Device and method for cleaning a drain pipe by ensuring the formation of at least two successive distinct water waves flowing in the pipe, with or without additive(s). The device comprises: a reservoir (R) comprising separate compartments (C1, C2, C3, C4), each compartment (C1, C2, C3, C4) provided with an outlet opening; an outlet (10) adapted to be connected to the drain pipe, said outlet (10) being associated with a knife valve (KV) actuated by actuating mechanism (S8) between a fully closed position and a fully open position; a duct (30) comprising several distinct channels (1A, 1B, 1C, 1D) extending each between the outlet opening of a compartment and an outlet opening (1A1, 1B1, 1C1, 1D1) of the channel considered adjacent to the outlet (10) of the device, said duct (30) comprising a curved portion of 45° to about 90°; whereby the knife valve (KV) is adapted to move from a fully closed position up to a fully open position, with intermediate positions for which one or more outlet openings (11A1, 11B1, 11C1, 11D1) of one or more channels (11A, 11B, 11C, 11D) are not closed; in which the different channels (11A, 11B, 11C, 11D) are provided adjacent to their outlet opening with a honeycomb structure adapted for generating a laminar flow for the water flowing through said outlet opening (10) when not closed by the knife valve (KV).
Drain pipe cleaning device and Method of cleaning

Abstract of the disclosure

The invention relates to a device and a method for cleaning a drain pipe or a pipe connected thereto, by ensuring the formation of successive distinct water waves flowing in the pipe, with or without additive(s).

The state of the art

Drain pipes of buildings are nowadays more and more problematic, as being sources of infections, contamination, health problems, etc.

Drain pipe installed in a building is for conducting waste water from kitchen and/or sanitary appliances, such as toilets, wash basins, bathtubs, etc. into the sewer usually located in the underground of the building. In the case of a multi-storey building, the drainage system comprises a substantially vertically stack extending through the floor of each store and branch pipes for conducting the waste water from each sanitary appliances present on each floor.

For detecting deficiencies in drain pipes, WO 2008/03224 discloses a specific equipment comprising essentially an air transient generator and a pressure transducer.

With the advent of low flush volume toilets and urinals, the proper flushing and purging of the drainage pipe has become a major concern, due to various deposits.

WO2014/172310 discloses a device suitable for ensuring periodic heavier flush volume introduced into the toilets or urinals, the flush coming directly from the water supply. Such a device is not suitable for removing important deposit in drain pipes, and is water consuming.

Up to now there is no efficient system for ensuring a drain pipe cleaning using when required a low amount of treatment medium, such as water with or without additives.

Brief description of the invention

The invention relates to a device for cleaning a drain pipe or a pipe connected thereto in order to break down or reduce at least one blockage present in the drain pipe or a pipe connected thereto by at least two successive waves of liquid escaping at least the device according to a laminar flow, said device comprising at least:

- a reservoir comprising distinct separate compartments, the said reservoir having at least one connecting part adapted for connecting it to a water supply, said
connecting part being advantageously associated to non return means, whereby each distinct compartment is provided with a distinct outlet opening;
- an outlet (10) adapted to be connected to pipe selected from the group consisting of the drain pipe and a pipe connected to the drain pipe, said outlet (10) being associated with a knife valve actuated by actuating mechanism (8) between a fully closed position and a fully open position;
- a duct comprising several distinct channels (11A,1 1B,1 1C) extending each between the outlet opening of a compartment of the reservoir and an outlet opening of the channel considered adjacent to the outlet (10) of the device, said duct comprising a curved portion of 45 to about 90° so as to enable at least a gravity flow of liquid from a compartment of the reservoir towards the outlet 10 of the device when the valve is in open position;
whereby the knife valve 3 actuated by the valve mechanism is adapted to move from a fully closed position in which the knife valve closes the outlet openings of the various channels of the duct, up to a fully open position in which the said outlet openings of the various channels of the duct are not closed by the knife valve, with intermediate positions for which one or more outlet openings of one or more channels are not closed by the knife valve, while one or more outlet openings of one or more other channels are closed by the knife valve;
in which the different channels are provided adjacent to their outlet opening with a honeycomb structure adapted for generating a laminar flow for the water flowing through said outlet opening when not closed by the knife valve.

With the device of the invention, it is possible to control the volume of water of the different flushing wave, by displacing the valve so as to ensure timely delayed flow of water from the different compartments. The device of the invention enables also to control volume of flush waves, as well as time elapsing between two successive waves and/or the different possible additive(s) used for the different waves.
The controlled flushing mechanism has advantageously a valve actuating system controlled by an electro-mechanical system. The electro-mechanical system is adapted to release staggered flushes in the pipe to be cleaned, to achieve good (preferably excellent of near maximum) drain line carry, blockage breakdown and build-up reduction

The device of the invention is advantageously quite compact and can be operated manually and/or automatically, for example at regular and/or specified moment or after detection of a possible problem.

By having several distinct compartments with distinct channels ensuring a laminar flow of medium into the pipe to be cleaned or treated, the opening of said channels being controlled by a same gate or knife valve, it is possible to ensure or control successive waves. Moreover, by flushing together water from two compartments, it is possible to ensure if required successive waves having different flushing volume, for example a higher final flushing volume and a lower initial flushing volume (preferably with a high concentration of one or more additives).
Details and advantageous characteristics of embodiments of the device of the invention are one or more of the followings:

- the different channels are provided adjacent to their outlet opening with a honeycomb structure adapted for generating a laminar flow for the water flowing through said outlet opening when not closed by the knife valve, said honeycomb structure being distant from said outlet opening by a distance of at least 0.5 cm, advantageously at least 1 cm, preferably from 1 to 5 cm.

- one or more compartments of the reservoir is/are each associated with a dosing system for adding one additive to the water present in the compartment considered.

- the duct has a substantial linear portion adjacent to the outlet opening of the device, said linear portion having a length of at least 5 cm, advantageously at least 10 cm, whereby the honeycomb structure extends at least partly within the said substantial linear portion.

- the honeycomb structure extends on a length of at least 20 cm within the distinct channels of the duct.

- The device is associated to an air admittance valve, advantageously adjacent to the knife valve.

- the duct comprises at least three distinct channels separate the one from the other by a wall, advantageously a curved wall.

- the wall separating two adjacent channels of a duct having a substantially circular cross section has a radius of curvature at least equal to the radius of substantially circular cross section.

- the reservoir comprises at least three distinct compartments, each of said three compartments being connected respectively to a first, second, and third distinct channel extending within a common duct, whereby the knife valve actuated by the valve control mechanism is adapted to control the displacement of said knife valve so as to control the opening of the first channel, while maintaining closed the second and third channels, then opening the first and second channels, before controlling the opening of the three channels.

- the reservoir comprises at least four distinct compartments, each of said four compartments being connected respectively to a first, second, third and fourth distinct channel extending each within a common duct, whereby the knife valve actuated by the valve control mechanism is adapted to control the displacement of said knife valve so as to control the opening of
the first channel, while maintaining closed the second, third and fourth channels, then opening the first and second channels, while maintaining closed the third and fourth channels, thereafter opening the first, second and third channels before conferring the opening of the four channels together.

- at least two distinct channels have a different volume.

- the knife valve is moving in a linear direction and has a circular edge end having substantially the radius of curvature corresponding to the radius of the duct.

- the valve control mechanism comprises an actuating means provided with a receiving means of a signal emitted by a detecting device adapted for detecting a blockage in the drain pipe and a pipe connected to the drain pipe, said detecting device being advantageously a sonar detecting device.

- each distinct compartment of the tank with its channel has a total flushing volume of less than 1 litre, advantageously less than 0.5 litre.

- the tank is connected to an air vent.

- the distinct channels of the duct are stacked the one above the other, whereby the base of one compartment forms a ceiling of another compartment.

- combinations of two or more of said details and characteristics.

The invention relates also to a method for cleaning a drain pipe or a pipe connected thereto in order to break down or reduce at least one blockage present in the drain pipe or a pipe connected thereto, said method comprising the steps of:
- detecting a problem relating to a blockage in the drain pipe or a pipe connected thereto,
- sending water, possibly with one or more additives, in the drain pipe or pipe connected thereto, in the form of successive distinct water waves, each of said waves having a volume of less than 1 litre, advantageously less than 0.5 litre; and
- detecting whether the problem relating to a blockage is solved or reduced.

Advantageously, the step of sending water, possibly with one or more additives, in the drain pipe or pipe connected thereto, in the form of successive distinct water waves, is operated by a device of the invention.

Preferably, in case after treating the drain pipe or pipe connected thereto with a predetermined series of successive distinct water waves, a problem in the treated drain pipe or pipe connected thereto is still detected, an alarm signal is emitted.
In the method of the invention, the pipe is treated with water possibly added with one or more additives, in the required concentration. Such additives are for example degreasing agents, enzyme, pipe coating agents, lubricants, perfumes, tMckening agents (for controlling the viscosity and/or speed of the wave flowing within the pipe), chemicals (sodium hydroxide, surfactants, etc.), anti adherence agents, and combinations thereof.

Details of a preferred embodiment will appear from the following description in which reference is made to the attached drawings.

**Brief description of the drawings**

Figure 1 is a schematic view of drain pipe associated to a sonar detection system for blockages and to cleaning devices; Figure 2 is a schematic cross section view of a device of the invention with the knife valve in fully open position, while Figures 3 to 6 are views similar to Figure 2 with different position of the knife valve; Figure 7 is a perspective view of the outlet section of the duct; Figure 8 is a perspective view of the inlet section of the duct; Figure 9 is a schematic view of the knife valve; Figures 10 to 12 are showing steps of a method of the invention.

**Description of a preferred embodiment**

Figure 1 shows a vertical main drain pipe MDP of a building, said main drain pipe being connected discharge pipes DP conducting waste water from kitchen and/or sanitary appliances, such as toilets, wash basins, bathtubs, etc. into the sewer usually located in the underground of the building. Each discharge pipe is associated to a sensor cooperating with a sonar equipment (SONAR-TEQ) for determining the presence and location of blockages. Each discharge pipe DP is associated to a device Flow-teq for introducing a treating liquid for treating the detected blockage, said device comprising at least:

- a reservoir R comprising distinct separate compartments (four in the embodiment represented in Fig 1, the number of distinct compartments can be from 3 up to 10, but is advantageously from 4 to 7), the said reservoir R having at least one connecting part adapted for connecting it to a water supply WS, said connecting part being advantageously associated to non return means 7, whereby each distinct compartment C1,C2,C3,C4 is provided with a distinct outlet opening. In the reservoir R, the compartments are separated the one from the other by separating walls SW extending below the cover of the reservoir, whereby creating an upper volume connecting the reservoir the one to the other, for example in case of overflow. The anti return system 7 is advantageously provided with a means for stopping the supply of water from the water supply WS when a specific water level of water is reached in one or more compartments of the reservoir R. Each compartment is advantageously associated to at least one dosing device 5 which can be connected to a removable canister containing the additive to be furnished in the water of the compartment considered.
- an outlet (10) adapted to be connected to pipe selected from the group consisting of the drain pipe and a pipe connected to the drain pipe, said outlet (10) being associated with a knife valve KV actuated by actuating mechanism (8) such as an electro-mechanical mechanism between a fully closed position and a fully open position. The knife valve KV has lateral edges sliding in substantially parallel grooves G. The movement of the valve KV is for example, but advantageously substantially vertical (arrow V), whereby the valve can return in its fully closed position only by the action of gravity. Possibly the lifting of the valve away from its closed position can be operated against the action of a return mechanism, such as a spring. The free downwards end KV1 of the valve KV is provided with a semi-circular portion adapted to ensure the closing of all channels, as well as the closing of only some channels.

- a duct 30 comprising several distinct channels (11A,1 1B,1 1C, 11D) extending each between the outlet opening of one distinct compartment (C1,C2,C3,C4) of the reservoir and an outlet opening (11AI,1 1B1,1 1C1,1 1D1) of the channel considered adjacent to the outlet (10) of the device, said duct 30 comprising a curved portion 30C of about 90° so as to enable at least a gravity flow of liquid from a compartment of the reservoir towards the outlet 10 of the device when the valve is in open position for the channel of the compartment considered.

The knife valve 3 actuated by the valve mechanism is adapted to move from a fully closed position in which the knife valve closes the outlet openings (HAL1 1BI, 11CI, 11DI1) of the various channels of the duct 30 (see figure 3 - the knife valve is in down position), up to a fully open position (see figure 2) in which the said outlet openings of the various channels of the duct are not closed by the knife valve KV, with intermediate positions (shown in Figures 4 to 6) for which one or more outlet openings (11A1,1 1B1,1 1C1,1 1D1) of one or more channels are not closed by the knife valve, while one or more outlet openings of one or more other channels are closed by the knife valve. For example in Figure 4, the outlet opening 11AI is not closed, whereby enabling the flow of water and additive present in compartment C4 to flow through the outlet 10 into the discharge pipe DP. In figure 5, the knife valve is lifted so that the openings 11A1 and 11B1 are not closed, whereby enabling water from compartment C3 to flow out through the outlet 10, advantageously a time after the end of compartment C4 is emptied. In Figure 6, the knife valve is further lifted, after the compartment C3 is emptied, so as to open the opening 11C1, whereby enabling the liquid present in the compartment C2 to flow out of the device.

In order to ensure a laminar flow for the liquid escaping the device through the outlet 10, the different channels are provided adjacent to their outlet opening (11AI,1 1B1,...) with a honeycomb structure HS adapted for generating a laminar flow for the water flowing through said outlet opening (11AI,1 1B1,...) when not closed by the knife valve. Said honeycomb structure extends partly in the axial/linear portion of the duct 30 adjacent to the outlet 10 and partly in the curved portion of the duct 30. If required the honeycomb structure can also extend in the axial portion of the duct between the curved portion 30C and the compartments.
It has been observed that it was advantageous that said honeycomb structure is
distant from said outlet opening by a distance of at least 0.5cm, advantageously at
least 1cm, preferably from 1 to 5 cm. This enables a quick initial high flow of
liquid out of the channel when the open section of its opening is increased (see
figure 7).

The duct has a substantial linear/axial portion adjacent to the outlet opening 10 of
the device, said linear portion having a length of at least 5cm, advantageously at
least 10 cm, whereby the honeycomb structure extends at least partly within the
said substantial linear portion.

The honeycomb structure extends on a length of at least 20cm, such as from 25 to
50cm within the distinct channels of the duct. According to a possible embodiment
each distinct channel for the liquid coming from a compartment is provided with a
series of internal honeycomb channels.

The duct 30 comprises several distinct channels separate the one from the other by
an inner wall, advantageously an inner curved wall 30W having the shape of a
substantially circular portion which has a radius of curvature at least equal to the
radius of substantially circular cross section of the duct 30.

The outlet 10 of the device is provided with a connection adapted for an air vent,
such as an air admittance valve. The outlet 10 can also be adapted to be connected
to a drain pipe provided with an air vent or an air admittance valve.

The lifting of the knife valve is advantageously controlled by an electric motor 1
receiving signals from a computer, for example connected to the sonar detection
system SONAR TEQ.

The cleaning of a drain pipe or a discharge pipe connected thereto in order to break
down or reduce at least one blockage present in the drain pipe or discharge pipe
connected thereto, can be operated as follows:
- detecting a problem relating to a blockage in the drain pipe or a pipe connected
thereto, such a detection can be operated with a sonar technology, or by any other
suitable technologies;
- the various devices of the invention (Flow-Teq) are ready to use or are filled with
water when a blockage is detected;
- the location and type of blockage is determined by a computer determines then the
device of the invention to be used;
- command signal is then sent to the device Flow-Teq to be used for treating the
blockage, said command signal controlling the working of the electric motor for
lifting step by step the gate or knife valve for sending water, possibly with one or
more additives, in the drain pipe or pipe connected thereto, in the form of
successive distinct water waves, each of said waves having a volume of less than 1
litre, advantageously less than 0.5 litre;
- repeating said treatment with water waves, if required and
- detecting whether the problem relating to a blockage is solved or reduced after one or more steps of water wave treatment, and

- in case after treating the drain pipe or pipe connected thereto with a predetermined series of successive distinct water waves, a problem in the treated drain pipe or pipe connected thereto is still detected, an alarm signal is emitted.
Claims

1. Device for cleaning a drain pipe or a pipe connected thereto in order to break down or reduce at least one blockage present in the drain pipe or a pipe connected thereto by at least two successive waves of liquid escaping at least the device according to a laminar flow, said device comprising at least:
   - a reservoir comprising distinct separate compartments, the said reservoir having at least one connecting part adapted for connecting it to a water supply, said connecting part being advantageously associated to non return means, whereby each distinct compartment is provided with a distinct outlet opening;
   - an outlet (10) adapted to be connected to pipe selected from the group consisting of the drain pipe and a pipe connected to the drain pipe, said outlet (10) being associated with a knife valve actuated by actuating mechanism (8) between a fully closed position and a fully open position;
   - a duct comprising several distinct channels 11A,1 1B,1 IC extending each between the outlet opening of a compartment of the reservoir and an outlet opening of the channel considered adjacent to the outlet (10) of the device, said duct comprising a curved portion of 4.5 to about 90° so as to enable at least a gravity flow of liquid from a compartment of the reservoir towards the outlet 10 of the device when the valve is in open position; whereby the knife valve 3 actuated by the valve mechanism is adapted to move from a fully closed position in which the knife valve closes the outlet openings of the various channels of the duct, up to a fully open position in which the said outlet openings of the various channels of the duct are not closed by the knife valve, with intermediate positions for which one or more outlet openings of one or more channels are not closed by the knife valve, while one or more outlet openings of one or more other channels are closed by the knife valve;
   - in which the different channels are provided adjacent to their outlet opening with a honeycomb structure adapted for generating a laminar flow for the water flowing through said outlet opening when not closed by the knife valve.

2. The device of claim 1, in which the different channels are provided adjacent to their outlet opening with a honeycomb structure adapted for generating a laminar flow for the water flowing through said outlet opening when not closed by the knife valve, said honeycomb structure being distant from said outlet opening by a distance of at least 0.5cm, advantageously at least 1cm, preferably from 1 to 5 cm.

3. The device of claim 1 or 2, in which one or more compartments of the reservoir is/are each associated with a dosing system for adding one additive to the water present in the compartment considered.

4. The device of any one of the claims 1 to 3, in which the duct has a substantial linear portion adjacent to the outlet opening of the device, said linear portion having a length of at least 5cm, advantageously at least 10 cm, whereby the
honeycomb structure extends at least partly within the said substantial linear portion.

5. The device of any one of the claims 1 to 4, in which the honeycomb structure extends on a length of at least 20cm within the distinct channels of the duct.

6. The device of any one of the preceding claims, which is associated to an air admittance valve, advantageously adjacent to the knife valve.

7. The device of any one of the preceding claims, in which the duct comprises at least three distinct channels separate the one from the other by a wall, advantageously a curved wall.

8. The device of claim 7, in which the wall separating two adjacent channels of a duct having a substantially circular cross section has a radius of curvature at least equal to the radius of substantially circular cross section.

9. The device of any one of the preceding claims, in which the reservoir comprises at least three distinct compartments, each of said three compartments being connected respectively to a first, second, and third distinct channel extending within a common duct, whereby the knife valve actuated by the valve control mechanism is adapted to control the displacement of said knife valve so as to control the opening of the first channel, while maintaining closed the second and third channels, then opening the first and second channels, before controlling the opening of the three channels.

10. The device of any one of the preceding claims, in which the reservoir comprises at least four distinct compartments, each of said four compartments being connected respectively to a first, second, third and fourth distinct channel extending each within a common duct, whereby the knife valve actuated by the valve control mechanism is adapted to control the displacement of said knife valve so as to control the opening of the first channel, while maintaining closed the second, third and fourth channels, then opening the first and second channels, while maintaining closed the third and fourth channels, thereafter opening the first, second and third channels before controlling the opening of the four channels together.

11. The device of any one of the preceding claims, in which at least two distinct channels have a different volume.

12. The device of any one of the preceding claims, in which the knife valve is moving in a linear direction and has a circular edge end having substantially the radius of curvature corresponding to the radius of the duct.

13. The device of any one of the preceding claims, in which the valve control mechanism comprises an actuating means provided with a receiving means of a signal emitted by a detecting device adapted for detecting a blockage in the drain
pipe and a pipe connected to the drain pipe, said detecting device being advantageously a sonar detecting device.

14. The device of any one of the preceding claims, in which each distinct compartment of the tank with its channel has a total flushing volume of less than 1 litre, advantageously less than 0.5 litre.

15. The device of any one of the preceding claims, in which the tank is connected to an air vent.

16. The device of any one of the preceding claims, in which the distinct channels of the duct are stacked the one above the other, whereby the base of one compartment forms a ceiling of another compartment.

17. Method for cleaning a drain pipe or a pipe connected thereto in order to break down or reduce at least one blockage present in the drain pipe or a pipe connected thereto, said method comprising the steps of:
- detecting a problem relating to a blockage in the drain pipe or a pipe connected thereto,
- sending water, possibly with one or more additives, in the drain pipe or pipe connected thereto, in the form of successive distinct water waves, each of said waves having a volume of less than 1 litre, advantageously less than 0.5 litre; and
- detecting whether the problem relating to a blockage is solved or reduced.

18. The method of claim 17, in which the step of sending water, possibly with one or more additives, in the drain pipe or pipe connected thereto, in the form of successive distinct water waves, is operated by a device of any one of the claims 1 to 16.

19. The method of claim 17 or 18, in which in case after treating the drain pipe or pipe connected thereto with a predetermined series of successive distinct water waves, a problem in the treated drain pipe or pipe connected thereto is still detected, an alarm signal is emitted.
Fig 5

L : Liquid
Fig 9
Fig 10

SONAR-TEQ Detects Blockage

FLOW-TEQ

Blockage
SONAR-TEQ Sends Signal to FLOW-TEQ

Fig 11
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. B08B9/032 E03F9/00

ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B08B E03F E03C

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Relevant to claim No.</th>
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<td>EP 0 246 562 A2 (VOLLMAR OSKAR GMBH [DE])</td>
<td>17, 19</td>
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<td>A</td>
<td>col umn 2, line 1 - col umn 8, line 32; figures</td>
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<td>X</td>
<td>EP 2 108 752 A2 (MALKA RAFAEL [IL])</td>
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<td>A</td>
<td>10 February 2000 (2000-02-10) page 6 - page 10; figures</td>
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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 o n or after the international filing date
  *L* document which may throw doubts on priority claim(s) on 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

**"** 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

**"A** document member of the same patent family

Date of the actual completion of the international search

6 October 2016

Date of mailing of the international search report

18/10/2016

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
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Authorized officer

Fajarnes Jessen, A
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INTERNATIONAL SEARCH REPORT

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.:
   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:

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:

see additional sheet

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 an 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.
1. claims: 1-19

Device for cleaning a drain pipe by at least two successive waves of liquid escaping the device according to a laminar flow, the device comprising a reservoir comprising distinct separate compartments, each compartment provided with an outlet opening; an outlet adapted to be connected to the drain pipe, said outlet being associated with a knife valve actuated by actuating mechanism between a fully closed position and a fully open position; a duct comprising several distinct channel's extending each between the outlet opening of a compartment and an outlet opening of the channel considered adjacent to the outlet of the device, whereby the knife valve is adapted to move from a fully closed position up to a fully open position, with intermediate positions for which one or more outlet openings of one or more channels are not closed in which the different channels are provided adjacent to their outlet openings with a honeycomb structure.

1.1. claims: 17-19

Method for cleaning a drain pipe or a pipe connected thereto in order to break down or reduce at least one blockage present in the drain pipe or a pipe connected thereto, said method comprising the steps of:
- detecting a problem relating to a blockage in the drain pipe or a pipe connected thereto,
- sending water, possibly with one or more additives, in the drain pipe or pipe connected thereto, in the form of successive distinct water waves, each of said waves having a volume of less than 1 litre, advantageously less than 0.5 litre; and
- detecting whether the problem relating to a blockage is solved or reduced.

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