoms as distance between the carbon atoms changes (left side), and the levels of electron density of binding and antibinding of a C-atom (right side).

[0045] Degeneration of electron level changes the nuclear configuration according to the Jahn-Teller effect, acting to remove the electron degeneration. This condition corresponds to movements of nuclear systems that lower symmetry of a nuclear configuration. FIG. **4**C illustrates this movement, specifically a displacement of nuclei that increases the distance between them.

[0046] Degeneration is promoted by transforming electron terms of antibinding a-orbital and electrons transitioning between s and p orbitals. This set of processes in an electron and nuclear configuration enables dissociation of CC-bond. Electron-oscillatory (i.e., vibronic) interactions underlie many chemical reactions including depolymerization reactions.

[0047] These processes under normal physical conditions (e.g., normal density of the physical vacuum) require a significant use of energy. As the energy density of the physical vacuum changes, the amount of energy used changes.

[0048] The theoretical foundations of the physical vacuum technology are presented in the works of leading physicists and are shown in the form of quantum electrodynamic phenomena known as the Casimir effect, Unruh effect, Sokolov-Ternov effects, Lamb shift (i.e., shift of electron levels), and others. During the creation of the Theory of General Relativity, Einstein introduced an additional term—the cosmological constant—denoting an existence in astronomical space of a force that prevent the compression of matter and thus the compression of the universe under the influence of gravitational forces. The force preventing the compression of matter is manifested by the concept of a "physical vacuum" as a special material medium with a special physical state and which provides a state with a negative density sign. See equation (2) below for one result of the Theory of General Relativity.

$$R_{\mu\nu}-(\tfrac{1}{2})g_{\mu\nu}R=((8\pi G)/c^4)T_{\mu\nu}+\Lambda g_{\mu\nu} \quad (2)$$

[0049] Where "Λ" is the cosmological constant

[0050] Processes in a vacuum are the cause of the expansion of the universe (according to Gliner), which is expressed by the vacuum equation of state, formulated by De Sitter in the Einstein equations he modified. Theory holds that $p=-\varepsilon$, which means the direct proportionality of the pressure of matter (p) to the negative energy density of the vacuum (ε).

[0051] The mechanism of induction of vacuum flows with a change in vacuum density, and the rotational motion of the material masses, is described by the angular velocity and angular displacement vector. In this situation, according to Einstein, the sign of these quantities of the physical vacuum must be reversed and the negative vector of the angular velocity and angular displacement vector of vacuum induces a vacuum flow in the direction opposite to the flow of material masses.

[0052] In quantum theory, the basic state of matter is “empty space” with a special structure, called a physical vacuum according to Dirac. The vacuum state is the ground state (i.e., the lowest level) of energy of material particles and fields. The theoretical foundations of these states are developed in and described in detail in the field of quantum electrodynamics (“QED”) and quantum chromodynamics (“QCD”).

[0053] The material sources (i.e., particles such as electrons, protons, etc.) of the field are surrounded by virtual quanta, i.e., the zero state of the electromagnetic field (“EMF”). Around the masses and electric charges are created real quanta (with a non-zero energy). An atom interacting with an electromagnetic vacuum field in the ground state is surrounded by a cloud of virtual photons. Near the field source, the boson field contributes to the field energy density.

[0054] With respect to interactions in the physical vacuum, the material field of an object acts as a source of EMF, and the internal dynamic structure of the sources is influenced by the virtual field. There is a continuous process of energy fluctuations—the creation and annihilation of pairs of virtual particles and antiparticles. Despite their virtual and ephemeral nature, they put pressure on the material media in a process known as the static Casimir effect. Along with this effect, charges are also affected by the dynamic Casimir effect, which is a transformation of physical vacuum fluctuations into real particles (in particular, photons). Classical physics considers “zero” vacuum oscillations as quasi-elastic acoustic oscillations in a continuous medium,

[0055] The interaction with a physical vacuum determines the behavior of electrons, their interaction with positive charges in an atom and an equilibrium structure of atoms and molecules that form at normal physical vacuum density.

[0056] The interaction with the physical vacuum strongly influences the electron state in the atom, in particular the properties of the electron shells of the atoms. Physical vacuum polarization, as its energy density increases, removes the degeneracy of electrical levels. Electrons can emit and absorb a virtual photon, while its interaction with the Coulomb field of the nucleus changes and it receives a pulse. This results in a decrease in the localization of the electron’s wave function near the nucleus at the s-level orbital. This noticeably changes the electron’s frequency near the nucleus, raising it to 1 GHz. A modification of the Coulomb field with physical vacuum polarization shifts the s-level by 25 MHz. This is manifested in the effect of splitting levels, i.e., the Lamb shift. Accordingly, a decrease in the physical vacuum density leads (i.e., increases the probability) of degeneracy of the electron levels.

[0057] According to the Unruh effect, a real mass moving with acceleration induces the appearance (i.e., changes the structure) of a physical vacuum in the surrounding space. The Unruh effect is present in any accelerating material system, such as an elementary particle, atom, molecule, crystal, solid or liquid body. The accelerating material system may include a material rotating around an axis of rotation (including uniform circular motion), which experiences radial (i.e., centripetal) acceleration. The Unruh effect, when arising from a rotating mass having a moment of rotation and radial acceleration, induces a vacuum flow, the quality and composition of which varies with the material being rotated and characteristics of the rotation. The vacuum flow, according to Einstein-de Sitter’s rule, has a negative sign of the moment of rotation relative to the moment of rotation of the real mass. A directed vacuum flow is formed in the direction opposite to the moment of rotation of the real domain. This directed vacuum flow creates displacements of the vacuum environment with the formation of a region with a modified vacuum density and a region of increased vacuum density. In an area with a modified vacuum density, Lamb effects take place in the electron structure. In an area with a lower vacuum density, the effects of electron states degeneration increase, with the development of Jahn-Teller effects, with degeneration of electron levels of vibronic states of molecules.

[0058] The Unruh effect is an example of a vacuum and magnetic influence. To increase the Unruh effect generated by a rotating material (the rotating material being, e.g., a rotating source substance or composition thereof, generically “source substance”) upon a target substance being processed (the target substance being, e.g., crude oil or other hydrocarbon), the material to rotate is selected according to principles of its resonant interaction with oil.

[0059] The selection principles for the rotating material include, first, that the rotating material should include molecules (or molecule groups) whose concentration should increase in the processed material during processing. Second, the rotating material should include ionic and low-molecular components that are part of the solvate shells of the colloidal system of the target substance. The process may operate with unregulated or loosely regulated temperature and pressure conditions in the PMVR. Third, the rotating material should have predetermined IR and/or Raman absorption and emission bands that coincide with the bands of the target substance. For example, the rotating material will have a greater beneficial effect upon the target substance as the IR and/or Raman spectrum of the rotating material better matches or correlates with the IR and/or Raman spectrum of the target substance (or processed product thereof). Each target substance may have a respective source substance that acceptably matches the target substance. An acceptable match of the source substance may be selected or prepared according to predetermined Infrared (IR)/Raman vibrational spectra criteria. The resulting source substance forms a vacuum flow that has increased effect upon the respective target substance, compared to a vacuum flow from non-matching source substances.

[0060] In one embodiment, the source substance may be a hydrocarbon colloidal substance having an IR/Raman spectrum wavenumber shift of about 400 cm^{-1} to about 4,000 cm^{-1}.

[0061] IR/Raman Spectroscopy.

[0062] As known in the art, Raman spectroscopy is a form of vibrational spectroscopy, much like infrared (IR) spectroscopy. However, whereas IR bands arise from a change in the dipole moment of a molecule due to an interaction of light with the molecule, Raman bands arise from a change in the polarizability of the molecule due to the same interaction. This means that these observed bands (corresponding to specific energy transitions) arise from specific molecular vibrations. When the energies of these transitions are plotted as a spectrum, they can be used to identify the molecule as they provide a “molecular fingerprint” of the molecule being observed. Certain vibrations that are allowed in Raman are forbidden in IR, whereas other vibrations may be observed by both techniques although at significantly different intensities thus these techniques can be thought of as complementary. Thus IR and Raman spectroscopy have similar effects upon a target hydrocarbon for the purpose of cracking molecular hydrocarbon chains.

[0063] Raman scattering of a photon by a molecule can occur with a change in vibrational, rotational or electronic energy of the molecule. Embodiments herein are concerned primarily with the vibrational Raman effect. The difference in energy between an incident photon and a corresponding Raman scattered photon is equal to the energy of a vibration of the scattering molecule. The Raman effect arises when a photon is incident on a molecule and interacts with the electric dipole of the molecule. It is a form of electronic (more accurately, vibronic) spectroscopy, although the spectrum contains vibrational frequencies. In classical terms, the interaction can be viewed as a perturbation of the molecule's electric field. In quantum mechanical terms the scattering can be described as an excitation to a virtual state lower in energy than a real electronic transition with nearly coincident de-excitation and a change in vibrational energy. In the Raman effect the electron excited in the scattering process decays to a different level than that where it started and is termed inelastic scattering.

[0064] Numerically, the energy difference between the initial and final vibrational levels, or Raman shift in wave numbers (cm^{-1}), is calculated as the difference in the reciprocal of incident and scattered wavelengths, in which incident and scattered refer to the wavelengths (in cm) of the incident and Raman scattered photons, respectively.

[0065] The vibrational energy is ultimately dissipated as heat. At room temperature the thermal population of vibrational excited states is low, although not zero. Therefore, the initial state is the ground state, and the scattered photon will have lower energy (longer wavelength) than the exciting photon. A small fraction of the molecules are in vibrationally excited states. Raman scattering from vibrationally excited molecules leaves the molecule in the ground state.

[0066] The energy of a vibrational mode depends on molecular structure and environment. Atomic mass, bond order, molecular substituents, molecular geometry and hydrogen bonding all affect the vibrational force constant which, in turn dictates the vibrational energy. For example, the stretching frequency of a phosphorus-phosphorus bond ranges from 460 to 610 to 775 cm^{-1} for the single, double and triple bonded moieties, respectively.

[0067] Typical strong Raman scatterers are moieties with distributed electron clouds, such as carbon-carbon double bonds. The pi-electron cloud of the double bond is easily distorted in an external electric field. Bending or stretching the bond changes the distribution of electron density substantially, and causes a large change in induced dipole moment.

[0068] A quantum-mechanical approach to Raman scattering theory relates scattering frequencies and intensities to vibrational and electronic energy states of a molecule. Standard perturbation theory treatment assumes that the frequency of the incident photons or phonons is low compared to the frequency of the first electronic excited state. Small changes in the ground state wave function are described in terms of the sum of all possible excited vibronic states of the molecule.

[0069] If the wavelength of a photon or phonon source is within the electronic spectrum of a molecule then the intensity of some Raman-active vibrations increases by a factor of about 10^2-10^4. This resonance enhancement or resonance Raman (RR) effect may be useful. Resonance enhancement does not begin at a sharply defined wavelength. Enhancement of 5×-10× is commonly observed if the exciting source is within even a few hundred wavenumbers below the electronic transition of a molecule. This pre-resonance enhancement may also be experimentally useful. RR is best observed in molecules possessing vibrations that can be resonantly enhanced.

[0070] A Raman spectrum (e.g., a stokes-scattered Raman spectrum) is a plot of the intensity of Raman scattered radiation as a function of its frequency difference from the incident radiation (usually in units of wavenumbers, cm^{-1}). This difference is called the Raman shift. Note that, because it is a difference value, the Raman shift is independent of the frequency of the incident radiation. Each Raman spectrum has a characteristic set of peaks that allow it to be distinguished from another Raman spectrum.

Application to the Embodiments

[0071] Let a processing channel refer to a sequence of nodes installed in a system, through which a liquid (e.g., a colloid hydrocarbon medium) passes during processing. The physical basis for embodiments in accordance with the present disclosure is the application of an acoustic field to the liquid in the processing channel. In particular, the physical basis is the organization of a resonant interaction of the hydrocarbon liquid in the processing channel to provide energy transfer to a limited set of molecular degrees of freedom, with a significant reduction in energy costs compared to the process of scattering in many degrees of freedom of the molecular system.

[0072] The source of the energy transferred to the molecular degrees of freedom is a device that excites vibrations in a hydrocarbon liquid medium. Under one or two stage stochastic resonance, and in the presence of a modified physical vacuum density, some bonds are broken and macromolecules are transformed into free radicals. Such free radicals are very active and will cause a number of chemical reactions to occur in polymers in the hydrocarbon liquid medium. Although these processes of free radical transformation depend on neighboring macromolecules, phonon excitation and electron state of macromolecules fragments, the processes are mostly spontaneous.

[0073] System Overview:

[0074] A process to decompose polymeric compounds in a hydrocarbon medium includes treating the hydrocarbon medium by thermal, acoustic and mechanical effects against the background of a modified physical vacuum density. A change in the physical vacuum density significantly increases the probability of tunnel electron transitions from the dissociation of covalent and others bonds in molecular systems against the background of temperature and mechanical (acoustic) fields in the medium. The process makes it possible to reduce the required power consumption by a factor of several times compared to the power expended during conventional thermal cracking.

[0075] A system and apparatus to carry out processes of cold cracking of hydrocarbons in the hydrocarbon medium under condition of modified physical vacuum includes a pump acoustic field generator ("PAFG") that performs medium pumping and acoustic treatment of the medium in presence of a modified physical vacuum. The PAFG is designed to impart acoustic and mechanical effects on the environment by design elements such as a relief and shape of lamellae, gratings on an output channel of the PAFG casing, and gratings arranged along an outer circumferential portion of the lamella disk.

[0076] The system further includes a rotating drum unit (also known as a vacuum action source unit, "VASU"), which processes the hydrocarbon medium in a single housing within a pump magnetic vacuum reactor ("PMVR"). The hydrocarbon medium rotates as it is processed, and the rotating hydrocarbon medium in the drum is a source of vacuum flow, which changes the density of the physical vacuum in a middle portion and in the PMVR.

[0077] An exposure chamber is situated in the middle of the housing between the PAFG and the drum unit. The chamber is coupled to an inlet pipe through which the hydrocarbon medium flows for treatment. The hydrocarbon medium is supplied to the center of the front wall of the drum unit housing. The hydrocarbon medium fills the exposure chamber, passes out an outlet passage of the exposure chamber, and passes into a central opening of the pump acoustic field generator. After treatment, an impeller forces the treated hydrocarbon medium into an outlet pipe coupled to the PMVR.

[0078] In the PMVR, the hydrocarbon medium is under the influence of mechanical, acoustic and thermal fields in conditions of modified physical vacuum density, i.e., under conditions of increased probability of quantum tunnel transitions, allowing the one or two stage stochastic resonance to occur, and leading to a dissociation of chemical bonds.

[0079] Lamellae of the pump acoustic field generator and the VASU are driven by different electric motors with independent control, which allows a system operator to control separately the speed of pumping hydrocarbon material, and the level and the way of change in the density of vacuum.

[0080] The PMVR adds a powerful source of magnetic-physical vacuum action and acoustic influence on the hydrocarbon medium. In the presence of a modified density of physical vacuum, acoustic influence causes a significant weakening of different types of chemical bonds.

[0081] The main principle of operation is: First, modifying the physical vacuum density in the volume of the hydrocarbon medium being processed. Second, allowing state transitions of electrons in the electron shell of molecules. Third, modifying a molecular and colloidal structure of the hydrocarbon material. The result is improved processing efficiency and degree of processing quality.

[0082] By selecting and controlling specific frequencies of the acoustic field, the acoustic field will create acoustic phonons that vibrate molecules of the liquid on a molecular scale. This is in contrast to larger-scale vibrations of a bulk material that provide a relatively more coherent vibration of the entirety of a bulk material. Energy from the acoustic phonons is transferred to the electron states of atoms in the molecules of the liquid. The result of this control of the acoustic field is to transfer energy to a wide range of vibrational degrees of freedom while reducing the density of a physical vacuum (including an electromagnetic quantum vacuum), allowing the process to be performed at low temperatures (i.e., cold cracking). Bond breaking occurs when molecular groups oscillate relative to each other at a modified vacuum density, which reduces the strength of the C—C bond. In this case, the bond is not capable of holding the C atoms together and the C atoms disassociate and break the C—C bond. The physical vacuum includes the electromagnetic vacuum.

[0083] System Details:

[0084] FIG. **5** illustrates a schematic of a system **500** in accordance with an embodiment of the present invention. The overall system configuration of the number of units may vary depending upon the type of material used as the incoming hydrocarbon liquid feedstock, and upon the desired application or output products.

[0085] At a high level of description, system **500** operates on the follow principles: A processing block including an oscillator-reactor with a system of pipelines with a set of control sensors and adjusting valves. A block of auxiliary pumps is included in the system of distribution of material flows. External tanks temporarily store the hydrocarbon liquid from the system between the processing stages. A hydrodynamic mixer homogenizes the hydrocarbon liquid between processing stages. A cooling system helps maintain desired temperature levels in the processing line at different nodes.

[0086] Different materials (e.g., water, diluent, gas, etc.) may be administered to achieve the desired parameters of the product obtained at different stages of processing the hydrocarbon liquid. Depending upon a selected processing mode and type of material, the processing targets may be the result of an open system or a closed loop.

[0087] At a lower level of description, system **500** includes inlet **551** to accept feedstock for processing, such as unprocessed or partially processed hydrocarbon liquid. The feedstock is drawn in by pump **504**, through a first auxiliary tank **553**, and then is fed to hydrodynamic mixer **505**. Hydrodynamic mixer **505** mixes the feedstock from inlet **551** together with partially processed product from short bypass **508** and long bypass **509**, and with H_2 or other type of light hydrocarbons from inlet **510**. Separate bypasses **508**, **509** may be useful in order to improve homogenization and to increase a concentration of new type of activated or fresh hydrocarbon liquid for improved quality and efficiency. For a continuous chain reaction, short bypass **508** supplies activated feedstock containing free radicals. The relative volumes or flow rates of each of the inputs to hydrodynamic mixer **505** will be based upon the type of feedstock, the type of light hydrocarbon from inlet **510**, the desired output products of the process, and the thermodynamic working regimes needed to produce the desired output products. Valve **506** may be used to form different mixture ratios of short bypass **508** and the long bypass **509** to be fed back to hydrodynamic mixer **505**.

[0088] Pressure indicator PI and temperature indicator TI monitor the pressure and temperature respectively of the output of hydrodynamic mixer **505**. The output of hydrodynamic mixer **505** then is fed through valves(s) (e.g., a motorized valve and auxiliary hand valve paired together) and supply pipe **512** into pump magnetic vacuum reactor **501** (i.e., the pump reactor), within which the majority of processing takes place.

[0089] A shift of chemical balance, aside from depolymerization, is carried out by adjusting the operation of PMVR **501**, with the help of electrical motor **502** and motor **503**, thus modifying the density of the physical vacuum.

[0090] In system **500** a second pump **507**, at the outlet, is used to create a soft turbulent flow regime after vigorous stirring by contacting the feedstock with the walls and rotating lamellae **801** inside pump magnetic vacuum reactor **501**. Lamellae **801** are a feature of a lamella disk **800**, and are described in greater detail below in connection with FIG. **8**. In particular, pump **507** is used when the reaction process is to be stopped, and to pump the treated material to its final destination (e.g., a tank farm, a pipe line, etc.).

[0091] In the second pump **507**, free radicals are recombined in the absence of conditions for bond dissociation (such as the Jahn-Teller effect) by interaction of highly-reactive radicals with a hydrogen source (e.g., water, low-molecular hydrocarbons; hydrogen). These reactions reduce the concentration of free radicals and interrupt chemical chain reactions, thereby interfering with polymerization processes.

[0092] Increased transmission of energy into micelles occurs when frequencies in the polymeric system constructively add to acoustic frequencies in the medium induced by the PMVR **501**.

[0093] The dissociation of chemical bonds is carried out in PMVR **501** by an acoustic impact on the medium (i.e., the hydrocarbon liquid) under conditions of modified density of the physical vacuum. Vortex pump **503** supplies the medium and is a source of hydrodynamic and acoustic effects on the environment within PMVR **501**, specifically a portion within PMVR **501** known as a vacuum action source unit (or drum unit), changes the energy density of the physical vacuum. More specifically, the configuration and relief of the lamellas (e.g., quantity, surface shape and roughness of the lamellas) coupled to vortex pump **503** create pressure pulsations and an increase in temperature, causing acoustic and thermal effects on and within the medium. In the turbulent streams generated by PMVR **501**, there are fields of pulsating electromagnetic voltages whose frequency, density and acoustic power depend upon of the flow, in particular depend upon the flow rate and feedstock medium density. The pulsating electromagnetic voltages determine the speed of transfer of momentum through any cross-sectional surface of medium flow due to flow rate pulses. The physical description of the fields in the hydrocarbon liquid is given by an equation of continuity in time and an amount of motion along the X-axis, having the form shown in Equation (3) below.

$$\rho - \rho_0 = \frac{1}{4\pi C_0^2} \frac{\partial^2}{\partial_{X_i} \partial_{X_j}} \int_V \frac{T_{ij}\left(y, t - \frac{r}{C_0}\right)}{r} dV(y) \tag{3}$$

[0094] In Equation (3) and all other equations herein, the following notation is used:

[0095] ρ—density of medium,

[0096] η—factor of shear viscosity of medium,

[0097] p—pressure,

[0098] t—time,

[0099] τ—time for which the sound wave extends from a source,

[0100] c_0—Speed of distribution of a sound in medium,

[0101] T_{ij}—tensor of differences of pressure in a stream and the based medium,

[0102] dV—an element of volume of a liquid,

[0103] y—co-ordinate of volume dV of liquid,

[0104] r—distance from an element of volume of a liquid to a supervision point,

[0105] x—co-ordinate of a point of supervision in a sound field,

[0106] u_i—speed of currents of pulsations of a liquid,

[0107] U_c—exit speed of the liquid from a nozzle,

[0108] D—the size of an exhaust outlet,

[0109] φ—an angle of distribution of a sound,

[0110] θ—an angle between an expiration and supervision direction,

[0111] I—intensity of a sound,

[0112] L—characteristic spatial scale of pulsations of speed,

[0113] ω—characteristic frequency (in system of co-ordinates),

[0114] Ψ—function of influence of effect of convection on acoustic radiation.

[0115] The sources of turbulent flow in the reactor oscillator feedstock (i.e., the hydrocarbon liquid being processed) are the impeller and the relief of channels located in the lamella disk **800**. Flows generated by blades of the stator are sources of pressure waves in the acoustic and hypersonic field (hypersonic being above about 1 GHz), which in turn engage with the hydrocarbon liquid being processed.

[0116] A quantum-mechanical representation of the acoustic and thermal fields excited in the treated environment includes fields of acoustic and optical phonons. Vibronic state molecular systems bring together the optical and acoustic phonons at the expense of convergence of their energy options, such as the velocity of the electrons and nuclei.

[0117] This creates conditions for the absorption of acoustic phonons and pumping energy into optical phonons. A phonon absorption process is determined by the anharmonicity of the medium (in this case, the C—C bonds) and is determined in accordance with Equations (4a)-(4b) below.

$$\left(\frac{dE}{dt}\right)3 - \phi o H = \frac{\pi \beta \bar{h}^3 w_S^3}{4Nm^3} \sum_k [|f_3(k_S, k, k)|]^2 \frac{e^{\beta\pi w}}{(e^{\beta\tau w - 1})^2} \tag{4a}$$

$$\lfloor \delta(w_s + w' - w)\Delta(k_s + k' - k) \rfloor \tag{4b}$$

[0118] The process of absorbing acoustic phonons (i.e., phonon processes) with the energy pumped into the optical branch is facilitated in a stochastic resonance (SR) condition, increasing the probability of transition between states of the system. The transition probability is given by Equation (5) below.

$$C_{n'}(t) = -\frac{1}{h} H'_{n,n} \frac{\left(e^{iwn'n^t} - 1\right)}{w_{n'} n} \tag{5}$$

[0119] High thermal energy phonons are generated by "resonance" in the system bands of stochastic resonance, which are amplified by the acoustic band and by noise in the thermal phonon background. An equilibrium state of the system is derived from the equilibrium conditions for SR occurring according to the Jahn-Teller effect.

[0120] At a high level of dynamics of a nuclear subsystem (e.g., a mechanical resonance of the subsystem) in multinuclear system, there are nuclear configurations with high levels of symmetry of local nuclear configurations. Such nuclear configurations with high symmetry are present in micellar oil colloid structures (e.g., asphaltenes, rubber, and hydrocarbon high polymer globules). A micellar structure (or a micelle) is known in the art as an aggregate of molecules with a specific structure, and the micelle has a central part known as a core. Nuclear in this context refers to the core of the oil colloid micelle, including polymer molecules.

[0121] In the background art, the dissociation of covalent C—C bonds is a free radical chemical reaction with an activation energy of 900 kcal/mol, and occurs (in the thermal cracking technology) at a temperature of over 500 degrees C., and occurs at normal physical vacuum density.

[0122] In contrast, in the present embodiments under conditions of a lower energy density of the physical vacuum, the energy required to change the structure of the electron system of atoms and molecules is significantly reduced and a chemical reaction can be carried out with a small use of energy.

[0123] Breaking C—C bonds of hydrocarbon polymers with the formation of free-radical states of the atomic groups induces chemical peroxidation of hydrocarbons in a chained medium.

[0124] Embodiments crack the covalent C—C bonds and other bonds by a free-radical chain reaction that decomposes of hydrocarbon polymers in three stages: first, an initiation stage of chain reaction; second, a continuation stage of chain reaction, during which additional reactions may branch and continue; and third, a termination stage of chain reaction, during which reaction chains are broken and any additional reactions are suppressed.

[0125] The embodiments are directed to realization of this scheme of chemical process and constructed according to the specified stages of reactions.

[0126] The first stage involves free radical reactions known as depolymerization. A schematic diagram of the formation of radicals-molecules (molecular groups) having unpaired (free) electrons is given below, in which hydrocarbons are disintegrated mainly by rupture of weaker CC-bonds and CH-bonds:

$$C_2H_6 \rightarrow 2.CH_3,$$

$$C_2H_6 \rightarrow H+.C_2H_5.$$

[0127] For the background art at 600 degrees C., the constant of disintegration rate of CC-bonds is higher by a factor of approximately 1,000 compared to the constant of disintegration rate of CH-bonds. Therefore, the disintegration rate of CH-bonds is not significant compared to the disintegration rate of CC-bonds.

[0128] Two variants exist for the formation of radicals: (1) a hemolytic disintegration of molecules, for which uncharged radicals are formed and the energy required is less than about 360 kJ/mol; and (2) a heterolithic reaction involving a formation of charged ions and the energy required by the reaction is less than about 1200 kJ/mol. The first variant energetically requires less energy and thus is considerably more preferable and more probable than the second variant.

[0129] The relative ease for which hemolytic bonds in hydrocarbons can rupture depends considerably on the stability of the radicals that were formed.

[0130] Complex, high-molecular compounds decompose through two mechanisms: First, a hydrogen atom transfers to a rupture location with formation of saturated and unsaturated low-molecular radicals. Second, by the formation of two free radicals, which can participate in isomerization reactions, recombination and disproportionation.

[0131] The second stage is a continuation of a chain reaction of radicals. Four types of free radicals enter reactions:

[0132] (1) Fragmentation of a radical:

$$CH_3CO.=CH_3.+CO$$

[0133] (2) Transfer of a radical:

$$CCl_3.+CH_3CH{=}CH_2=CCl_3H+CH_2{-}CH{-}CH_2.$$

[0134] (3) Branching reactions:

$$CF_3.+2ON_3{-}SN_3{=}CF_3H+CH_3.{-}CH_3$$

[0135] (4) Attachment of a radical:

$$CH_3.+CH_2{=}CH_2{=}CH_3CH_2CH_2.$$

$$H.+C_5H_5CH_3{=}C_6H_6+CH_3.$$

[0136] Macroradicals enter the same types of reactions, namely: (1) Radical fragmentation; (2) Transfer of radicals; (3) Branching reactions; and (4) Reactions of joining of radicals.

[0137] Of these, the most widespread and important transfer of radicals is the reaction of transfer of radicals including a separation of hydrogen atom.

[0138] All of the processes to perform the second stage of chain reaction involve thermodynamic conditions of pressure, temperature, and concentration of reagents under conditions of modified physical vacuum density.

[0139] The third stage involves cracking (i.e., chain breakage), carried out by two reactions: (1) a recombination of radicals; and (2) disproportionation of radicals, which is a bimolecular reaction process that forms radicals. The recombination produces (k_p) 2n-C_4H_{10} and the disproportionation of radicals can be expressed as:

$$n\text{-}C_2H_5.+n\text{-}C_2H_5.=(k_p)n\text{-}C_2H_6+n\text{-}CH_2=CH_2$$

[0140] The energy of activation of these reactions is equal to zero. Termination of the radical chain reaction occurs mainly on hard surfaces with intense diffusion of radicals.

[0141] Pump Magnetic Vacuum Reactor ("PMVR")

[0142] Background art devices for treating oil are designed on the basis of centrifugal pumps and mixers. The physics of dissociation of C—C bonds in these devices is based on pumping the binding energy sufficiently to overcome a potential barrier, thereby organizing the corresponding oscillatory processes in the feedstock.

[0143] In contrast, embodiments in accordance with the present disclosure provide a method and a system based on a different physical principle. Embodiments increase the probability of tunneling electron transitions by changing the physical vacuum density in the volume of the feedstock (i.e., in the unprocessed or partially processed hydrocarbon liquid) without changing the binding energy.

[0144] FIG. **6**A illustrates an external view of a Pump Magnetic Vacuum Reactor ("PMVR") **600** in accordance with an embodiment of the present invention. FIG. **6**B illustrates a cutaway view of PMVR **600**, at right angle to the view of FIG. **6**B. PMVR **600** is a more detailed view of PMVR **501** of FIG. **5**. PMVR **600** provides two resonant frequencies, via reducing the physical vacuum density with the help of the drum component inside pump magnetic vacuum reactor **501**.

[0145] Major components of PMVR **600** include a pump acoustic field generator ("PAFG") **603** (also known as an oscillator reactor or a reactor pump) adjacent to a middle portion **620**, which in turn is adjacent to a vacuum action source unit ("VASU") **601**, (also known as a drum unit) opposite from PAFG **603**. Middle portion **620** has a generally cylindrical interior shape that encloses exposure chamber **602**. PAFG **603**, VASU **601** and middle portion **620** generally occupy a single housing.

[0146] The function of VASU **601** is to generate an electro-magnetic field to change the structure of the physical vacuum and generate a vacuum flow. Feedstock (either as a liquid or as a high density solid feedstock) is introduced into VASU **601** and is subjected to a rotational force. The rotating feedstock in VASU **601** is a source of vacuum flow, which changes the density of the physical vacuum in VASU **601**.

[0147] The function of exposure chamber **602** is to be a receptacle in which vacuum magnetic treatment takes place. In particular, middle portion **620** includes an inlet pipe **610** through which the feedstock to be treated flows into exposure chamber **602**. The feedstock is supplied to the center of the front wall of VASU **601**, is exposed to the vacuum flow from VASU **601**, after which the feedstock fills the volume of exposure chamber **602** and passes into the central opening **805** of the PAFG **603**. PMVR **600** also includes a first electric motor **604** and second electric motor **605** that churns lamellae through the feedstock material.

[0148] The function of PAFG **603** is to generate a pump acoustic field that provides the mechanical force and treatment of the feedstock material from exposure chamber **602** being treated. In particular, after processing, a lamella disk and impellers (illustrated in FIG. **8** as impeller **803** and lamella disk **801**) inject the processed feedstock into the outlet pipe **612** of the acoustic field generator **603**.

[0149] In the exposure chamber **602** and the PAFG **603**, the feedstock is under the influence of mechanical, acoustic and thermal fields under conditions of reduced physical vacuum density, i.e. under conditions of increased probability of tunneling electron transitions leading to the dissociation of chemical bonds.

[0150] The components of PMVR **600** are designed to cause acoustic and mechanical effects in the environment of the PMVR **600** usage, including design features of the components such as: the relief and shape of the lamella **801**, a grating on the interior of output channel **706**, and the grating **807** on the circumferential edge region of lamella disk **800**.

[0151] First electric motor **604** and second electric motor **605** may be sized depending upon the density of feedstock entering PMVR **600**. For example, first electric motor **604** may provide 20/50 kW of power (27/67 horsepower (hp)), and second electric motor **605** may provide 50 hp 50/100 kW of power (67/134 hp). One of motors **604**, **605** transfers energy to generate an acoustic field, and the other of motors **604**, **605** modifies the physical vacuum structure.

[0152] FIG. **7** illustrates cross-sectional detail of a central portion of PMVR **600** in accordance with an embodiment of the present invention. Exposure chamber **602** is adjacent to one or more housing **703**, which together at least partially toroidally encircle motor shaft **714**. VASU **710** is located within housing **703**, and both are coupled to respective inlet port **712** to enable filling of VASU **710** from the outside of housing **703**.

[0153] Prior to operation, each VASU **710** is at least partially filled with a source material of vacuum and magnetic influence (also referred to as "source material of influence"). This is a material selected to help improve the generation of vacuum flow and magnetic action. In particular, the source material of influence may be in a liquid state, a solid state, or a mixed state. The source material of influence may be determined according to the type of hydrocarbon feedstock.

[0154] During operation, motor **604** through shaft **714** rotates VASU **710** and agitates the source material of influence, producing a vacuum flow **704** and magnetic influence that propagates outside of VASU **710**. Feedstock **705** to be treated enters exposure chamber **602** from inlet **610** and is directed initially toward a front wall **716** of VASU **710**. Front wall **716** may comprise an amorphous, non-magnetic material. Feedstock **705** includes mixed untreated and previously treated feedstock, as provided by hydrodynamic mixer **505**. The front wall **716** is impermeable to the feedstock and is made from an amorphous material, so the feedstock is redirected to become flow **702**. The amorphous material is at least partially transmissive to vacuum and magnetic influence effects from VASU **710**, therefore these effects pass through front wall **716** of VASU **710** and change the electron state of feedstock located adjacent to front wall **716**, producing partially treated feedstock. In particular, the vacuum and magnetic influence effects may facilitate quantum tunneling in the polymeric feedstock in exposure chamber **602**.

[0155] The partially treated feedstock is directed as flow **702** for further processing by pump acoustic field generator ("PAFG") **603**. In particular, flow **702** is directed toward lamella disk **701**, which is part of PAFG **603**. Motor **605** rotates lamella disk **701** in order to impart mechanical treatment onto the feedstock and to pump up an acoustic field within the feedstock. The feedstock thus treated exits exposure chamber **602** by way of outlet pipe **706**.

[0156] Rotatable VASU **710** and lamellae of PAFG **603** are driven by different electric motors with independent controls, which allow separate control the speed of pumping material and control of the level of change in the density of a physical vacuum.

[0157] FIG. **8**A illustrates a front plan view of lamella disk **800**, and FIG. **8**B illustrates a sectional view of lamella disk **800** along axis A-A, both in accordance with an embodiment of the present invention. Lamella disk **800** is a more detailed view of lamella disk **701** of FIG. **7**. Lamella disk **800** is made from a material that is selected according to a type of feedstock to be processed, and will be added to help improve the generation of vacuum flow and magnetic action. In particular, lamella disk **800** is made from a material selected to provide a predetermined electron band-gap energy, the specific electron band-gap energy being determined by the type of hydrocarbon feedstock. Lamella disk **800** will have different relief features on the major surface of FIG. **8**A, depending of density of feedstock. For example, some relief features may include lamellae **801** or other features that are at least partially concentric (e.g., grooves, ridges, etc.). Lamella disk **800** as illustrated includes central opening **805** and impellers **803**.

[0158] In operation, lamella disk **800** as illustrated in FIG. **8**A rotates clockwise. Lamella disk **800** is accessible to an output opening of exposure chamber **602**, such that partially processed feedstock from exposure chamber **602** flows through central opening **805**, whereupon impellers **803** push the partially processed feedstock radially outward toward lamellae **801** and gratings **807** for additional processing. The feedstock flows radially outwards, through radial openings in lamella **801** into an annular gap, whereby the radial openings are evenly arranged at the exterior surface of the rotor. The liquid in the annular gap is subjected to the fast rotation of the rotor as function of: (a) the rate of revolution, (b) the radius of lamellae disk **800** and (c) the number of openings at the exterior surface of lamella disk **800**, with an appropriate frequency of oscillating and reciprocating pressure waves. The frequency of the oscillating and reciprocating pressure waves can be controlled by design of the revolution rate, the radius of lamella disk **800**, and the number of openings. The additionally processed material is then pushed out through outlet pipe **706**.

[0159] Upon cracking of the colloidal hydrocarbon medium (e.g., oil), components of the oil occupy a reaction zone. Simultaneously there are free radicals of various activity also in the reaction zone, leading to competing reactions that finally produce the various products.

[0160] FIG. **9** illustrates cross-sectional detail of a Pump Magnetic Vacuum Reactor ("PMVR") **900** in accordance with an embodiment of the present invention. PMVR **900** is similar to PMVR **600**, but illustrated from an opposite (i.e., "behind") point of view. Major components of FIG. **9** include feedstock **905** entering an exposure chamber **902**, a housing **903** enclosing a vacuum action source unit ("VASU"), vacuum flow **904** produced by the VASU, motor **908** to rotate the VASU in order to produce the vacuum flow, lamella disk **901** to mechanically operate on partially processed feedstock from exposure chamber **902**, and output channel **906** through which processed feedstock exits PMVR **900**.

[0161] FIG. **10** illustrates a process **1000** in accordance with an embodiment of the present invention. Process **1000** begins at step **1001**, at which a colloidal hydrocarbon polymeric medium is introduced into an exposure chamber.

[0162] Next, process **1000** proceeds to step **1003**, at which a hydrocarbon medium in a drum adjacent to the exposure chamber is rotated in order to produce a modified density of a physical vacuum.

[0163] Next, process **1000** proceeds to step **1005**, at which the modified density of the physical vacuum is propagated to the exposure chamber to change an electron physical vacuum state in the colloidal hydrocarbon polymeric medium.

[0164] Next, process **1000** proceeds to step **1007**, at which energy from the acoustic phonons is transferred to electron states of atoms in molecules of the colloidal hydrocarbon polymeric medium.

[0165] Next, process **1000** proceeds to step **1009**, at which the shorter molecular products are withdrawn from the reaction chamber.

[0166] The criterion of adiabatic approach ($\hbar\omega/|En-Em|$) <<1 is not carried out for similar nuclear configurations, i.e., for degeneration ($\Delta E=0$) and quasidegeneration ($\Delta E\sim 0$) of electron states, where ΔE is known as a power gap in an electron spectrum or energy states, distinct of electron conditions. In particular, "electron states" refers to quantum characteristics of an atom, and "electron conditions" refers to conditions that determine quantum electron states. For these degenerate electron states, the criterion of adiabaticity: $\hbar\omega/\Delta E\sim(me/Mn)$ is not applicable, and their electron states are strongly dependent on a state of a nuclear subsystem, specifically on dynamics of the nucleus. Thus electrons have low speeds, comparable with speeds of nuclei.

[0167] Thus, the generalized wave function of a molecular group, including interaction of electron and nuclear subsystems, is in the form of wave function vibronic states in accordance with Equation (6) below.

$$\Psi(r, Q) = \sum_{k=1}^{f} \Psi_K(r) x_k(Q) \tag{6}$$

[0168] Equation (6) expresses dependence of the states of the electron subsystem upon a nuclear state. The behavior of the degenerate or quasidegenerated ensemble $\psi_n(r)$ states of the electron system describes the vibronic Hamiltonian.

[0169] Equation (7) below describes local groups of atoms in vibronic coupling conditions, created in the local molecular groups in a condition of stochastic resonance. The vibronic coupling state releases correlation energy from the electron subsystem, which leads to an appearance of anharmonicity.

$$\hat{H} = \frac{1}{2}\sum_{r\gamma}(P^2 r_\gamma + w_r^2 Q_r^2)\hat{C}_{A_\perp} + \sum_{r\gamma} V_r Q_{r\gamma}\hat{C}_{r\gamma} \tag{7}$$

[0170] Processes and phenomena supported by PMVR **600** include: the kinetics of free-radical reaction, i.e., a shift of chemical equilibrium; polymerization and depolymerization; operating over a mixed mass ratio of activated and/or non-activated media; operating over a temperature range of about 50° C. to 150° C.; operating over a pressure range of about −0.5 bar to 8 bar; operating with a residence time in the reaction zone (i.e., circulation time) of about 1 second to 3 seconds; and providing improved stirring efficiency, which is determined by the type of feedstock and its physical parameters.

[0171] The process steps are based on selecting a combination of the following parameters within the given operating ranges: (1) inlet pressure and outlet pressure within a range of about −0.5 bar to +8 bar; (2) the rotor frequency within a range of about 10 kHz to 80 kHz; (3) feedstock temperature within a range of about 50 degrees C. to 150 degrees C.; (4) the ratio of the mixed mass of material (treated and untreated); (5) processing time; and (6) the circulation rate and the magnitude of the decrease in physical vacuum density at the appropriate drum speed.

[0172] With respect to a Pump Magnetic Vacuum Reactor for carrying out processes of cold cracking of hydrocarbons, a system embodiment includes a pump that performs pumping and acoustic treatment of the feedstock. The pump provides these acoustic and mechanical effects by including the following design elements: the relief of the lamella (e.g., quantity, surface shape and roughness of the lamella), a grating on the interior of output channel **706** of the pump casing and the grating **807** arranged along an outer circumferential portion of lamella disk **800**.

[0173] Processing time and circulation rate are determined by the required performance and specific mixture of output products that intended to result from the cracking process. A preferred specific combination of values of these six parameters within their operating ranges will depend upon the desired mixture of products to be produced. Typically, the desired mixture of products to be produced will be a mixture that maximizes the profit of the products at the time they will be sold (e.g., on the spot market, or pursuant to a contract, etc.). The desired mixture is readily solvable by combinatorial optimization, given yields, processing costs, and market prices of the products produced.

[0174] Change to the medium colloidal structure (e.g., viscosity, density, temperature, transition between a liquid state and a gel solid state of the colloidal (i.e., "sol-gel")) with changing physical parameters occurs due to changes in the medium fraction composition and structure of the colloidal interactions oil medium components with different molecular weight and type of intermolecular forces. An important condition is the values of these parameters within their ranges, chosen for processing the hydrocarbon liquid and producing a preferred combination of products.

[0175] Choosing a preferred and effective mode starts by selecting an operating mode at the time of initial start-up. The preferred operating mode is set by processing mode parameters (e.g., intensity of treatment), which in turn depend upon a feedstock assay. For example, the intensity of treatment is adjusted by selecting a motor mode of operation and by selecting an amount of the return flow on bypass, which is set by valves. Selecting a motor mode may set the motor speed, e.g., a first mode may operate at about 10 to 25 cycles per second ("CPS"), a second mode may operate at about 25 to 50 CPS, a third mode may operate at about 50 to 80 CPS, and so forth.

[0176] The hydrocarbon liquid may receive additional exposure in PMVR **600** by re-feeding the partially-processed hydrocarbon liquid back to the reactor input through one or more bypasses or feedstock recirculation loops. The bypasses include a short bypass from the output of PMVR **600** into the input of PMVR **600**, and a long bypass from the output of PMVR **600** into hydrodynamic mixer **505**. The additional exposure in PMVR **600** provided by re-feeding the partially-processed hydrocarbon liquid may be beneficial by facilitating additional cracking of branching chains and thereby increasing the concentration of free radicals.

[0177] At least part of the increase in processing time takes place as the feedstock is transported to temporary storage tanks in the external environment and then returned to the system. The temporary storage tanks are illustrated in FIG. **5** as auxiliary tanks T**1**, T**2**, and T**3**.

[0178] An external tank creates conditions for damped free-radical reactions, which resulted in a new colloidal structure for the colloidal hydrocarbon liquid. Subsequently, the treated feedstock can be returned to the system for reprocessing together with unprocessed liquid, or by retreating the partially-processed hydrocarbon liquid with its current composition of hydrocarbons. This procedure may be repeated several times.

[0179] Target temperatures in different parts of the system are determined by factors such as the mode of operation of oscillator reactors (e.g., the operating frequency of the rotor), the cooling system, as well as the ratio of the volume of the mixed feedstock (both heated and cooled) and the amount of circulation time for the partially-processed hydrocarbon liquid in the system.

[0180] The required pressure levels in different parts of the system are provided by the oscillator reactors (e.g., rotor frequency), settings of bypass valves, whether intermediate tanks are used, regulating pressure levels, and the amount of outflow feedstock from different parts of the system.

[0181] The free-radical reaction is initiated by an operating mode that sets a vibration mode of the system. The vibration mode is selected according to properties of the feedstock, in particular properties used to create stochastic resonance and modified physical vacuum density in PMVR **600**, which contains the hydrocarbon liquid to be processed. Vibration modes are identified by the frequency of vibration, which may range in value from a few Hz to over 1 MHz.

[0182] Frequency hydrodynamic (i.e., acoustic) effects, for a first (of two) continuous pump frequency reactors, are generated by adjusting modes of operation operating on the hydrocarbon liquid at the inlet **610** of PMVR **600** and within the oscillator reactor. Surface shape and texture of lamella disk **800**, lamellae **801** and the stator chamber are designed with respect to feedstock density and the composition criteria after processing of the hydrocarbon liquid between the entry and exit of the PMVR **600**. The lower temperature limit should be sufficient to obtain the required thermodynamic parameters.

[0183] Specific characteristics of two-mode (i.e., two-frequency) resonant pumping of energy into electron subsystem C—C bonds is chosen and tailored, for components in the hydrocarbon liquid to be processed, during operating of the system in accordance with the physical-chemical characteristics of the hydrocarbon liquid to be processed.

[0184] The mode of operation used to initiate a chain reaction continues for the whole period of oscillator reactors working time treatment period. This adds to the original induced chain reaction by adding chain processes for additional and recycled hydrocarbon liquid, thereby increasing the concentration of free radicals.

[0185] Maintaining and continuing the chain reaction is the main objective once the chain reaction starts. This is carried out by PMVR **600** coupled to a piping system and to an input hydrodynamic mixer **505** and auxiliary tanks T**1**, T**2**, T**3**, which facilitate mixing of the reaction products, maintaining the pressure parameters, and maintaining temperatures required for chain reaction.

[0186] A depolymerization action, which is a second stage in the chain reaction, is started and maintained by establishing in the system the desired thermodynamic conditions (e.g., temperature, pressure, and concentration ratio of the reactants), which shifts the reaction equilibrium toward a formation of free radicals from the dissociation of C—C bonds.

[0187] Maintaining a free-radical chain reaction is accomplished by stirring or otherwise mixing the feedstock (including treated and untreated media) in hydrodynamic mixer **505** and oscillators, and in PMVR **600** where the intensive mixing is performed and which is fed by the treated feedstock supplied from bypasses **508**, **509**. To improve the efficiency of this process in the inlet and outlet of the oscillator-reactor, bypass valves are installed at the inlet in order to regulate the differential pressure and differential temperature between the inlet **610** of PMVR **600** and the outlet **612** of PMVR **600**, and the ratio of the mass of the mixed processed and unprocessed material.

[0188] The input hydrodynamic mixer **505** performs the mixing of the activated feedstock and free radicals therein with incoming new material. As concentration of the starting material in the mixture increases, the chemical equilibrium shifts toward the formation of free radicals under appropriate thermodynamic conditions, leading to activation of a free-radical process.

[0189] The resulting products of the reaction are free-radicals, the nature of which depends upon the specific thermodynamic conditions in hydrodynamic mixer **505** and/or the remainder of PMVR **600** (e.g., temperature, pressure, the ratio of the reacting mass). The mixing process and the conditions it creates in the mixer create the necessary feedstock hydrocarbon colloidal fluid to produce a product having improved (i.e., lower) viscosity, due to cracking and restructuring.

[0190] Open free radical chain reactions occur through a disproportionate reaction and the recombination of free radicals. The reaction is "disproportionate" in the sense that the reaction transforms a molecule into two or more dissimilar products The main and most effective way to quench and to break the chain reaction process is by saturating the feedstock with hydrogen radicals having free valences.

[0191] After processing the material in auxiliary tanks T**1**, T**2**, T**3**, the free-radical reactions may be damped by, for example, introducing molecular hydrogen (H_2, water (e.g., steam)) or other light (i.e., low molecular weight) hydrocarbons into PMVR **600** in order to fill valence orbitals of the free radicals. Damping the free-radical reactions also may be facilitated by removing conditions in PMVR **600** that would otherwise tend to induce and support a free-radical reaction in the feedstock. Such conditions may include physical factors, e.g., a decrease in diffusion, temperature, and/or pressure. Reducing these factors would tend to damp the free-radical reactions. Low hydrostatic pressure dampens the chain reaction, which increases the diffusion of radicals, and increases the volume of a cell of activation. The activation cell, also referred to as the reaction cell, is an elementary volume of the space in which the reaction groups interact. The size of the activation cell is determined by temperature and pressure.

$$k=k_0 \exp(-Pv^*/RT)$$

[0192] where v* is an activation volume equal to the difference between the amount of the activated complex and the volume of the original molecules.

[0193] Damping of a chain reaction (e.g., by eliminating free radicals in the feedstock) occurs by eliminating the physical effects, discussed above, induced within the treated reaction feedstock at the storage tank exit.

[0194] An increase in temperature accelerates diffusion and increases the conformational dynamics of polymers, with accelerated transfer of an H atom in a macromolecule chain (i.e., a basic mechanism of macro radical end). Eliminating laminar zones and introducing turbulent flow areas increases the diffusion and mixing, thus contributing to the acceleration of recombination reactions.

[0195] To create these conditions, embodiments may use a second pump **507**, which creates a soft turbulent flow regime with vigorous stirring by contacting the feedstock with the walls and rotating lamellae.

[0196] In a second pump zone there is a process of a recombination of free radicals, in the absence of conditions for bond dissociation, by high-reactive radicals interaction with hydrogen sources (e.g., water including steam, low-molecular hydrocarbons) and with the hydrogen carrying over on the blank valences of macroradicals. These reactions reduce concentration of free radicals and interrupt chemical chain reactions, interfering with polymerization processes.

[0197] Test Results

[0198] PMVR **600** was tested in order to demonstrate a beneficial effect of vacuum flow and vacuum effect upon a hydrocarbon composition (e.g., crude oil) for the purpose of refining operations such as hydrocarbon chain cracking. Table 1 below summarizes the test results.

TABLE 1

Test Results.

Test Parameter	Unit	(A) Untreated Feedstock	(B) VASU Stopped	(C) VASU Empty	(D) VASU Filled
Density at 15° C.	Kg/L	0.9703	0.9703	0.9698	0.9292
API Gravity		14.33	14.33	14.40	20.7
Carbon Residue (MCRT) (wgt)	% mass	16.3	16.3	16.3	12.7
Viscosity (kinematic) at 40° C.	cSt	2455.0	2455.0	2453.8	134.7
Viscosity (kinematic) at 60° C.	cSt	547.0	547.0	546.7	51.52
Vanadium	mg/kg	238	238	238	181
Nickel	mg/kg	56	56	56	45
Nitrogen	mg/kg	5100	5100	5097	4000
Pour Point	° C.	3.000	3.000	2.999	−27.000
Sulphur	% mass	2.730	2.730	2.729	1.500
Total Acid Number	mg KOH/g	0.05	005	0.05	0.02

[0199] In Table 1, the columns marked with (A), (B), and (C) represent control cases, and the column marked with (D) represents measurements made with a functional system including PMVR **600**.

[0200] In particular, the measurements under (A) represent characteristics of an untreated hydrocarbon before being introduced into the system for treatment. The mass of untreated hydrocarbon was approximately 1 ton. The untreated hydrocarbon was similar to a diesel oil having an approximately 62% aromatic hydrocarbon content.

[0201] The measurements under (B) represent characteristics of the hydrocarbon after having been introduced into PMVR **600** (in particular exposure chamber **602**), but with the VASU **710** (FIG. **7**) being empty and not rotating or otherwise moving. Second electric motor **605** rated at 40 kW power, and lamella disk **701** coupled thereto, were rotating at a speed of 4,000 RPM. The test duration of the control case represented by (B) was approximately 1 hour. After being introduced, at least a portion of the hydrocarbon then was withdrawn from exposure chamber **602** to make the measurements reported under (B).

[0202] The measurements under (C) represent characteristics of the hydrocarbon after having been introduced into exposure chamber **602**, and after operating PMVR **600** with an empty VASU **710** rotated at 6,000 RPM by first electric motor **604** rated at 60 kW, and with second electric motor **605** and lamella disk **701** still rotating at a speed of 4,000 RPM. The test duration of the control case represented by (C) was approximately 1 hour.

[0203] The measurements under (D) represent characteristics of the hydrocarbon after having been introduced into exposure chamber **602**, and after operating PMVR **600** with the VASU **710** having been rotated at 6,000 RPM while being filled with a source material selected to have IF/Raman spectral characteristics matched to and compatible with the hydrocarbon in exposure chamber **602**, and with second electric motor **605** and lamella disk **701** having been rotated at a speed of 4,000 RPM. The test duration represented by (D) was approximately 1 hour. The hydrocarbon drawn from exposure chamber **602** may be referred to here in the test description as the treated hydrocarbon.

[0204] At the conclusion of the testing represented by (D), it was found that the treated hydrocarbon in exposure chamber **602** had additionally separated into a lighter portion and a heavier residue, more so than the separation observed in (B) and (C). The lighter portion was tested to provide the measurements under (D).

[0205] The measurements under (D) reveal significant changes and improvements in characteristic of the hydrocarbon compared to the measurements under (A)-(C). These changes and improvements are attributed to the operation of the system with a rotating VASU **710** at least partially filled with a hydrocarbon source material excited to produce a Raman wavelength shift of about 400 cm^{-1} to about 4,000 cm^{-1}. For example, the content of unwanted minerals vanadium and nickel had decreased in the lighter portion and were increased in the heavier residue. The nitrogen content had decreased in the lighter portion and was vented as gas. The sulphur separated as part of a slag for later removal. A benefit of this reduction is that the lighter portion with further refining will provide a product that causes less corrosion and produces fewer combustion emissions.

[0206] The lighter portion also was measured to have improved density, viscosity and pour point as a result of treatment, compared to the untreated hydrocarbon. This reduces the proportion of waxy and heavy crude in the treated hydrocarbon, and accordingly reduces the energy needs of further refining the treated hydrocarbon. The reduction in viscosity reduces the need for a diluent during transport of the processed products.

[0207] Subsequent to the testing documented in Table 1, a portion of the untreated feedstock not used for the testing of Table 1 was separately treated in PMVR **600** in two different runs, each run using a different type of source material in VASU **710**. Other than the selection of source material, both runs were conducted under the same conditions as column (D) of Table 1. The first run used a source material having an IR resonance at approximately 1028 cm^{-1} and the results are documented in Table 2 below. The second run used a source material having an IR resonance at approximately 1062 cm^{-1} and the results are documented in Table 3 below. Before and After measurements in Table 2 and Table 3 are in units of milliliters (ml). In comparison, the untreated feedstock had an IR resonance at approximately 1029 cm^{-1}.

TABLE 2

Test Results.

Cut Point Range	Before	After
300° C.-320° C.	90.6	170.8
360° C.-380° C.	165.21	181.4
500° C.-520° C.	35.5	30.3

TABLE 3

Test Results.

Cut Point Range	Before	After
300° C.-320° C.	90.6	95.4
360° C.-380° C.	165.21	170.12
500° C.-520° C.	35.5	34.79

[0208] Cut points are known in the art of petroleum refining as the temperatures in a distilling column at which various distilling products are separated during distillation in a conventional refinery. The temperature at which a product (or "cut" or "fraction") begins to boil is called the initial boiling point (IBP). The temperature at which the product is 100% vaporized is the end point (EP). In Table 2 and Table 3, the first cut point range (300° C.-320° C., or approximately 572° F.-608° F.) was the lightest distillation fraction measured here and represents light gas oil products such as gasoline and benzene. The second cut point range (360° C.-380° C., or approximately 680° F.-716° F.) is a heavier distillation fraction than the first cut point range, and represents products such as diesel fuel and other heavy gas oils. The third cut point range (500° C.-520° C., or approximately 932° F.-968° F.) was the heaviest distillation fraction measured here, and represents products such as vacuum gas oil and residuals.

[0209] Generally, lighter distillation fractions are relatively more desirable than heavier distillation fractions, because lighter distillation fractions are generally more economically valuable. Table 2 and Table 3 both show that the measured levels of distillation product in the first cut point range (300° C.-320° C.) and the second cut point range (360° C.-380° C.) increased compared to the untreated feedstock, and measured levels of distillation product in the less desirable third cut point range decreased. However, comparison of Table 2 to Table 3 shows that in Table 2 the measured amount of distillation product in the more desirable first and second cut point ranges increased more than that in Table 3. In addition, the measured amount of distillation product in the less desirable third cut point range decreased more in Table 2 compared to Table 3. Note that the IR resonance of the source material used in the first run (Table 2) more closely matched the IR resonance of the untreated feedstock, compared to the IR resonance of the source material used in the second run (Table 3).

[0210] In one embodiment, the IR resonance of the source material (or a dominant spectral component of the IR resonance) is within approximately +/−33 cm^{-1} of the IR resonance (or dominant spectral component thereof) of the target material. In another embodiment, the IR resonance of the source material is within approximately +/−1 cm^{-1} of the IR resonance of the target material. In another embodiment, a mathematical correlation of the IR resonance spectrum of the source material to the IR resonance spectrum of the target material, within a predetermined cm^{-1} band of interest, is above a predetermined threshold.

[0211] While the foregoing is directed to embodiments of the present invention, other and further embodiments of the present invention may be devised without departing from the basic scope thereof. It is understood that various embodiments described herein may be utilized in combination with any other embodiment described, without departing from the scope contained herein. Further, the foregoing description is not intended to be exhaustive or to limit the present invention to the precise form disclosed. Modifications and variations are possible in light of the above teachings or may be acquired from practice of the present invention.

[0212] No element, act, or instruction used in the description of the present application should be construed as critical or essential to the invention unless explicitly described as such. Also, as used herein, the article "a" is intended to include one or more items. Where only one item is intended, the term "one" or similar language is used. Further, the terms "any of" followed by a listing of a plurality of items and/or a plurality of categories of items, as used herein, are intended to include "any of," "any combination of," "any multiple of," and/or "any combination of multiples of" the items and/or the categories of items, individually or in conjunction with other items and/or other categories of items.

[0213] Moreover, the claims should not be read as limited to the described order or elements unless stated to that effect. In addition, use of the term "means" in any claim is intended to invoke 35 U.S.C. § 112(d), and any claim without the word "means" is not so intended.

1. A method to change the molecular composition of a target colloidal hydrocarbon polymeric medium under a condition of modified physical vacuum structure, comprising:

introducing the target colloidal hydrocarbon polymeric medium into an exposure chamber, wherein a Raman spectrum of the target colloidal hydrocarbon polymeric medium includes a predetermined target spectral resonance;

rotating a source hydrocarbon medium in a drum adjacent to the exposure chamber, to produce a vacuum and magnetic influence, wherein a Raman spectrum of the source hydrocarbon medium includes a predetermined source spectral resonance;

propagating the vacuum and magnetic influence to the target colloidal hydrocarbon polymeric medium in the exposure chamber;

applying a mechanical vibration to the target colloidal hydrocarbon polymeric medium to vibrate the target colloidal hydrocarbon polymeric medium on a molecular scale, to create colloidal molecular vibrations;

transferring energy from the colloidal molecular vibrations to an electron system of atoms in molecules of the target colloidal hydrocarbon polymeric medium until at least a portion of the molecules of the target colloidal hydrocarbon polymeric medium cracks into shorter molecular hydrocarbon products; and

withdrawing the shorter hydrocarbon molecular products from the exposure chamber.

2. The method of claim **1**, wherein the step of transferring energy comprises steps of:

inducing a radical chain reaction to create free radicals; and

applying the free radicals to the target colloidal hydrocarbon polymeric medium in order to crack molecules of at least the portion of the target hydrocarbon polymeric medium.

3. The method of claim **2**, wherein the step of applying the free radicals comprises steps of:

continuing the radical chain reaction, during which additional reactions may branch and continue; and

terminating the radical chain reaction, during which reaction chains are quenched and any additional reactions are suppressed.

4. The method of claim **2**, wherein the step of inducing the radical chain reaction causes depolymerization.

5. The method of claim **2**, wherein free radicals are created by a hemolytic disintegration of molecules, wherein uncharged radicals are formed with energy required less than about 360 kJ/mol.

6. The method of claim **2**, wherein free radicals are created by a heterolithic reaction involving a formation of charged ions, wherein the energy required by the heterolithic reaction requires is less than about 1200 kJ/mol.

7. The method of claim **3**, wherein the step of continuing the radical chain reaction comprises a step selected from a group consisting of: fragmenting a radical, transferring a radical, branching a radical, and attaching a radical.

8. The method of claim **3**, wherein the step of terminating the radical chain reaction comprises a step of performing a reaction selected from a group consisting of: recombination of radicals, and disproportionation of radicals.

9. The method of claim **1**, further comprising steps of:

introducing fresh colloidal hydrocarbon polymeric medium into a mixing chamber;

introducing partially processed colloidal hydrocarbon polymeric medium into the mixing chamber;

mixing the contents of the mixing chamber for a predetermined period of time until a radical chain reaction takes place; and

introducing the mixed contents into the exposure chamber.

10. The method of claim **1**, wherein molecules of the portion of the colloidal hydrocarbon polymeric medium crack into shorter molecular hydrocarbon products by reason of an up to two-stage stochastic resonance under conditions of vacuum and magnetic influence.

11. The method of claim **9**, wherein the mechanical vibration is applied to a single oscillatory system comprising the exposure chamber, the drum, the mixing chamber, and associated piping there between.

12. The method of claim **10**, wherein the two-stage stochastic resonance is produced by the mechanical vibration acting upon molecules of the colloidal hydrocarbon polymeric medium.

13. The method of claim **1**, wherein a resonance among molecules in the colloidal hydrocarbon polymeric medium provide an energy transfer to at least some degrees of freedom of molecules in the colloidal hydrocarbon polymeric medium.

14. The method of claim **1**, wherein molecules of the colloidal hydrocarbon polymeric medium crack at least when the colloidal hydrocarbon polymeric medium is within a temperature range of 70 degrees Celsius or lower to 150 degrees Celsius or lower.

15. The method of claim **1**, wherein the vacuum and magnetic influence increases a probability of tunneling electron transitions in the colloidal hydrocarbon polymeric medium without changing a binding energy.

16. The method of claim **1**, wherein the vacuum and magnetic influence comprises Unruh radiation.

17. The method of claim **1**, wherein the predetermined source spectral IR resonance is within 1 cm^{-1} of the predetermined target spectral IR resonance.

18. The method of claim **1**, wherein the predetermined source spectral IR resonance is within 33 cm^{-1} of the predetermined target spectral IR resonance.

19. A shorter molecular hydrocarbon product prepared by a process comprising the steps of:

introducing a colloidal hydrocarbon polymeric medium into an exposure chamber;

rotating a hydrocarbon medium in a drum adjacent to the exposure chamber;

applying a mechanical vibration to the colloidal hydrocarbon polymeric medium to vibrate the colloidal hydrocarbon polymeric medium on a molecular scale, to create colloidal molecular vibrations;

transferring energy from the colloidal molecular vibrations to an electron system of atoms in molecules of the colloidal hydrocarbon polymeric medium until at least a portion of the molecules of the colloidal hydrocarbon polymeric medium cracks into shorter molecular hydrocarbon products; and

withdrawing the shorter molecular hydrocarbon product from the exposure chamber.

* * * * *

EXHIBIT 5

10,053,635

’635 Patent Claim Element	Elements Found in the NVT ‘402 Application
Claim 1	
A method for the treatment of a liquid consisting essentially of mineral oil to increase the portion of low-boiling fractions, wherein said treatment comprises	A “system and procedure for treatment of liquids, in particular a colloid hydrocarbon medium mineral oil … in order to “increase the content of light, low boiling point fractions….” ¶ 9; *see also* ¶¶ 2, 9, 30, 31, 34, etc.
(a) feeding the liquid through an application region of a pressure wave generator so as to subject the liquid to pressure waves having a first frequency in the application region,	“The sources of turbulent flow in the reactor oscillator feedstock (i.e., the hydrocarbon liquid being processed) are the impeller and the relief of channels located in the lamella disk 800. Flows generated by blades of the stator are sources of pressure waves ….” ¶ 115; *see also, e.g.,* Fig. 6B, ¶¶ 93, 147, 148, 150, 158 (addressing the “frequency of oscillating and reciprocating pressure waves”).
wherein the pressure wave generator comprises a rotor mounted in a housing,	The energy is “induced by a rotor of a pump” (¶ 9, see also, e.g., ¶¶ 144, 180-83)
(b) withdrawing a portion of the liquid that was subjected to the first frequency in (a) before that portion of liquid reaches a tank for collection, and refeeding said withdrawn portion of liquid in a recirculation pipe so as to pass through said application region,	“The hydrocarbon liquid may receive additional exposure in PMVR 600 by re-feeding the partially-processed hydrocarbon liquid back to the reactor input through one or more bypasses or feedstock circulation loops.” ¶ 176; Fig. 5; *see also* ¶¶ 177, 178, 187)
and adjusting the pressure of the withdrawn liquid in the recirculation pipe by the aid of at least one adjustable throttle valve as needed so as to achieve or maintain a resonance frequency of a system comprising the pressure wave generator and piping leading to and piping leading away from the pressure wave generator and the liquid contained therein,	System is “selecting an amount of the return flow on bypass, which is set by valves.” ¶ 175; *see also, e.g.,* ¶ 180 (pressure is set in part by “settings of the bypass valves”), ¶ 187 (same). The pressure creates vibration at the resonance frequency of the system. *See, e.g.,* ¶ 181 (operating at “vibration mode of the system”; ¶¶ 144, 180-83)
whereby the resonance frequency of the system occurs at a second frequency,	The system involves a “two-mode (*i.e.,* two frequency) resonant pumping of energy….” ¶ 181; *see also, e.g.,* ¶ 144 (“PMVR 600 provides two resonant frequencies…”).
and wherein the liquid has a lower temperature of before (a) than after the resonance frequency is achieved or maintained;	There is a “differential temperature between the inlet of 610 of PMVR 600 and outlet 612 of PMVR 600”). ¶ 187. “[T]he configuration and relief of the lamellas . . . coupled to vortex pump 503 create pressure pulsations and an increase in temperature,

	causing acoustic and thermal effects on and within the medium." ¶ 93.
and (c) collecting the thus treated liquid in the tank,	"The feedstock is transported to temporary storage tanks in the external environment and then returned…" and identifying "auxiliary tanks T1, T2, and T3." ¶ 177; *see also, e.g.*, ¶¶ 85, 87, 90, 177-80, etc.
the thus treated liquid having an increased portion of low-boiling fractions.	The treated liquid "increase[s] the content of light, low boiling point fractions…." ¶¶ 9, 30, 31, 34, etc.
Claim 6	
A method for the treatment of a liquid consisting essentially of mineral oil to increase the portion of low-boiling fractions, wherein said treatment comprises	A "system and procedure for treatment of liquids, in particular a colloid hydrocarbon medium mineral oil … in order to "increase the content of light, low boiling point fractions…." ¶ 9; *see also* ¶¶ 2, 9, 30, 31, 34, etc.
(a) feeding the liquid through an application region of a pressure wave generator so as to subject the liquid to pressure waves having a first frequency in the application region;	"The sources of turbulent flow in the reactor oscillator feedstock (i.e., the hydrocarbon liquid being processed) are the impeller and the relief of channels located in the lamella disk 800. Flows generated by blades of the stator are sources of pressure waves …." ¶ 115; *see also, e.g.*, Fig. 6B, ¶¶ 93, 147, 148, 150, 158 (addressing the "frequency of oscillating and reciprocating pressure waves").
(b) withdrawing a portion of the liquid treated in (a) before that portion of liquid is collected as treated liquid in (d), and recirculating the withdrawn liquid and refeeding said withdrawn liquid portion back through said application region of the pressure wave generator in (a),	"The hydrocarbon liquid may receive additional exposure in PMVR 600 by re-feeding the partially-processed hydrocarbon liquid back to the reactor input through one or more bypasses or feedstock circulation loops." ¶ 176; Fig. 5; *see also* ¶¶ 177, 178, 187)
(c) adjusting the pressure of the recirculating withdrawn portion of liquid in so as to attain or maintain a resonance frequency of a system comprising the pressure wave generator and piping leading to and piping leading away from the pressure wave generator and the liquid contained therein,	System is "selecting an amount of the return flow on bypass, which is set by valves." ¶ 175; *see also, e.g.*, ¶ 180 (pressure is set in part by "settings of the bypass valves"), ¶ 187 (same). The pressure creates vibration at the resonance frequency of the system. *See, e.g.*, ¶ 181 (operating at "vibration mode of the system"; ¶¶ 144, 180-83)
wherein the resonance frequency is at a second frequency that is different from the first frequency;	The system involves a "two-mode (*i.e.*, two frequency) resonant pumping of energy…." ¶ 181; *see also, e.g.*, ¶ 144 ("PMVR 600

	provides two resonant frequencies…”).
and (d) collecting the thus treated liquid,	“The feedstock is transported to temporary storage tanks in the external environment and then returned…” and identifying “auxiliary tanks T1, T2, and T3.” ¶ 177; *see also, e.g.,* ¶¶ 85, 87, 90, 177-80, etc.
the thus treated liquid having an increased portion of low-boiling fractions.	The treated liquid “increase[s] the content of light, low boiling point fractions….” ¶¶ 9, 30, 31, 34, etc.

EXHIBIT 6

CMGO Provides Update

NEWS PROVIDED BY
CMG Holdings Group, Inc. →
Aug 26, 2021, 10:25 ET

CHICAGO, Aug. 26, 2021 /PRNewswire/ -- SCMGO XA (OTC: CMGO) is providing an update on previously mentioned jobs in the works. Our job for Timberland is in production and the project will take place over three days starting September 22nd. It will be taking place in NYC. Our next Madewell event will take place in September. XA is extremely pleased to produce these substantial installations for our loyal customers. Two other jobs scheduled for late September will likely be pushed to October. The fourth quarter looks very robust and we are expecting a solid holiday season.

CMG has also been working on an investment in new technology related to the crude oil refining business, specifically in the oil-upgrading sector. It is a multi-patent procedure for re-structuring oil through magnetic vacuum upgrading which has the ability to dramatically reduce sulfur and other impurities. The commercial adaptation of this new, extremely disruptive technology is very close. Excitement is building; and because CMG has been a lender since the company's inception, it is well placed to become a participant with, and beneficiary of, this new technology company, by opting to turn a group of loans into an investment. Due to an existing NDA, which should lift soon, more details can't be disclosed at this time, but suffice it to say, this investment should be a game changer for CMG and its shareholders. We will be back with more details as legal matters allow.

About CMG Holdings Group, Inc.

CMG Holdings Group, Inc. is a Chicago holding company whose primary operating subsidiary is XA – The Experiential Agency, Inc. (http://www.experientialagency.com) – which engages in the alternative advertising, digital media, experiential and interactive marketing, and entertainment sectors. XA is involved in production and promotion, event design, sponsorship evaluation, negotiation and activation, talent buying, show production, stage and set design, and data analysis and management activities. The business also offers branding and design services, such as graphic, industrial and package designs across traditional and new media, public relations, social media, media development and relations, and interactive marketing platforms to provide its clients with customary private digital media networks to design and develop individual broadcasting digital media channels to sell, promote, and enhance their digital media video content through mobile, online, and social mediums. XA serves clients across the marketing communication industry. Separately, CMG Holdings Group owns Lincoln Acquisition Corp., a subsidiary formed to manage its portfolio investments.

Disclosure Statement

Statements in this press release about our future expectations, including without limitation, the likelihood that CMG Holdings Group, Inc. will meet minimum sales expectations, be successful and profitable, bring significant value to its stockholders, and leverage capital markets to execute its growth strategy, constitute "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, Section 21E of the Securities Exchange Act of 1934, and as that term is defined in the Private Litigation Reform Act of 1995. Such forward-looking statements involve risks and uncertainties and are subject to change at any time, and our actual results could differ materially from expected results. The Company undertakes no obligation to update or release any revisions to these forward-looking statements to reflect events or circumstances after the date of this statement or to reflect the occurrence of unanticipated events, except as required by law. CMG's business strategy described in this press release is subject to innumerable risks, most significantly, whether the Company is successful in securing adequate financing and materially decreases its convertible debt. No information in this press release should be construed in any form shape or manner as an indication of the Company's future revenues, financial condition or stock price.

EXHIBIT 7

CMG Holdings Group, Inc. Discusses Upcoming Commercialization of Flagship Product and 2022 Revenue Potential with The Stock Day Podcast

Phoenix, Arizona--(Newsfile Corp. - February 7, 2022) - The Stock Day Podcast welcomed CMG Holdings Group, Inc. (OTC Pink: CMGO) ("the Company"), a Chicago holding company whose primary operating subsidiary is XA - The Experiential Agency, Inc. (http://www.experientialagency.com (https://www.newsfilecorp.com/redirect/3ewkvS58ED)) - which engages in the alternative advertising, digital media, experiential and interactive marketing, and entertainment sectors. CEO of the Company, Glenn Laken, joined Stock Day host Everett Jolly.

Jolly began the interview by asking about the Company's background and current projects. "We are a holding company that trades on the OTC," said Laken. "I have been associated with the company for ten years and have served as the Chairman and CEO since 2014," he added. "We have one holding right now, XA - The Experiential Agency, Inc.," explained Laken, adding that the Company has previously had holdings which were spun out. "We have one new major investment that we just made within the last few months."

"Could you explain your flagship product and what it does?", asked Jolly. "It takes cheaper grade oil, including crude oil, heating oil, ship oil, and removes impurities with a magnetic vacuum upgrading technology," said Laken. The profit on this process is out sized. We are just about ready to go commercial with it and we are extremely bullish," he added. "This is a multi-billion-dollar industry, and we expect to be a major disruptor in this industry."

Jolly then asked about the Company's wholly-owned subsidiary, XA - The Experiential Agency, Inc. "We do Experiential Advertising for a variety of customers, providing live experience for advertising customers," explained Laken. "We recently landed a very large job for a Western European country he continued. The events that are planned will generate interest in travel across the pond . The budget on this job is quite large.

The conversation then turned to the challenges of COVID-19, especially in regard to travel. "This project was pushed back about 30 days to fit in with the new regulations that are taking place," said Laken, adding that the Company hopes that by the time the project launches, restrictions and regulations will not affect travel as significantly.

Jolly then asked about a recent announcement detailing the purchase of company shares. "I recently announced that I had purchased 1.5 million shares in the company over a period of a few months," said Laken. "I believe the stock is extremely undervalued," he added. "My own belief is that when we get our oil business going, these prices will be a distant memory."

"Do you have any revenue projections for 2022?", asked Jolly. "From the Experiential side we expect to do somewhere between two and four million dollars," shared Laken. "We are hoping to get the oil business up and running commercially around the beginning of April."

To close the interview, Laken encouraged listeners and shareholders to consider the potential of the Company's current and upcoming projects, especially as they continue to prepare for the commercialization of their impurity removing oil product.

To hear Glenn Laken's entire interview, follow the link to the podcast here: https://audioboom.com/posts/8026908-cmg-holdings-group-inc-discusses-upcoming-commercialization-of-flagship-product-and-2022-revenu (https://www.newsfilecorp.com/redirect/NN5KyuLoNk)

Investors Hangout (https://www.newsfilecorp.com/redirect/XnRzjT8JPv) is a proud sponsor of "Stock Day," and Stock Day Media encourages listeners to visit the company's message board at https://investorshangout.com/ (https://www.newsfilecorp.com/redirect/D3MyRh03nk).

ABOUT CMG HOLDINGS GROUP, INC.

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Disclosure Statement

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Contact:

Paul Knopick
E&E Communications
940.262.3584
pknopick@eandecommunications.com (mailto:pknopick@eandecommunications.com)

About The "Stock Day" Podcast

Founded in 2013, Stock Day is the fastest growing media outlet for Nano-Cap and Micro-Cap companies. It educates investors while simultaneously working with penny stock and OTC companies, providing transparency and clarification of under-valued, under-sold Micro-Cap stocks of the market. Stock Day provides companies with customized solutions to their news distribution in both national and international media outlets. The Stock Day Podcast is the number one radio show of its kind in America.

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EXHIBIT 8

Explore

Settings

Thread

CMG Holdings Group Inc. (CMGO)
@CMGONews

$CMGO I have been asked about a status report on our oil venture. When we made a strategic decision to locate the business to the terminal in southern NJ we were aware about the terminal's readiness, but the economics were overwhelming in it's favor. The terminal is being readied

2:47 PM · Apr 20, 2022 · Twitter Web App

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CMG Holdings Group Inc. (CMGO) @CMGONews · Apr 20
Replying to @CMGONews
for us. Due to supply chain issues they are running behind and it looks like July is a more realistic start date for our project. While we are a bit disappointed by the delay the massive upside of this project makes this a inconsequential delay. Sorry for the delay in reporting

1 1 6

CMG Holdings Group Inc. (CMGO) @CMGONews · Apr 20
but I wanted to have a better handle to provide this update, thanks Glenn.

1 1 5

More Tweets

DFarmer.eth @OGDfarmer · Apr 30
In the midst of this crytpo bloodbath, there's 3 coin that are the right color: $APE $LOOKS and $ENS

But sure, keep fading us with ridicule and bury your head in the ground because you're too lazy to be curious. Should continue to be a profitable strategy…

29 55 429

Oliver Kell @1charts6 · Apr 30
XLE-Lots of people been playing energy stocks and wouldn't shock me if see them roll over. Failed breakout and 1-2-3 flags on the 50SMA region in many of them. Ferts, steels, and others. Some refiners, coals, etc still look decent but most stocks look like shorts to me.

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oil has fallen

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EXHIBIT 9

Sills Cummis & Gross
A Professional Corporation

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New York, New York 10178
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Fax (212) 643-6500

Scott D. Stimpson
Member
Admitted In NY
Direct Dial: 212-500-1550
Email: sstimpson@sillscummis.com

The Legal Center
One Riverfront Plaza
Newark, NJ 07102
Tel: (973) 643-7000
Fax: (973) 643-6500

May 13, 2022

Via E-Mail & FedEx
Stephen P. Katz, Esq.
Board Member
New Vacuum Technologies USA, LLC
c/o Connell Foley
56 Livingston Avenue
Roseland, New Jersey 07068

Re: NVT Infringement of United States Patent No. 10,053,635

Dear Mr. Katz:

We represent Earle Refining, LLC ("Earle Refining") in intellectual property matters.

This letter addresses an apparent infringement of Earle Refining's United States Patent No. 10,053,635 ("the '635 patent"; Exhibit A) by New Vacuum Technologies USA, LLC ("NVT"). Specifically, we have reviewed various sources of evidence indicating that NVT has used, and is using, a process for refining crude oil that infringes on the '635 patent. We demand that NVT promptly cease and desist all infringement and provide proof to that effect.

The details of the NVT process are confidential and inaccessible for us, and so we are basing our conclusion of infringement on publicly available information. While we are confident that there is infringement, should NVT believe for any reason that its process has not infringed the '635 patent, we request that definitive evidence of the alleged non-infringement be provided. We are willing to amicably discuss these issues with you, and we are willing to obtain any confidential NVT information under an appropriate non-disclosure agreement.

Should NVT refuse to provide adequate proof that infringement has stopped, we will have no choice but to assert claims for infringement.

Evidence of Infringement

The evidence of infringement we have uncovered to date includes the following:

(1) The 11/30/21 Press Release. By press release dated November 30, 2021 (Exhibit B), CMG Holdings Group, Inc. ("CMG") disclosed a joint venture with North Jersey Petroleum Partners LLC (NJPP), with regard to Magnetic Vacuum Upgrading (MVU) technology for refining crude oil. According to the press release, "NVT successfully installed and tested its MVU technology at a prototype plant in Southern New Jersey during the fall of 2020," and the process is covered by a patent application owned by NVT.

(2) United States Patent Application US2020/0325402 A1. The NVT application addressing the MVU technology is Application No. US2020/0325402 A1 ("the '402 Application"; Exhibit C). The '402 Application describes an NVT process that would infringe multiple claims of the Earle '635 patent. A claim chart comparing this process to independent claims 1 and 6 of the '635 patent is attached as Exhibit D for your reference.

(3) Overlap of Inventors. The '635 patent shares two inventors in common with the '402 Application, Messrs. Chernikov and Delgado Castillo. Particularly given the disclosures in the '402 Application (see Exhibits C and D), it appears clear that these inventors – surely confident in the technology of their own prior invention in the '635 patent – would have incorporated that technology here, too. In addition, the third inventor of the '402 patent, Joseph Laura, is the owner, Chairman, Chief Executive Officer, and Managing Director of Pristec America, Inc. (Nevada), a prior exclusive licensee of the '635 patent in the United States.

(4) The Pristec AG Work of Chernikov and Delgado Castillo. Beyond the fact that Chernikov and Delgado Castillo were inventors on both the '635 patent the '402 Application, we understand that they were both specifically working on combining the resonance technology with vacuum technology. Indeed, we understand that between 2008 and 2018, Chernikov and Delgado Castillo worked for Pristec AG in research and development, and both helped to develop not only the technology of the '635 patent, but a method to combine the phenomena of resonance technology with vacuum resonance. This approach, using the '635 technology in combination with vacuum resonance, is described in the '402 Application.

(5) Apparent Admission of Infringement: the 8/26/21 Press Release. An earlier press release from CMG (Exhibit E) describes the same process as a "multi-patent procedure." The '402 Application was only pending at the time, and the only issued patent was the '635 patent. Thus, this press release seems an admission that the '635 patent covered this technology, and that information surely would have been supplied by those having intimate knowledge of the process. We cannot identify any other patents to which this press release could be referring.

(6) Upcoming Commercialization: the 2/7/22 Press Release. In February of this year, CMG issued another press release (Exhibit F), referencing the "upcoming commercialization" of the process, and stating the hope to "get the oil business up and running commercially around the beginning of April." This indicates not only that the process may be running presently, but also that the process was used previously to confirm the utility of the '635 patented technology.

In our view, considering all the above evidence, it is inconceivable that the NVT process is not violating Earle Refining rights in the '635 patent.

Our Requests

We request the following:

(a) NVT immediately cease and desist infringement of the '635 patent.

(b) No later than June 1, 2022, NVT provide evidence sufficient for Earle Refining to determine that infringement has stopped (or, if you believe there has been no infringement, detailed explanations of your position and accompanying evidence). As noted, we are willing to sign an NDA and consider limits on disclosure of confidential information. While we welcome your comments and opinions, and would welcome a discussion should you prefer to start this process in that manner, we will not accept bare allegations of no infringement (whether in declaration form, affidavit form, or otherwise), nor will we accept inconclusive evidence, given the strong evidence we have of infringement set forth in this letter.

Upon receipt of the foregoing, and provided NVT has stopped infringement, we will discuss appropriate compensation to Earle Refining for past infringement.

As we are sure you realize, NVT should promptly implement a "litigation hold" on all documents and things relating to the foregoing, assuring that evidence is not altered or lost.

We look forward to receiving your response.

Sincerely,

Scott D. Stimpson

SS:
cc: CSC

EXHIBIT 10

Katherine Lieb

From:	Scott D. Stimpson
Sent:	Friday, May 13, 2022 2:51 PM
To:	Stephen P. Katz
Subject:	Re: NVT infringement
Attachments:	Katz letter.pdf

Thank you for your prompt response. Do you have a contact for NVT I could use?

Sent from my iPhone

On May 13, 2022, at 2:45 PM, Stephen P. Katz <SKatz@connellfoley.com> wrote:

*** External Email ***

Further to my prior email. I am not a board member of New Vacuum technologies.

____

On: 13 May 2022 14:35,
"Scott D. Stimpson" <sstimpson@sillscummis.com<mailto:sstimpson@sillscummis.com>> wrote:

External email: careful w/links or attachments.
____

Dear Mr. Katz:

Please find attached a letter directed to you in your capacity at New Vacuum Technologies.

Sincerely,

Scott D. Stimpson

Scott D. Stimpson
Chairman of the Intellectual Property Group
[Sills Cummis & Gross P.C.]<http://www.sillscummis.com/>

website<http://www.sillscummis.com/> |
bio<http://www.sillscummis.com/professionals/attorneys/scott-d-stimpson.aspx> |
vCard<http://www.dynasend.com/signatures/vcard/sstimpson-at-sillscummis.com.vcf> |
newsroom<http://www.sillscummis.com/newsroom/> | email<mailto:sstimpson@sillscummis.com>

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EXHIBIT 11

Linxuan Yan

From: Scott D. Stimpson
Sent: Friday, June 10, 2022 8:55 AM
To: KOConnor@pecklaw.com
Cc: William Tellado; Thomas A. DellaCroce; Katherine Lieb; Linxuan Yan
Subject: Infringement of Earle Refining '635 Patent
Attachments: 5.13 letter to Katz.pdf

Kevin:

As you know, this firm represents Earle Refining.

On May 13, we sent a letter to Stephen Katz detailing what we see as infringement of Earle Refining's '635 patent by New Vacuum Technologies, USA LLC. While Mr. Katz responded that he was not affiliated with NVT USA, we assume that he promptly forwarded my letter to you, Mr. Laura and/or others at NVT. We also sent a copy of the letter on May 13 by Federal Express to NVT's registered service agent. A copy of the letter is attached.

While my letter was addressed to NVT USA, public information indicates that the infringement may be by one or more other related and/or affiliated entities, such as New Vacuum Technologies LLC, New Vacuum Technologies of New Jersey, Inc. and New Jersey Petroleum Partners LLC ("NJPP").

We assume that you represent Mr. Laura and his companies (including NVT USA, NVT LLC, NVT of New Jersey, and NJPP) in connection with the issue of infringement of the '635 patent. We also assume that you, along with Mr. Laura and his entities, have been aware of my letter for about four weeks now.

My letter requested a response by June 1, but we have not received a response. Can you please let us know when we can expect to receive a substantive response to my letter? As it has already been about four weeks, we expect that we will receive a substantive response in the next week or two.

As my May 13 letter advised, we intend to be reasonable – we will receive any confidential information under an appropriate NDA, and we would be pleased to amicably discuss these issues at your convenience if you prefer that approach. But if we are to avoid patent litigation, we must receive proof that infringement of the '635 patent has stopped, or if you believe that there was never infringement we must receive proofs supporting that allegation.

If you do not represent any of Mr. Laura, NVT USA, NVT LLC, NVT of New Jersey, or NJPP in connection with these infringement issues, please promptly let us know and identify counsel handling these representations (if none, we will contact Mr. Laura directly).

We look forward to hearing from you.

Sincerely,
Scott D. Stimpson

Scott D. Stimpson
Chairman of the Intellectual Property Group
Sills Cummis & Gross P.C.

website | bio | vCard | newsroom | email

101 Park Avenue, 28th Floor, New York, NY 10178
p (212) 500-1550 | f (212) 643-6500 **map**

EXHIBIT 12

Linxuan Yan

From:	Scott D. Stimpson
Sent:	Tuesday, June 21, 2022 3:34 PM
To:	KOConnor@pecklaw.com
Cc:	William Tellado; Thomas A. DellaCroce; Katherine Lieb; Linxuan Yan
Subject:	RE: Infringement of Earle Refining '635 Patent

Kevin,

We have not had any response to my below June 10 email, and so Kate Lieb and I called your office this morning and left a message with your secretary (she noted you were on the phone when we called). We have not yet heard back from you in response to that message.

Can we please set up a time tomorrow for a call? We are interested in amicably discussing the situation and, if there are any responses to our infringement claims, we would like to hear them.

If we do not hear from you by COB on June 23, we will assume that you are not representing any of Mr. Laura, NVT USA, NVT LLC, NVT of New Jersey, or NJPP in connection with this infringement issue, and we will proceed to contact them directly.

We look forward to hearing from you.

Scott

Scott D. Stimpson
Chairman of the Intellectual Property Group
Sills Cummis & Gross P.C.
website | bio | vCard | newsroom | email

101 Park Avenue, 28th Floor, New York, NY 10178
p (212) 500-1550 | f (212) 643-6500 **map**

From: Scott D. Stimpson
Sent: Friday, June 10, 2022 8:55 AM
To: KOConnor@pecklaw.com
Cc: William Tellado <wtellado@sillscummis.com>; Thomas A. DellaCroce <TDellacroce@sillscummis.com>; Katherine Lieb <klieb@sillscummis.com>; Linxuan Yan <lyan@sillscummis.com>
Subject: Infringement of Earle Refining '635 Patent

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USA, we assume that he promptly forwarded my letter to you, Mr. Laura and/or others at NVT. We also sent a copy of the letter on May 13 by Federal Express to NVT's registered service agent. A copy of the letter is attached.

While my letter was addressed to NVT USA, public information indicates that the infringement may be by one or more other related and/or affiliated entities, such as New Vacuum Technologies LLC, New Vacuum Technologies of New Jersey, Inc. and New Jersey Petroleum Partners LLC ("NJPP").

We assume that you represent Mr. Laura and his companies (including NVT USA, NVT LLC, NVT of New Jersey, and NJPP) in connection with the issue of infringement of the '635 patent. We also assume that you, along with Mr. Laura and his entities, have been aware of my letter for about four weeks now.

My letter requested a response by June 1, but we have not received a response. Can you please let us know when we can expect to receive a substantive response to my letter? As it has already been about four weeks, we expect that we will receive a substantive response in the next week or two.

As my May 13 letter advised, we intend to be reasonable – we will receive any confidential information under an appropriate NDA, and we would be pleased to amicably discuss these issues at your convenience if you prefer that approach. But if we are to avoid patent litigation, we must receive proof that infringement of the '635 patent has stopped, or if you believe that there was never infringement we must receive proofs supporting that allegation.

If you do not represent any of Mr. Laura, NVT USA, NVT LLC, NVT of New Jersey, or NJPP in connection with these infringement issues, please promptly let us know and identify counsel handling these representations (if none, we will contact Mr. Laura directly).

We look forward to hearing from you.

Sincerely,
Scott D. Stimpson

Scott D. Stimpson
Chairman of the Intellectual Property Group
Sills Cummis & Gross P.C.

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EXHIBIT 13

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June 24, 2022

VIA FEDERAL EXPRESS

President or Other Officer
North Jersey Petroleum Operations LLC (formerly known as North Jersey Petroleum Partners LLC)
534 South Front Street
Elizabeth, New Jersey 07722

President or Other Officer
New Vacuum Technologies of New Jersey, Inc.
c/o Corporation Service Company
Princeton South Corporate Center, Suite 160
100 Charles Ewing Blvd
Ewing, NJ 08628

Re: Infringement of Earle Refining United States Patent No. 10,053,635

Dear President or Other Officer:

We represent Earle Refining LLC in intellectual property matters.

This letter addresses an apparent infringement of Earle Refining's United States Patent No. 10,053,635 by one or more of the New Vacuum Technology Companies and New Jersey Petroleum Operations, LLC ("NJPO"). We have made multiple prior contacts regarding these infringement allegations, first to Stephen Katz and then to Kevin O' Connor. Please find attached our May 13 letter to Mr. Katz, and our recent correspondence with Mr. O'Connor, all regarding the infringement issue. As you can see, we have assumed (without dispute from Mr. O'Connor) that Mr. Katz and Mr. O'Connor have been keeping you fully informed of our correspondence and the infringement issues, and yet we have received no response.

We also asked Mr. O'Connor to confirm whether he is representing you or any of these entities in connection with the patent infringement issues. As Mr. O'Connor did not respond to this inquiry either, we assume he is not representing you in connection with the patent infringement allegations. ***However, if Mr. O'Connor or other counsel is representing you in this matter, please immediately inform them and ask them to contact us promptly, so all our communications will be with your counsel***.

As it has now been six weeks without response to any of our correspondence, we are coming to the conclusion that the NVT companies and NJPO do not intend to respond to any of our inquiries. While we respect your right to make that decision, we ask that you please reconsider and provide substantive responses to our inquiries within the next ten calendar days.

Thank you for your consideration.

Sincerely,

Scott D. Stimpson

SS:lk

cc: Joseph M. Laura (via Federal Express)
Principal of: NVT LLC, NVT USA, NVT LLC,
NVT of New Jersey, and North Jersey Petroleum Operations
21 Kirsten Drive
Freehold, NJ 07728

Kevin J. O'Connor, Esq. (via Federal Express)
Peckar & Abramson, P.C.
70 Grand Avenue
River Edge, NJ 07661