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(81) Designated States (unless otherwise indicated, for every

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

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TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to the identity of the inventor (Rule 4.17(i))

Published:

— with international search report (Art. 21(3))
— in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE

(54) Title: THE METHOD FOR THE PRODUCTION OF NANO-EMULSION OF WATER WITH HEAVY FLUID FUELS

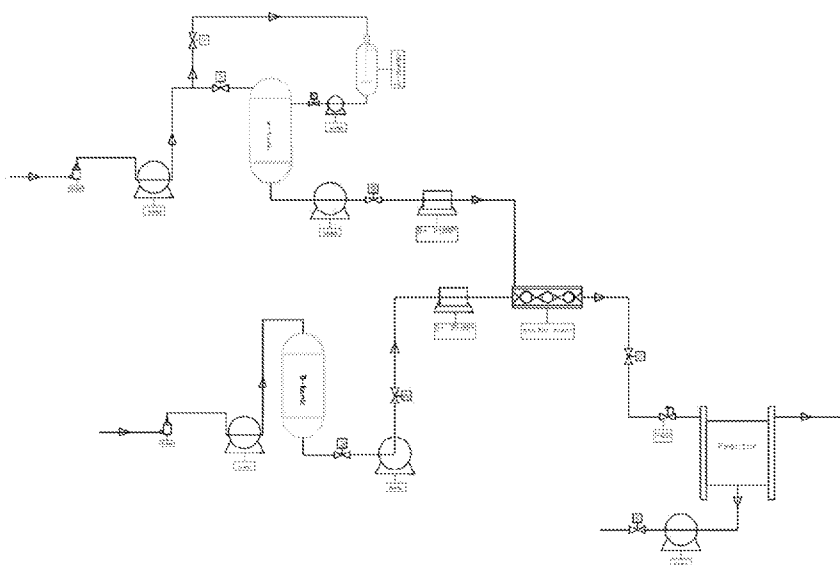


Figure 1

(57) Abstract: The present invention produces the fuel-water emulsion with a particular method and a reactor. Due to the longevity of produced emulsion's homogenized state and very small size of suspended particulate matters in 5 emulsion, it is applicable in most of industrial cases.



The method for the Production of Nano-Emulsion of water with heavy fluid
fuels

5 **TECHNICAL FIELD:**

This invention is about fossil fuels including fuels with relatively larger molecules, mixing procedure of water with fuel and required equipment for it and the aforementioned fuels` functions.

10 **BACKGROUND OF THE INVENTION:**

One of these methods is the production of water-fuel emulsion. According to this method, emulsion is the procedure through which materials such as water, oil or gasoline, which cannot be combined by one another, by nature, are mixed in order to make a temporary suspension by reducing particles` size. However,
15 suspension recovers into its early form as time passes by, in which materials used to be in two separate phases. The time during which suspension switches back into its earlier version is dependent on the viscosity type, particles` size and mixed materials` combination ratio as well as the temperature .In particular, if the particulate matters` size reduces to sub-micron, the mixture tends to keep
20 the fluid state of emulsion for longer time. More amount of added water to the fuel leads to the production of fuel emulsion in the water whereas the reverse combination ratio would lead to water emulsion in fuel. Water emulsion in fuel can improve combustion efficiency while burning. The mechanism is such that water particles get evaporated and dispersed in an explosive manner as a result
25 of heating. One gram of evaporated water gets 1244 times as voluminous and in its course disperses the surrounding fuel particles, which accordingly reduces

the fuel particles` size. Smaller fuel particles have larger surface contact with oxygen and finally will finally improve the combustion efficiency.

Among the water emulsion in fuel samples is Mr. Viktor Maschenko`s invention with registration number of EP20100741445 in which using a reactor
5 cavitation, mixture of Mazut fuel with water of 120 degrees and stirring a turbulence in the flow, between the rotor wall and stator that is located on stator of parallel cavities, brings about the mixture of fuel and water and accordingly the creation of water emulsion in fuel.

In registration file of another invention with registration number of
10 WO2013169669 A1 by Victor Gurin, Mindaugas MACIJAUSKAS, Pavel Pikul and Serguei Permikov applied to register an invention about the system of producing water emulsion in fuel, in which they make use of the advantages of water emulsion in fuel by mixing gas, water, and fuel and injecting the produced mixture to the engine. In the past, many cases of fossil fuels which
15 have been turned to emulsion by water have been examined. Hence, as regards the problems occurred by previous inventions are the quick switch of the fuel into two distinct phases and the large size of the fuel particles in the emulsion.

THE DESCRIPTION OF THE INVENTION:

20 For resolving the problems mentioned above, the present invention produces the fuel-water emulsion with a particular method and a reactor. Due to the longevity of produced emulsion`s homogenized state and very small size of suspended particulate matters in emulsion, it is applicable in most of industrial cases.

This invention is a set of equipment and method for the production of Nano-
25 Emulsion of fuel and water, in which, according to fig.1, fuel enters the emulsion production line through entrance pipe (fig.1, part1) and later enters circulation pump by passing through control valve which is connected to

production line management structure. (fig.1, part3) Afterwards, it is dispatched to maintenance repository.(fig.1 part 11)In the meantime, fuel enters the repository through electronic control valve. The fuel is drained to main fuel tank after passing the dosing system by the help of a pump(fig.1 part 8) Exit path through which the fuel mixed with additives is led to main pump`s dosing by a pumping aid is designed under the tank. Passing through the dosing system enables the supervision of fuel inflow rate to the mixer (fig.1, part 12)On the other hand, pure water finds its path to the control valve through the pipeline in fig.1 part 20 and by entering control valve (fig.1 part 19)and enters water repository rank (fig.1, part 17) Later, water can be ushered to water pump dosing(fig.1, part 14) by passing through the control valve(fig.1, part 13) Afterwards, water enters the mixer with specific volume flow rate.(fig.1, part 12)

Inside the mixer (fig.5), there occurs a great deal of turbulence due to the numerous layers with corresponding angles and flowing movement. Occurring turbulence causes the water and fuel particles to mix and accordingly a heterogeneous emulsion with bigger particles. The pass of primary fluid emulsion through control valves(fig.1, parts 21& 25) helps to control the staying duration of primary emulsion inside cavitation(fig.1, part 22). According to the flow rate of water (discharge) from reactor by pump and outflow discharge rate which is adjusted by control valve (fig.1, part26), the product can be utilized directly or dispatched to the reservoir tank.

Taking the electric current flow rate in production line and the chance to increase it in comparison to the exit as well as for controlling the staying duration of materials in each section, another exit (fit.1, part 23) from secondary wall of the reactor in the form of bypass is sent inside the line before the mixer.

The mixture of fuel and water is thrown out of the rotor holes when they enter cavitation reactor because of high velocity of rotor. They also tend to move

towards the inner crust of stator. In the meantime, due to having a bigger diameter of rotor's surface in comparison to bed diameter of rotor's holes, linear speed of fluid in created column in rotor's holes is higher than its speed in the hole's bed. Henceforth, acceleration difference of the fluid in the created
5 column and rotor holes' bed, fluid undergoes a microscopic extension which in turn leads to the formation of vacuum bubbles. After the fluid containing vacuum microscopic bubbles to the environment between rotor and stator, the fluid tends to switch back to its earlier state, which in turn triggers the microscopic hits against existing particles and accordingly causes strife as a
10 result of this shock. In other words, the created cavitation causes the particles to get pulverized and mixed together. The more the particles stay inside the reactor, the smaller the particles become and more homogenized the mixture gets. Bearing in mind that created particles in this invention are much smaller than micro scale and settle among one another in a homogenized manner, the
15 existing force between two different fluids' molecules is stronger than molecular attraction, which henceforth hinders the union of similar particles and prevents the emulsion to get two-phase status.

BRIEF DESCRIPTION OF FIGURES:

20 Figure number one shows the production line's layout according to the cavitation reactor

Figure Number two shows cavitation reactor's secondary wall.

Figure Number three shows cavitation reactor's rotor

Figure Number four displays stator and secondary wall of the reactor

25 Figure Number five provides a perspective of the mixer

Figure Number six is explosive map of cavitation reactor

Figure Number seven shows full-fledged view of the cavitation reactor.

Figure Number eight is a side-view of the mixer

Figure Number nine is a complete view of the mixer

CLAIMS:

- 1- The invention of a method for the production of Nano-Emulsion compound of water with heavy fluid fuels including at least a fuel tank, a water tank, two dosing pumps, a multi-layered mixer and a cavitation reactor.
5
- 2- The invention of number one claim in which the inflow rate of input material in system's entry can be stipulated by control valves.
- 3- The invention of the number one claim that the fluid input rate can be measured by any system and equipment
- 10 4- The invention of the first claim that necessary additives to the fuel can be added in primary fuel tank by a secondary mixer and tank
- 5- The invention of number one claim that production procedure can be managed relying on a computer system.
- 15 6- The invention of number one claim that any kind of mixer or a multi-layered mixer can be used in mixer section.
- 7- The invention of the first claim that any reactors can be used in cavitation reactor section
- 8- The invention of number one claim that creation and destruction of vacuum bubbles in cavitation reactor causes the fluid particles to crumble and hence produce a homogenous emulsion.
20
- 9- The invention of number one claim that a cavitation reactor is equipped with by-pass system
- 10- The invention of number one claim that the suspended particles' size of emulsion is in a direct relation to the staying duration of materials in the reactor.
25

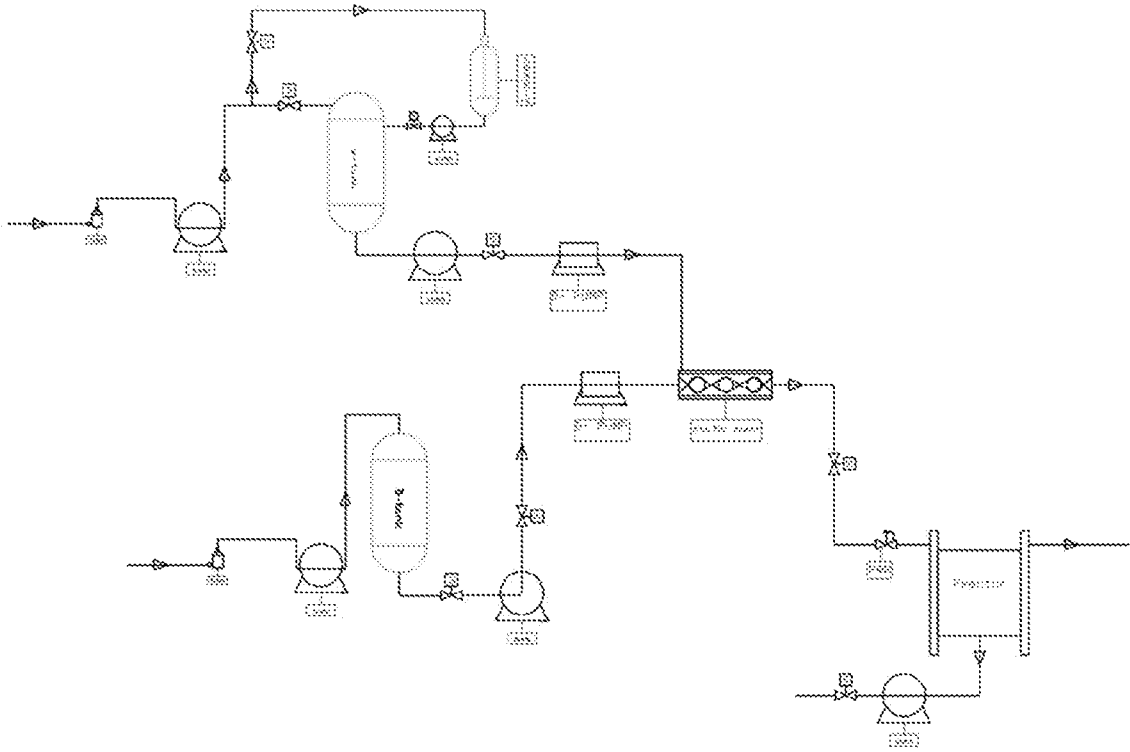


Figure 1

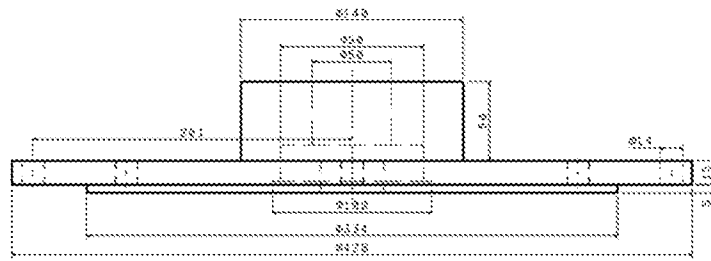


Figure 2

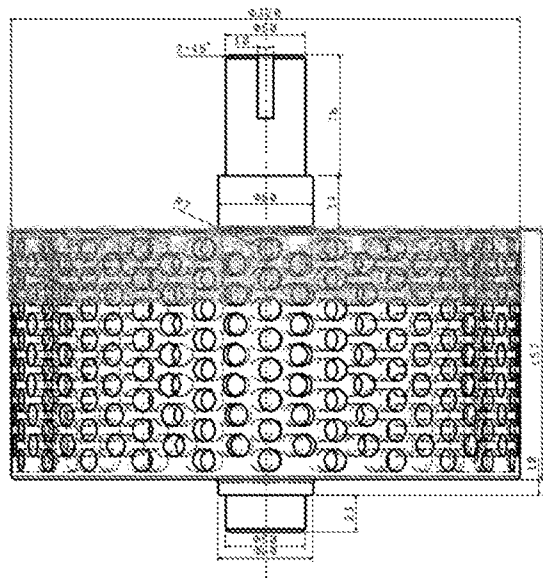


Figure 3

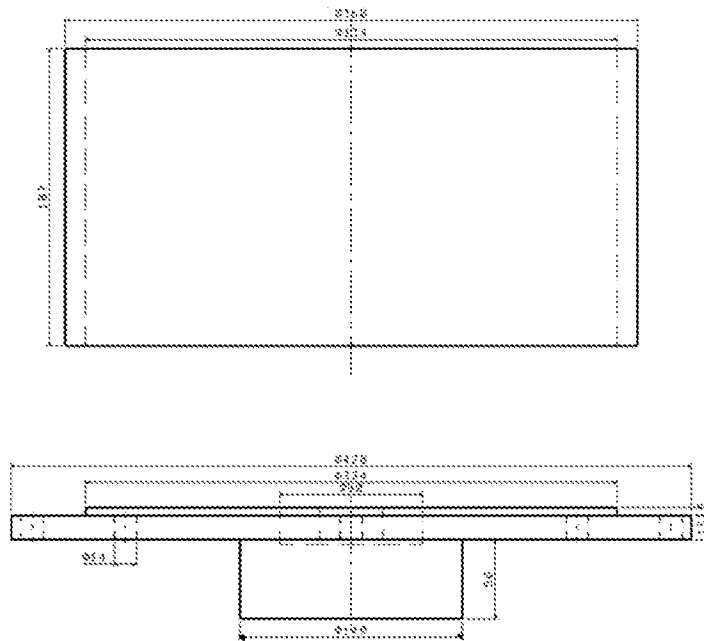


Figure 4

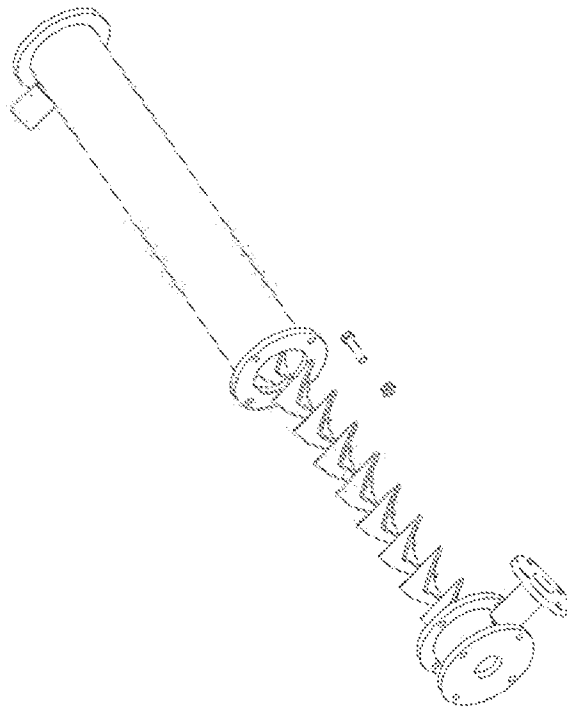


Figure 5

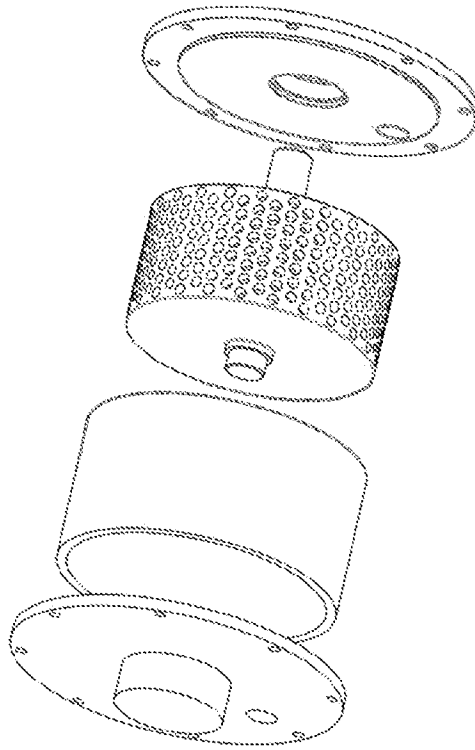


Figure 6

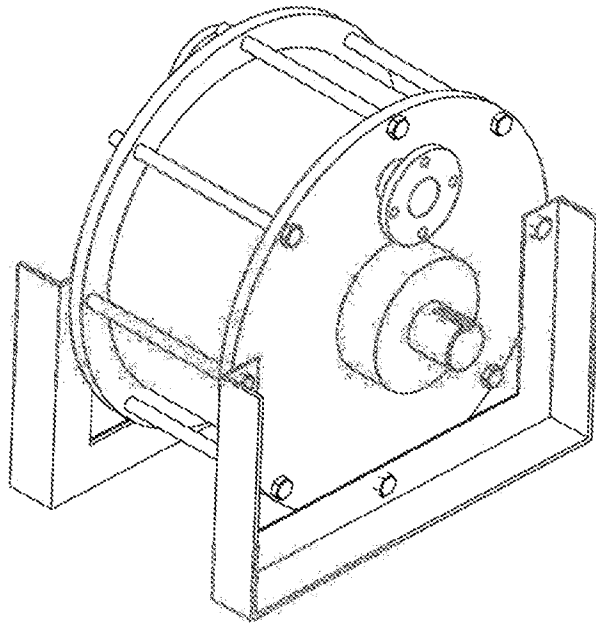


Figure 7

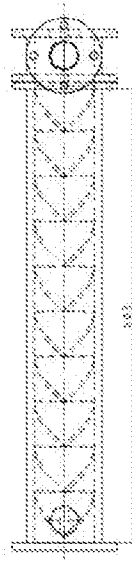


Figure 8

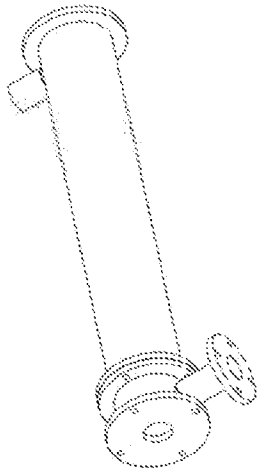


Figure 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2018/056262A. CLASSIFICATION OF SUBJECT MATTER
B01F3/08, B01F5/06 Version=2018.01

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B01F

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

TotalPatent One, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO2006120687A2 (NANO EM LTD) 16 Nov 2006 (16-11-2006) Line 16-22 in Page-16, Line 3-9 in Page-26; figures 4B	1, 3-4, 6, 8
Y	WO2006120687A2 (NANO EM LTD) 16 Nov 2006 (16-11-2006) Line 16-22 in Page-16, Line 3-9 in Page-26; figures 4B	2, 9
A	WO2006120687A2 (NANO EM LTD) 16 Nov 2006 (16-11-2006) Line 16-22 in Page-16, Line 3-9 in Page-26; figures 4B	10
Y	WO2015053649A1 (KORMILITSIN, Vladimir Ilich et al.) 16 Apr 2015 (16-04-2015) Line 25-28 in Page-22	2
Y	US20020096456A1 (KIM, Wan-Mo et al.) 25 Jul 2002 (25-07-2002) Paragraph [0065]; Figure 2	9

 Further documents are listed in the continuation of Box C.
 See patent family annex.

* Special categories of cited documents:

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

03-12-2018

Date of mailing of the international search report

03-12-2018

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2018/056262**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: 5, 7
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Regarding claim-5, applicant claiming that production procedure to be managed relying on a computer system which is out of scope of description and regarding claim-7, applicant claiming for any reactors to be used in cavitation reactor section. the term "any
3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2018/056262

Citation	Pub.Date	Family	Pub.Date
WO 2006120687 A2	16-11-2006	US 2006050605 A1	09-03-2006
US 20020096456 A1	25-07-2002	AU 1524802 A	21-05-2002
		KR 20020036884 A	17-05-2002
		WO 0238512 A1	16-05-2002