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(54) **SHOWERHEAD EMBODIMENTS WITH PISTON OR SPRING-LOADED PISTON DELIVERY OF A LIQUID WASHING AGENT**

(57) The proposed showerhead comprises a showerhead housing having a handle with a water delivery duct, and also a nozzle in the form of a head for separating a flow into jets at the end of the showerhead. Arranged inside the housing are a reservoir for a washing agent, a precisely adjustable valve for regulating the quantity of washing agent, and a filling duct for introducing gel from outside. Also arranged inside the housing are a switch for switching between a washing mode and a rinsing mode, and two check valves in the washing agent filling duct and a washing mixture delivery duct respectively. The separating head comprises, in addition to holes in

the nozzle itself for allowing the passage of water, a smaller-sized mesh for mixing the washing mixture with air. In a piston delivery embodiment, the reservoir, which has a water delivery hole on the shower hose side, contains two rigidly interconnected pistons of different diameters, and the reservoir itself is formed from two volumes corresponding to the diameter of a large piston and a small piston respectively. In a spring-loaded piston delivery embodiment, the reservoir has a single diameter and, instead of a large piston, a spring is used in the reservoir, the moving end of which has a small piston attached thereto.

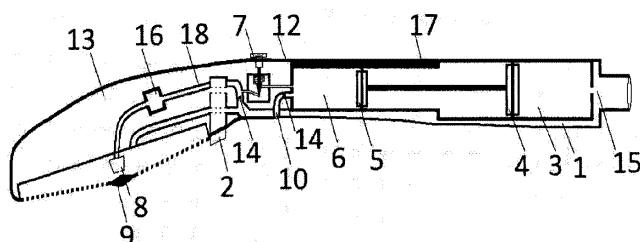


Fig. 1

Description

[0001] The claimed technical solution relates to the field of shower devices and is a plumbing product designed to dispense cleansers in the form of a rich foam onto human skin through the spray of the dividing head of the showerhead nozzle.

[0002] The foam is generated when the mixed solution, which is formed inside the showerhead nozzle body by mixing water and the cleanser, usually shower gel, passes through the mesh of the dividing head of the showerhead nozzle and mixes with air. The showerhead nozzle looks no different from ordinary showerheads and can be connected to the shower hose without any additional devices. The mechanism for generating foam is located inside the showerhead nozzle, where the mixing takes place. The cleanser is refilled into the reservoir of the showerhead nozzle under pressure using a special dispenser that is external to the shower and not part of the showerhead nozzle construction. This showerhead has the advantage of allowing users to immediately obtain foam for washing from the showerhead nozzle, making it effective for use in everyday life as well as by the elderly, sick, or immobile, since there is no need for additional effort or assistance to obtain and apply the foam to the body. With the help of a special mode switch button located on the showerhead nozzle, the user can choose between the foam mode and the normal mode for rinsing water flowing from the showerhead nozzle. In addition, the claimed device allows for charging the showerhead nozzle with various liquid mixtures, including medicines, cosmetics, or aromatic agents, instead of liquid cleansers, depending on the intended use.

[0003] An analogue is known, a shower head with a wash function, according to the patent of the Russian Federation for invention No. 2742478 dated August 22, 2019, published on February 8, 2021, which includes a hollow handle with a standard water inlet on one side and a head for dividing a single stream into multiple jets on the other side. The shower head is designed to transition into an elongated holder with an additional washing head. The elongated holder with the washing head has grips at the washing head to fix a washcloth stretched over it, which coincides with it in shape and size, as well as to fix external washcloths. The grips are made in the form of spring-loaded clamps with pointed combs to hold the washcloth, while the washing head may have silicone or rubber protrusions on the front surface. The shower head with a wash function can be made either as a single monolithic design, or the elongated holder with the washing head can be a detachable attachment with fasteners to the shower head.

[0004] The claimed solution and the analogue showerhead with a wash function according to Russian patent No. 2742478 share common features, such as the presence of a handle with a standard water inlet and a divider head that separates a single stream of water into multiple streams.

[0005] Another difference between the two solutions is that the patent for the showerhead with a wash function (RU patent No. 2742478) includes an extended handle with an additional washing head and clamps for securing a washcloth to the washing head. Meanwhile, the claimed solution includes a reservoir integrated into the showerhead's body during manufacturing.

[0006] One disadvantage of the aforementioned analog by Russian patent No. 2742478 is the relative complexity of its design, which may affect the convenience of using the showerhead. The analog employs clamps on the washing head to fix a washcloth, which are designed as spring-loaded clamps with sharpened combs to hold the washcloth, and the washing head may have silicone or rubber protrusions on the frontal surface. Such clamps and protrusions make the construction heavier and less portable, and the numerous additional elements complicate both the manufacture and use of the showerhead. The manufacturing complexity, cost, and increased material consumption allow us to conclude that this device is primarily applicable in limited cases, as indicated in its description, specifically for people with limited functionality. The numerous elements, particularly in the external part of the device, make it less portable, and the analog does not provide the possibility of generating foam simultaneously with the water flow, as with the use of this analog device, one has to apply the soap to the washcloth manually.

[0007] The known device for simultaneous adjustable dosed delivery of cleaning and/or medicinal agents through a showerhead (PROTOTYPE) according to the patent for invention RU2517998 dated December 21, 2012, published on June 10, 2014, comprises a nozzle connected at the inlet to the water supply line and at the outlet to the hose for delivering cleaning and/or medicinal agents, at the end of which the showerhead is installed. The nozzle contains a partition dividing it into two adjacent chambers, one of which, the main one, forms a channel for direct water flow, while the other, additional, is made in the form of a Venturi tube, the throat of which communicates with an adapter connected to a plurality of pipelines. The outputs of the main and additional chambers are combined into one channel, which is connected to the user's liquid delivery hose. The device also includes a two-position switch located at the inlet of the nozzle, which ensures the passage of water through one of the adjacent chambers, multiple sealed containers for cleaning agents and medicinal preparations installed on a comb equipped with controllable valves providing selective connection/disconnection of sealed containers to the adapter, and a check valve installed at the outlet of the Venturi tube to prevent water from passing through the Venturi tube when water flows through the main chamber.

[0008] Another common feature between the claimed solution and the prototype device according to the Russian patent No. 2517998 is the presence of a water supply pipeline and a showerhead. However, the claimed solu-

tion utilizes a more portable design by integrating it inside the showerhead, instead of using a separate attachment.

[0009] The differences between the prototype and the claimed technical solution are due to the differences in their construction. In the claimed solution, a more portable and integrated design is used, located inside the showerhead, instead of a separate attachment. The prototype utilizes a Venturi tube and a comb with multiple sealed containers for the cleaning and medicinal liquids. As specified in the prototype description, the user can obtain a mixture of water and cleaning or medicinal liquids from the showerhead, and the amount of liquid used can be regulated by adjusting the flow rate of the water from the mixer or the volume of the suctioned liquid from the containers by controlling the valve opening. In contrast, the claimed device allows the user to obtain a foamy cleaning solution, rather than a liquid cleaning solution or a mixture of water and cleaning solution, while simultaneously operating as a showerhead. The claimed device is monolithic and has no attachments, and all the components for producing a foamy cleaning solution are inside the showerhead. The advantages of the claimed device include improved portability, the ability to operate as a regular showerhead and as a foam-producing showerhead, water and cleaning solution savings, and time savings due to the showerhead's unique mechanism of operation. Additionally, the claimed device can operate at minimal water pressure, starting from 1 atm, and it can use any liquid cleaning solution.

[0010] The claimed solution uses a piston system to create pressure. In the prototype according to the patent for invention No. 2517998, the agent is taken using the Venturi tube principle with the use of the ejection process, but this principle cannot achieve a ready-to-use foam output from the showerhead. Unlike the claimed solution, the Venturi tube principle does not work if there is resistance when the ready-to-use mixture exits, and without resistance, it is impossible to achieve the required consistency of the foam. The design differences from the prototype consist of the fact that in the claimed solution, the agent reservoir is located in the handle of the showerhead, as well as the use of nozzles and meshes to obtain thick foam, and the presence of a tap for precise regulation of the density of the resulting foam during output.

[0011] The disadvantage of the prototype is the relative complexity of the design and material consumption, as well as the lack of an effective way to produce foam - the prototype simply dispenses a mixture of water and detergent from the showerhead, resulting in high detergent consumption. Furthermore, the scope of application is quite limited, mainly to medical institutions, as there is no need for soapy water in everyday life.

[0012] The above-mentioned prototype construction involves additional elements in the construction of a shower room or cabin, while the claimed device is quite flexible and can be applied as a regular shower component within a shower mixer, but with the additional func-

tion of washing the body with foam.

[0013] The technical problem addressed by the present invention is the lack of convenience and portability, as well as inefficient water and detergent consumption in existing shower devices. The present invention is designed to solve the above-mentioned problems and enhance the effectiveness of showering, making it more convenient and economical for users.

[0014] The goal of the development of the claimed technical solution is to expand the functional capabilities of using a shower head, primarily by providing the ability to wash with ready foam, and in particular, to create additional convenience for people while bathing with significant savings in water, foaming liquid, and, most importantly, time.

[0015] The convenience lies in the fact that this device not only delivers the usual water flow, but also dispenses rich foam upon pressing the button or turning the switch lever. This device can be an efficient replacement for regular showerheads, as it has a similar appearance and can be easily attached to the shower hose or wall mount.

[0016] The technical task of the present invention is to create a shower head that is convenient, portable, ergonomic, and economical to use. The task was to place a reservoir with a cleaning agent inside the shower head without significantly increasing its volume, using a piston or piston-spring system to deliver the cleaning agent into the water stream. Additionally, a mesh is installed in the spray head's diffuser to add the necessary amount of air to create foam. The backflow valve is sealed and works at high pressures and temperatures.

[0017] The technical result achieved by implementing the present invention is uninterrupted and sufficiently long-term operation due to the convenience of placing all the elements for mixing water, air, and detergent in a single assembly inside the showerhead, providing convenience and portability. Devices previously proposed for this purpose were too complex and expensive to be practical, and as a rule, they require installation by a plumber, making it difficult for the average person to purchase and install such a device in their shower. The technical result achieved by implementing this invention is a significant increase in both the ease of switching between washing and rinsing modes, as well as the optimal use of the device, reducing labor intensity, maintaining working condition and uninterrupted operation, and with the presence of a spring combined with a piston - creating greater pressure inside the reservoir.

[0018] The technical result is achieved by mixing of water, cleaning liquid, and air to obtain foam (using a reservoir with a piston system, a valve for precise regulation, and a mesh) with such resistance at the outlet, at which their mixing was not possible only by mechanical means, without the use of electronic devices or other more complex and expensive solutions. This increases the stability of the equipment compared to the operation of known showerheads.

[0019] The main advantage of the invention is the prac-

ticality of the showerhead's design. Firstly, it is easy to use for the user. Secondly, it saves water, cleaning solution, and time due to the unique mechanism of the showerhead's operation. Thirdly, it can use any liquid cleaning solution, including gels, and can operate at a minimum water pressure of 1 atmosphere. Refilling the showerhead with cleaning solution takes approximately 10 seconds and does not require any additional effort. This allows the showerhead to operate in "foam" mode continuously for 15-20 minutes, which is enough for bathing 5-10 times. Additionally, the price of the invention is relatively affordable compared to its analogs, which often use additional expensive components. The showerhead is also ergonomic and comfortable to hold without additional attachments.

[0020] The essence of the proposed technical solution is that the shower head includes a body with a handle and a water supply channel, as well as a nozzle in the form of a dividing head for dividing the flow into streams at the end of the shower head. Inside the body, there is a reservoir for the cleaning agent, a precise control valve with the ability to switch the amount of the cleaning agent, a channel for filling with gel from the outside, and a switch for switching between washing and rinsing modes. Two check valves are located in the channel for filling with the cleaning agent and in the channel for supplying the ready-made mixture. A tablet for mixing water and cleaning agent is located in the channel for supplying the foam on the way to the dividing head. The dividing head, in addition to its own water outlet nozzles, contains a smaller mesh for mixing the cleaning agent with water. In the piston version, the reservoir contains two pistons of different diameters, rigidly connected to each other, and is made with the use of two volumes, each corresponding to the diameters of the large and small pistons. In the spring-piston version, the reservoir is of a single diameter, and instead of a large piston, a spring is used, to the moving end of which the small piston is attached.

[0021] The claimed technical solution is illustrated by the drawings of Fig. 1 and Fig. 2, which depict the showerhead construction with two pistons in Fig. 1, and with one piston and a spring in Fig. 2, where:

- 1 - water supply channel;
- 2 - mode switch;
- 3 - reservoir;
- 4 - large piston;
- 5 - small piston;
- 6 - reservoir, adjustable part of the reservoir for filling with cleaning agent;
- 7 - precise gel control valve;

- 8 - nozzle;
- 9 - mesh;
- 10 - gel filling channel;
- 11 - spring;
- 12 - body;
- 13 - dividing head;
- 14 - check valve;
- 15 - opening for water supply from the shower hose side;
- 16 - mixing tablet;
- 17 - handle;
- 18 - ready-to-use mixture supply channel

[0022] In the piston variant of liquid detergent dispensing, the shower head includes a body 12 consisting of a handle 17, a dividing head 13, and a mode switch 2, with water being supplied from the shower hose through a water supply channel 1. Inside the handle 17, there is a reservoir 3 with large 4 and small 5 pistons rigidly fixed in it, and an opening 15 for water supply from the shower hose side. During operation, the reservoir 3 fills with water, and then, as the pistons 4 and 5 move, the adjustable part of the reservoir 6, located on the side of the dividing head (13), gradually changes its volume to fill with detergent. The precise gel control valve 7 is located outside the shower head in the upper part, and the nozzle 8 and mesh 9 are used to direct water or saturated foam to the consumer from the dividing head 13. An check valve 14 is used in the shower device to prevent changes in the direction of fluid flow in the technological system. The mixing tablet 16 is located in the ready-to-use mixture supply channel 18. In the spring-piston variant of liquid detergent dispensing, the shower head includes a body 12 consisting of a handle 17, a dividing head 13, and a mode switch 2, with water being supplied from the shower hose through a water supply channel 1. Inside the handle 17, there is a reservoir with a construction of spring 11 and a small piston 5. During operation, detergent is poured into the reservoir, and then, as the spring 11 and small piston 5 move, the adjustable part of the reservoir (6), located on the side of the dividing head (13), gradually changes its volume to fill with detergent. The precise gel control valve (7) for regulating the amount of gel is located outside the shower head in the upper part, and the nozzle 8 and mesh 9 are used to direct water or saturated foam to the consumer from the dividing head 13. A check valve 14 is used in the shower device to prevent changes in the direction of fluid flow in the technological system. The

mixing tablet 16 is located in the ready-to-use mixture supply channel 18.

[0023] The difference between the two versions of the proposed technical solution is only in the reservoir for the cleaning agent, while the internal construction is almost identical.

[0024] The claimed technical solution can be implemented in two versions, and the operation of the showerhead device is shown below for the case when the reservoir is filled with shower gel.

[0025] In the piston version, water is supplied through the shower hose from the mixer to the water supply channel 1. Water then flows into the mode switch 2. Above the water supply channel 1 are reservoirs 3 and 6 with two pistons of different diameters, large 4 and small 5, and an opening 15 for water supply from the shower hose. The reservoirs 3 and 6 are of different sizes, each designed for the movement of the corresponding piston diameter, and the difference in diameter between the rigidly coupled pistons 4 and 5 is 5% or more. When reservoir 3 is filled with water, water pushes large piston 4 which pushes the rigidly connected small piston 5, which then expels the shower gel located in reservoir 6. Due to the difference in size between pistons 4 and 5, according to the principles of hydraulics, small piston 5 pushes the gel with higher pressure in the part of the reservoir 6, than the initial water pressure. Such an increase in pressure is necessary for the delivery and further mixing of the gel with water. The required proportion is regulated by the precise gel control valve 7, which the user sets once for the required density of the resulting foam. Next, the ready mixture of water and gel flows into the mode switch 2. When the delivery mode is switched to foam, the mixture passes through the ready-to-use mixture supply channel 18, through the mixing tablet 16 for better mixing, and enters the nozzle 8 where it is turned into thick foam by passing through the specially shaped mesh 9 and mixing with air. Reservoir 6 is refilled with gel through the gel filling channel 10, in which a check valve 14 is placed, using a special external dispenser. Check valves 14 are used to prevent changes in the direction of the medium flow in the technological system of the showerhead and to achieve the tightness of the check valve, which operates under high pressures and in conditions of possible high temperature of the working medium, such as hot water.

[0026] The positive result is achieved through the proper positioning of all parts and the observance of the necessary dimensions. For example, if the mesh 9 has an incorrect cross-section or is too close to the sprayer (less than 0.5 mm), the result will be significantly worse. Additionally, this device has the advantage over others in that the agent in the reservoir is sufficient for multiple uses, and refilling the device is not difficult for the user.

[0027] In the spring-piston variant of liquid detergent dispensing, the main difference from the piston variant is in the operation of the reservoir. In this variant, there is no reservoir 3, which in the piston variant consisted of

a sealed part made up of two pistons 4 and 5, and a part 6 filled with gel (i.e. the detergent did not fill the reservoir 3 completely). In the spring-piston variant, the entire space is occupied by reservoir 6, which in this case is filled with gel completely and does not contain separate parts.

[0028] In the piston version of the invention, the cleaning agent is pushed out of the reservoir 6 by the higher water pressure in the reservoir, which is obtained due to the different volumes of reservoirs 3. In the spring-piston version, a spring 11 is installed in the reservoir 6 with the gel, which will push the gel out to mix with water. The advantage of this spring-piston version is the possibility of increasing the volume of the reservoir. The more gel is dispensed from the external dispenser, the more the spring 11 compresses, and the reservoir 6 can be filled completely. The peculiar feature of the spring's operation is that with its relaxation, the pressure of the gel going into the water decreases. Therefore, the precise gel control valve 7 plays a significant role in the spring-piston version. The difference between the two options for the user is that even small variations in water pressure in the water supply require the user to adjust the level of gel delivery using the valve 7. However, this relative inconvenience is compensated for by the convenience of being able to adjust the amount of gel for different densities of the gel using the valve 7, making the device versatile for different types of cleaning agents. Furthermore, in the spring-piston version, the larger gel reservoir more than compensates for this inconvenience since the gel lasts for a more extended period.

[0029] In the spring-piston variant of the showerhead, the device operates as follows: water is supplied from the mixer hose to the water supply channel 1 and enters the water supply mode switch 2. Positioned above the water supply channel 1 is the reservoir 6 with small piston 5 and spring 11. Upon pressing the mode switch 2, the main water supply channel 1 is closed, and the additional ready-to-use mixture supply channel 18 is opened for the mixing of the liquid and soap agent. In the open channel, the piston 5 pushes the gel in the reservoir 6 with a higher pressure than the initial water pressure due to the pressure of the compressible spring 11. This pressure is necessary for the delivery and further mixing of the gel with water. The required proportion is regulated by the precise gel control valve 7, which has the function of controlling the amount of gel delivery. Passing through the mode switch 2 and set to the foam mode, the mixture flows through the ready-to-use mixture supply channel 18 and through mixing tablet 16 for better mixing, then enters nozzle 8 where, under pressure, it flows through the special mesh 9 with a particular cross-section, forming dense foam when mixed with air. The reservoir 6 is refilled through gel filling channel 10 (which contains a check valve 14) using a special dispenser, as in the piston variant.

[0030] When using the claimed showerhead, the user gets the opportunity to obtain foam for 20 minutes con-

tinuously with an economical use of the cleaning agent. In the medium-economical variant, foam will be formed from one filling of the reservoir for 10 minutes. If a very thick foam is needed, the washing stage will take 5 minutes, which is sufficient for comfortable showering, as one minute is usually enough for high-quality soaping of a person. Then, the user switches the shower using mode switch 2 to the flow mode, rinses off the foam, and the washing process is complete.

[0031] Compared to known showerhead devices, the claimed design is characterized by its portability and universality. The area of application of the claimed design is significantly wider than that of known analogs due to its compactness and simplicity of both manufacturing and use.

[0032] The possibility of multiple reproductions of the claimed construction is due to the method of its industrial packaging, which allows for the reproduction of the claimed showerhead device on an industrial scale.

[0033] This combination of universality, the ability for multiple reproductions, and relative simplicity in both manufacturing and use has not been achieved in the prior art types. Based on the above, it can be concluded that the claimed technical solution meets the criteria of "novelty", "inventive level", and "industrial applicability".

Claims

1. Showerhead in piston and spring-piston versions for dispensing liquid detergent, comprising a body with a handle and a water supply channel, as well as a nozzle in the form of a flow divider into streams at the end of the showerhead. The invention is **characterized in that** the body has a reservoir for the detergent, a precise regulation valve with the ability to switch the amount of detergent, a channel for filling the reservoir from the outside with gel, and a switch for switching between washing and rinsing modes. Additionally, two check valves are installed in the channel for filling the reservoir with the detergent and in the channel for supplying the finished mixture. A tablet for mixing water and detergent is located on the path to the flow divider. The flow divider, in addition to its own nozzle openings for pouring water, contains a smaller mesh for mixing the finished mixture with air. In the piston version, two pistons of different diameters are rigidly connected in a reservoir containing a water supply opening from the shower hose, and the reservoir itself is made using two volumes, each with the diameter of the large and small pistons. In the spring-piston version, the reservoir is of a single diameter, and a spring is used in the reservoir, to the moving end of which a small piston is attached.

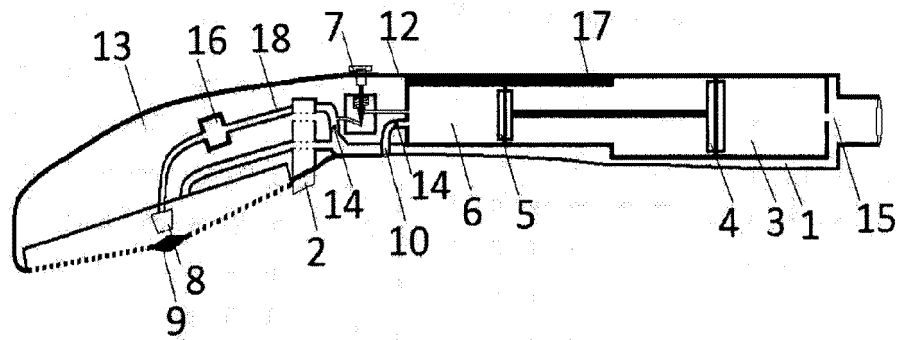


Fig. 1

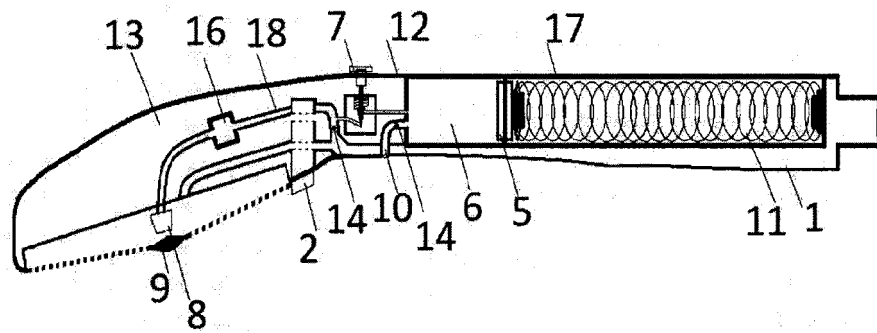


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2021/000258

A. CLASSIFICATION OF SUBJECT MATTER
A47K 3/28 (2006.01); B05B 1/18 (2006.01)

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)

A47K 3/00, 3/28, 7/00, 7/04, A46B 11/00, 11/06, 13/00, 13/02, 15/00, 17/00, 17/02, B05B 1/00, 1/02, 1/18, B08B 1/00, 1/04

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)

PatSearch (RUPTO Internal), USPTO, PAJ, Espacenet, Information Retrieval System of FIPS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2009/0121042 A1 (MITRY RAGAI) 14.05.2009, par. [0045]-[0064], figures 1-15	1
A	RU 2698221 C1 (GLUKHOV SERGEI VLADIMIROVICH) 23.08.2019	1
A	US 2019/0078306 A1 (ESTELHOMME TRACEY) 14.03.2019	1
A	US 2015/0292186 A1 (KAWAMOTO SHINICHI) 15.10.2015	1

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

☐ See patent family annex.

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

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“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

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“&” document member of the same patent family

Date of the actual completion of the international search

01 February 2022 (01.02.2022)

Date of mailing of the international search report

10 February 2022 (10.02.2022)

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Patent documents cited in the description

- RU 2742478 [0003] [0004] [0005] [0006]
- RU 2517998 [0007] [0008]
- WO 2517998 A [0010]