



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.08.2017 Bulletin 2017/35

(51) Int Cl.:
F23D 5/02 (2006.01)

(21) Application number: **17157709.1**

(22) Date of filing: **23.02.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(30) Priority: **25.02.2016 BE 201605135**

(54) **IMPROVED BIO ETHANOL FIREPLACE**

(57) Improved bioethanol stove (8) for igniting and burning bioethanol (3) that at least comprises the following elements:

- a burner (9) that is provided with a burner bed (10);
- a separate reservoir (11) for the storage of bioethanol (3); and,
- supply means (12) for the supply of fuel (3) to the burner bed (10).

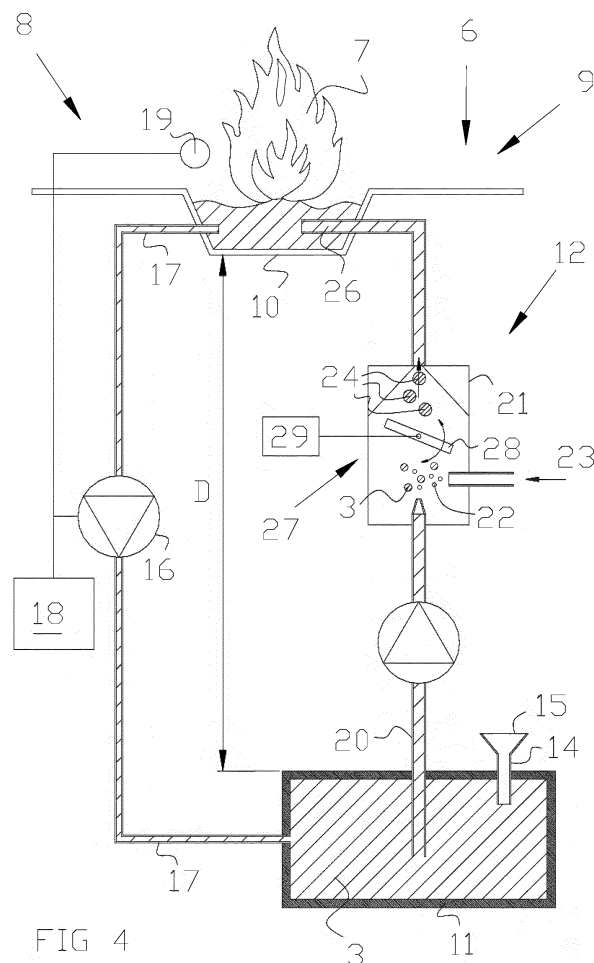


FIG 4

Description

[0001] The present invention relates to an improved bioethanol stove.

[0002] More specifically, the present invention relates to an improved bioethanol stove that is intended for igniting and burning bioethanol fuel.

[0003] Many types of bioethanol stoves of the aforementioned type are already known, but they are open to considerable improvement.

[0004] With the known bioethanol stoves the bioethanol is poured into a channel or small tank.

[0005] After ignition the bioethanol present is burned.

[0006] A first big problem with the known bioethanol stoves is that refilling such a stove with fuel, more specifically bioethanol, involves relatively considerable hazards.

[0007] Bioethanol is a fuel that is rather volatile, and which upon heating easily goes from the liquid phase to the gas phase.

[0008] Furthermore, gaseous bioethanol is highly inflammable.

[0009] For this reason, after the stove has been burning for some time, at all times bioethanol may only be added to the stove when the stove has cooled down sufficiently. Otherwise, when refilling the stove with bioethanol it can lead to the formation of gaseous bioethanol that can easily self-ignite.

[0010] This last aspect of course constitutes an enormous fire hazard, such that not only materials in the vicinity of the stove can easily catch fire, but whereby the burning bioethanol can also cause substantial burns for the person refilling the stove.

[0011] The person refilling the stove usually holds a well filled bottle or can of bioethanol during filling, which in the event of ignition of the gaseous bioethanol formed can slip from his hands due to a shock reaction and/or quickly catch fire, such that a large quantity of fuel is ignited.

[0012] All this can lead to disastrous consequences in a minimum of time.

[0013] Another disadvantage of the known bioethanol stoves is consequently that between the burning and refilling and igniting the stove again, a certain period of cooling down must be respected, which is far from practical and such that the effect of the heating is partially lost during the waiting period.

[0014] Another disadvantage of bioethanol stoves is that a relatively large quantity of bioethanol is always present in the stove, which can also easily ignite for the said reasons, with a potential fire hazard as a result.

[0015] Another disadvantage of bioethanol stoves is that with these known bioethanol stoves the combustion takes place "in its own liquid" or "in its own tank", which in practice means that the combustion and the flame directly takes hold of the entire volume of bioethanol that is present in the stove.

[0016] Such an arrangement again constitutes a very considerable hazard, but there is also another disadvantage of this, i.e. that the combustion is not complete or inefficient combustion takes place, such that an unpleasant odour is emitted and such that the user often suffers from a headache.

[0017] The purpose of the present invention is to provide a solution to one or more of the aforementioned and/or other problems.

[0018] More specifically, the purpose of the invention is to provide an improved stove for the combustion of bioethanol that is safer to use and whereby better combustion is realised.

[0019] To this end the present invention concerns an improved bioethanol stove for igniting and burning bioethanol, whereby this stove at least comprises the following elements:

- a burner that is provided with a burner bed;
- a separate reservoir for the storage of bioethanol; and,
- supply means for the supply of fuel to the burner bed.

[0020] A first big advantage of such an improved bioethanol stove according to the invention is that the stove is provided with a burner with a burner bed over which the fuel is distributed, more specifically pure bioethanol or a fuel mixture consisting of such bioethanol mixed with air.

[0021] In this way, during the combustion of fuel, the flame only comes into contact with a proportion of the bioethanol present in the stove, which of course contributes to the safety of such a bioethanol stove according to the invention.

[0022] Another advantage of the application of a burner bed is that much better combustion of the bioethanol can be obtained than with the known bioethanol stoves, as no combustion takes place in its own liquid.

[0023] According to a preferred embodiment variant, the burner bed is formed such that it comprises a base and one or more walls reaching to the base.

[0024] One or more of these walls is provided with passages or openings.

[0025] In the usage position the base is at the lowest possible position, and the passages or openings are at a height above the base, whereby the height is preferably between 5 millimetres and 45 millimetres, and more preferably between

7 millimetres and 35 millimetres.

[0026] The openings provide a suitable oxygen supply for the combustion with good high flames and complete combustion as a result.

[0027] The right oxygen supply thus prevents the well known odour nuisance of bioethanol stoves and also the often cited headaches.

[0028] Another big advantage of an improved bioethanol stove according to the invention is that the stove is provided with supply means for the supply of fuel to the burner bed.

[0029] These supply means enable the fuel to be dosed onto the burner bed, whereby preferably the bioethanol is already mixed with air beforehand so that optimum combustion is obtained.

[0030] In an improved bioethanol stove according to the invention, complete combustion of the fuel takes place, such that the users do not experience any odour nuisance, which is indeed the case with the known bioethanol stoves.

[0031] Another important advantage of an improved bioethanol stove according to the invention is that the bioethanol is stored in a separate reservoir, which again greatly limits the fire hazard risk, or in any case greatly reduces the consequences thereof compared to what is the case with the known bioethanol stoves.

[0032] In a preferred embodiment of an improved bioethanol stove according to the invention, the reservoir is provided with a supply for refilling the reservoir with bioethanol, whereby preferably this reservoir of bioethanol is arranged such that the reservoir can be replenished without danger while the stove is burning.

[0033] Preferably to this end the supply is provided at some distance from the burner bed in order to be able to fill the reservoir without danger while the stove is burning.

[0034] A big advantage of these embodiments of an improved bioethanol stove according to the invention is that the risk of fire is again greatly reduced, while the ease of use increases.

[0035] After all, the person no longer has to wait until the bioethanol stove has cooled down sufficiently before the stove can be refilled with fuel, which is indeed the case with the known bioethanol stoves.

[0036] This constitutes a time saving on the one hand, but also the heating effect of the stove no longer has to be interrupted, so that the efficiency of an improved bioethanol stove according to the invention when heating a space is much greater than with the known bioethanol stoves.

[0037] In a possible embodiment of an improved bioethanol stove according to the invention, the reservoir is provided as a compartment in the burner bed.

[0038] Such an embodiment of an improved bioethanol stove according to the invention has the advantage that the stove can be made very compact, while the stove is much safer than the known bioethanol stoves, on account of the closed nature of the fuel storage.

[0039] In another possible embodiment of an improved bioethanol stove according to the invention, the reservoir is provided at a certain distance from the burner bed, for example at a distance of at least 10 cm, or for example at least 15 cm or at a distance of at least 20 cm or even more.

[0040] In these possible embodiments of an improved bioethanol stove according to the invention, the emphasis is on safety and ease of use when refilling the stove with fuel and less on its compactness.

[0041] In another embodiment of an improved bioethanol stove according to the invention, an intermediate solution can be chosen whereby the reservoir in the stove is provided close to the burner bed, but far enough from it to be able to safely replenish fuel while the stove is burning.

[0042] Another preferred aspect of an improved bioethanol stove according to the invention consists of providing the stove with a pump and pipes with which bioethanol or fuel present in the burner bed can be pumped back to the reservoir.

[0043] Preferably in such an improved bioethanol stove according to the invention, the stove is provided with a controller for automatically controlling the pump and an electronic circuit for extinguishing the stove, whereby the controller is such that when extinguishing the stove using the electronic circuit, surplus bioethanol or fuel in the burner bed is automatically pumped back to the reservoir.

[0044] Such possible embodiments of an improved bioethanol stove according to the invention are equipped even more safely, as after extinguishing the stove no or practically no bioethanol or fuel is left behind on the burner bed, so that no gaseous highly inflammable vapours can occur due to the remaining heat present in the just extinguished stove, which is indeed the case with the known bioethanol stoves.

[0045] With the intention of better showing the characteristics of the invention, a few preferred embodiments of improved bioethanol stoves according to the invention are described hereinafter, by way of an example without any limiting nature, with reference to the accompanying drawings, wherein:

figure 1 schematically illustrates the operation of a known bioethanol stove;

figure 2 schematically shows a first possible embodiment of an improved bioethanol stove according to the invention; and

figures 3 and 4 schematically show two other embodiments of an improved bioethanol stove according to the invention;

figure 5 shows an improved embodiment of a part of a burner bed.

[0046] The bioethanol stove 1 schematically shown in figure 1 is a bioethanol stove 1, as is known according to the state of the art.

[0047] This known bioethanol stove has a channel, tank or container that acts as a storage space 2 in which a user has to pour the bioethanol 3 to be burned.

[0048] This storage space 2 typically has a base 4 and side walls 5, but moreover is open at the top 6.

[0049] In such a known bioethanol stove 1 the bioethanol 3 present in the storage space 2 is ignited whereby a flame 7 is formed.

[0050] The combustion of the bioethanol 3 hereby takes place directly on the storage space 2, which in the trade jargon is described as "combustion in its own liquid" or "combustion in its own tank".

[0051] A big disadvantage of such a known configuration is the considerable risk of fire, for example due to spillage when refilling or self-ignition of gaseous bioethanol, as discussed in the introduction.

[0052] The consequences of such a fire can also be substantial, because a large quantity of bioethanol is in direct contact with the flame 7.

[0053] Another disadvantage of these known bioethanol stoves 1 is that with such "combustion in its own liquid" complete combustion of the bioethanol does not take place, at least seen from a chemical point of view.

[0054] In the event of complete combustion of ethanol, i.e. with a sufficient supply of oxygen and heat, the ethanol breaks down into harmless and odourless water and carbon dioxide.

[0055] In the event of the incomplete combustion of ethanol, all kinds of other by-products get into the air that are harmful to health and which can cause a considerable odour nuisance.

[0056] In the event of "combustion in its own liquid" insufficient oxygen may be supplied to the seat of the fire to obtain complete combustion, with the described disadvantages as a result.

[0057] Figure 2 shows a first embodiment of an improved bioethanol stove 8 according to the invention.

[0058] This improved bioethanol stove 8 comprises a burner 9 that is provided with a burner bed 10. Although not shown in figures 1 to 4, the burner bed 10 can be provided with passages or openings at a height above its base, and above the level of the fuel that is only shown schematically here.

[0059] The bioethanol 3 is stored in a separate reservoir 11.

[0060] It is clear that the top 6 of the improved bioethanol in this case is closed or practically closed with a clear separation between the bulk of the bioethanol 3 present in the stove and the actual flame 7 or seat of the fire 7.

[0061] Moreover, the improved bioethanol stove 8 is provided with supply means 12 for the supply of fuel 3, in this case pure bioethanol 3, to the burner bed 10.

[0062] In the example shown of figure 2, these supply means 12 are schematically shown as a pipe or passage 13 to the burner bed 10, but in reality these supply means 12 can be much more complicated, as will be discussed in more detail with regard to figure 4.

[0063] Means can hereby be provided for correctly mixing the bioethanol 3 with air or oxygen and for the dosed supply of the bioethanol 3 or the fuel mixture to the burner bed 10.

[0064] The improved bioethanol stove 8 according to the invention is suitable for burning both bioethanol 95 and bioethanol 98.

[0065] An advantage of this arrangement according to the invention is that the bulk of the bioethanol 3 is stored separately in the reservoir 11 and is not in direct contact with the flame 7, such that the risk of ignition of a fire outside the stove 8 is greatly reduced and certainly the scale of any such fire is enormously reduced.

[0066] Another advantage of such an improved bioethanol stove 8 according to the invention is that only a limited quantity of fuel is present in the burner bed 10, such that again the possibility to form a large fire outside the stove 8 is greatly reduced.

[0067] Yet another advantage of the improved bioethanol stove 8 is that the supply means 12 can adjust the nature and quantity of the fuel supplied to the burner bed 10, so that much better combustion, more specifically complete combustion from a chemical point of view, can be obtained so that no harmful gases and gases that cause an odour nuisance get into the environment.

[0068] The reservoir 11 is provided with a closable supply 14 for replenishing the reservoir 11 with bioethanol 3.

[0069] This supply 14 is preferably arranged such that the reservoir 11 can be refilled with bioethanol 3 without danger, and this preferably while the stove 8 is burning.

[0070] In order to enable the safe topping up of bioethanol 3 in the reservoir 11, to this end the mouth 15 of the supply 14 can be provided at a sufficiently large distance from the burner bed 10, for example.

[0071] The improved bioethanol stove 8 according to the invention is preferably provided with a pump 16 and pipes 17 with which bioethanol 3 or fuel present in the burner bed 10 can be pumped back to the reservoir 11.

[0072] As is also the case in figures 2 to 4, the improved bioethanol stove 8 is preferably provided with a controller 18 for automatically controlling the pump 16 and an electronic circuit 19 for extinguishing the improved bioethanol stove 8.

[0073] The controller 18 is hereby preferably such that when extinguishing the improved bioethanol stove 8, surplus bioethanol 3 or fuel in the burner bed 10 is automatically pumped backed to the reservoir 11 with the aid of the electronic circuit 19.

[0074] With such an embodiment of an improved bioethanol stove 8 with automated shut-off protection in the form of the controller 18 and circuit 19, the risk of a fire outside the burner 9 is further reduced, because the stove 8 can be extinguished quickly and because immediately after extinguishing the stove 8, all the remaining, albeit limited quantity, of bioethanol 3 or fuel in the burner bed 11 is immediately automatically removed with the pump 16 via the pipes 17.

[0075] In the embodiment of figure 2 the reservoir 11 of the improved bioethanol stove 8 is provided as a compartment in the burner bed 10.

[0076] Thus a compact version of an improved bioethanol stove 8 according to the invention is obtained, but with rather limited possibilities for the provision of a good control of the supply means 12 and with fewer possibilities for the safe refilling of the reservoir with bioethanol 3.

[0077] Figure 3 shows a possible alternative embodiment of an improved bioethanol stove 8 according to the invention.

[0078] In this embodiment, the reservoir in the stove 8 is provided close to the burner bed 11 and is no longer constructed as a single unit with the burner bed 11.

[0079] Between the reservoir 11 and the burner bed 10 a pipe 20 is provided for the supply of bioethanol 3 to the burner bed 10, which forms part of the supply means 12 and whereby in other embodiments, as already mentioned, all kinds of other facilities can be provided to improve the combustion in the burner 9.

[0080] It goes without saying that as a result, the separation between the actual seat of the fire 7 and the storage of bioethanol 3 is further increased, which contributes to the safety of this version of the improved bioethanol stove 8.

[0081] Figure 4 schematically shows another more developed embodiment of an improved bioethanol stove 8 according to the invention.

[0082] In this embodiment the reservoir 11 is affixed at an even greater distance D from the burner bed 10.

[0083] This distance D is preferably at least 10 cm, more preferably at least 15 cm, and even better a distance D between the burner bed 10 and reservoir 12 of at least 20 cm or more is applied.

[0084] It goes without saying that by respecting such a distance D, the fire hazard is further reduced and the possibilities for safely refilling the reservoir 11 with bioethanol 3 via the supply 14 during the combustion of the improved bioethanol stove 8 are also greatly increased.

[0085] Moreover, in this embodiment sufficient space to provide all kinds of facilities in the pipe 20 or the supply means 12 with which the supply of fuel to the burner bed 10 can be dosed and similar.

[0086] In the case of figure 4 the supply means 12 are provided, for example, with a carburettor 21 in which bioethanol 3 from the reservoir 11 is atomised and mixed with air 22, which is guided to the carburettor 21 via an inlet 23 to form a fuel mixture 24.

[0087] The bioethanol is guided from the reservoir 11 to the carburettor 21 and further to the burner bed 10 by means of a pump 25.

[0088] Moreover, the supply means 12 are provided with spraying means 26 in the form of a manifold or similar with which the fuel mixture 24 is sprayed onto the burner bed 10.

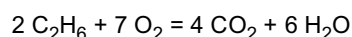
[0089] The supply means 12 also comprise a control 27 for controlling the quantity of fuel mixture 24 to be sprayed onto the burner bed 10.

[0090] The control 27 comprises an adjustable valve 28 that closes off the supply to the burner bed 10 to a greater lesser extent.

[0091] For the adjustment of the state of the valve 28 and thus for controlling the flow rate of fuel mixture 24 to the burner bed 10, the control 27 is provided with an electronic controller 29.

[0092] In this embodiment of an improved bioethanol stove 8 according to the invention, fuel mixture 24 is thus systematically injected on the burner bed 10 via the spraying means 26.

[0093] The electronic controller 29 determines the quantity of fuel mixture 24 that may be injected on the burner bed 10, as well as the mix ratio between air and bioethanol 3 that preferably at least corresponds to the ratio between oxygen and ethanol that is needed for complete combustion according to:



[0094] In this way, upon combustion only the harmless and odourless water and carbon dioxide are formed and no carbon monoxide or other harmful gases, for example.

[0095] With an improved bioethanol stove 8 according to the invention, both open combustion and closed combustion can be applied.

[0096] The improved bioethanol stove 8 according to the invention is preferably placed in a housing that is easy to convert into a two-sided or three-sided device.

[0097] Figure 5 shows a part of a specific embodiment of a burner bed 10.

[0098] It is clear that the principles and details can be applied in each of the embodiments discussed above.

[0099] Here, the burner bed 10 presents an essentially V-shaped section and to this end comprises a base 30 and two oblique walls 31, which reach to the base 30.

[0100] Here both walls 31 are provided with passages or openings 32.

[0101] In the usage position the base 30 is at the lowest possible position, and the passages or openings 32 are at a height above the base 30 whereby the height is preferably located between 5 millimetres and 45 millimetres, and more preferably between 7 millimetres and 25 millimetres, for example 10 millimetres.

[0102] The passages or openings 32 present a diameter between 2 and 20 millimetres, preferably between 4 and 12 millimetres, such as 5 millimetres here for example, and here they are provided at a mutual distance of 40 millimetres. It is clear that the diameter and the mutual distance can be proportional: the larger the passages or openings 32 the larger the distance between the passages or openings 32.

[0103] The passages or openings 32 provide a suitable oxygen supply for the combustion with good high flames and a complete combustion as a result.

[0104] The right oxygen supply thus prevents the well known odour nuisance of bioethanol stoves 8 and also the often cited headaches.

[0105] The ends of these walls 31 away from the base are folded here so that they form essentially horizontal flanks 33 in the usage position that can rest on the upright walls 34 of a broader U-shaped profile 35. The base 36 of the U-shaped profile 35 is provided under the base 30 of the burner bed 10 during use.

[0106] The V-shaped burner bed 10 thus forms as it were a cover with a V-shaped recess on the U-profile 35 that acts as protection and accommodates any spilled fuel, for example as a result of movement during use. It is clear that the head ends of all the aforementioned profiles are closed off by suitable head walls 37.

[0107] Both the upright side walls 34 of the U-profile 35 and the essentially horizontal flanks 33 of the V-shaped burner bed 10 in the usage position are provided here with slots 38 for the passage of air to the space between the V-shaped burner bed 10 and the underlying U-shaped profile 35.

[0108] The invention is by no means limited to the embodiments of improved bioethanol stoves 8 according to the invention, described as an example and illustrated in the drawings, but such improved bioethanol stoves 8 can be realised in other ways without departing from the scope of the invention.

Claims

1. Improved bioethanol stove (8) for igniting and burning bioethanol (3), **characterised in that** the stove (8) comprises at least the following elements:

- a burner (9) that is provided with a burner bed (10) that is formed such that it comprises a base (30) and one or more walls (31) reaching to the base, whereby one or more of these walls are provided with passages or openings (32), and whereby in the usage position the base (30) is at the lowest possible position, and the passages or openings (12) are provided at a height above the base, whereby the height is preferably between five millimetres and forty five millimetres, and more preferably between seven millimetres and thirty five millimetres;

- a separate reservoir (11) for the storage of bioethanol (3); and,
- supply means (12) for the supply of fuel (3) to the burner bed (10), whereby these supply means (12) are provided with spraying means (26) for spraying fuel (24) on the burner bed (10), as well as a carburettor (21) in which bioethanol (3) from the reservoir (11) is atomised and mixed with air (22) to form a fuel mixture (24).

2. Improved bioethanol stove (8) according to claim 1, **characterised in that** the reservoir (11) is provided with a supply (14) for replenishing the reservoir (11) with bioethanol (3).

3. Improved bioethanol stove (8) according to claim 2, **characterised in that** the reservoir (11) is provided with a supply (14) for replenishing the reservoir (11) with bioethanol (3) that is arranged such that the reservoir (11) can be refilled without danger while the stove (8) is burning.

4. Improved bioethanol stove (8) according to claim 3, **characterised in that** the supply (14) is provided at some distance from the burner bed (10) in order to be able to fill the reservoir (11) without risk while the stove (8) is burning.

5. Improved bioethanol stove (8) according to one or more of the previous claims, **characterised in that** the reservoir (11) is provided as a compartment in the burner bed (10).

6. Improved bioethanol stove (8) according to one or more of the claims 1 to 4, **characterised in that** the reservoir (11) in the stove (8) is provided close to the burner bed (10).
7. Improved bioethanol stove (8) according to one or more of the claims 1 to 4, **characterised in that** the reservoir (11) is provided at a distance (D) of at least 10 cm from the burner bed (10).
8. Improved bioethanol stove (8) according to claim 7, **characterised in that** the reservoir (11) is provided at a distance (D) of at least 20 cm from the burner bed (10).
9. Improved bioethanol stove (10)) according to one or more of the previous claims, **characterised in that** a pipe (20) is provided between the reservoir (11) and the burner bed (10) for the supply of bioethanol (3) to the burner bed (10).
10. Improved bioethanol stove (8) according to one or more of the previous claims, **characterised in that** the supply means (12) are provided with a control (27) for controlling the quantity of fuel mixture (24) to be sprayed on the burner bed (10).
11. Improved bioethanol stove (8) according to one or more of the previous claims, **characterised in that** the aforementioned control (27) comprises an electronic controller (29).
12. Improved bioethanol stove (8) according to one or more of the previous claims, **characterised in that** the stove (8) is provided with a pump (16) and pipes (17) with which bioethanol (3) present in the burner bed (10) can be pumped back to the reservoir (11).
13. Improved bioethanol stove (8) according to one or more of the previous claims, **characterised in that** the stove (8) is provided with a controller (18) for the automatic control of the pump (16) and with an electronic circuit (19) for extinguishing the stove (8), whereby the controller (18) is such that when extinguishing the stove (8) with the aid of the electronic circuit (19) surplus bioethanol (3) in the burner bed (10) is automatically pumped back to the reservoir (11).

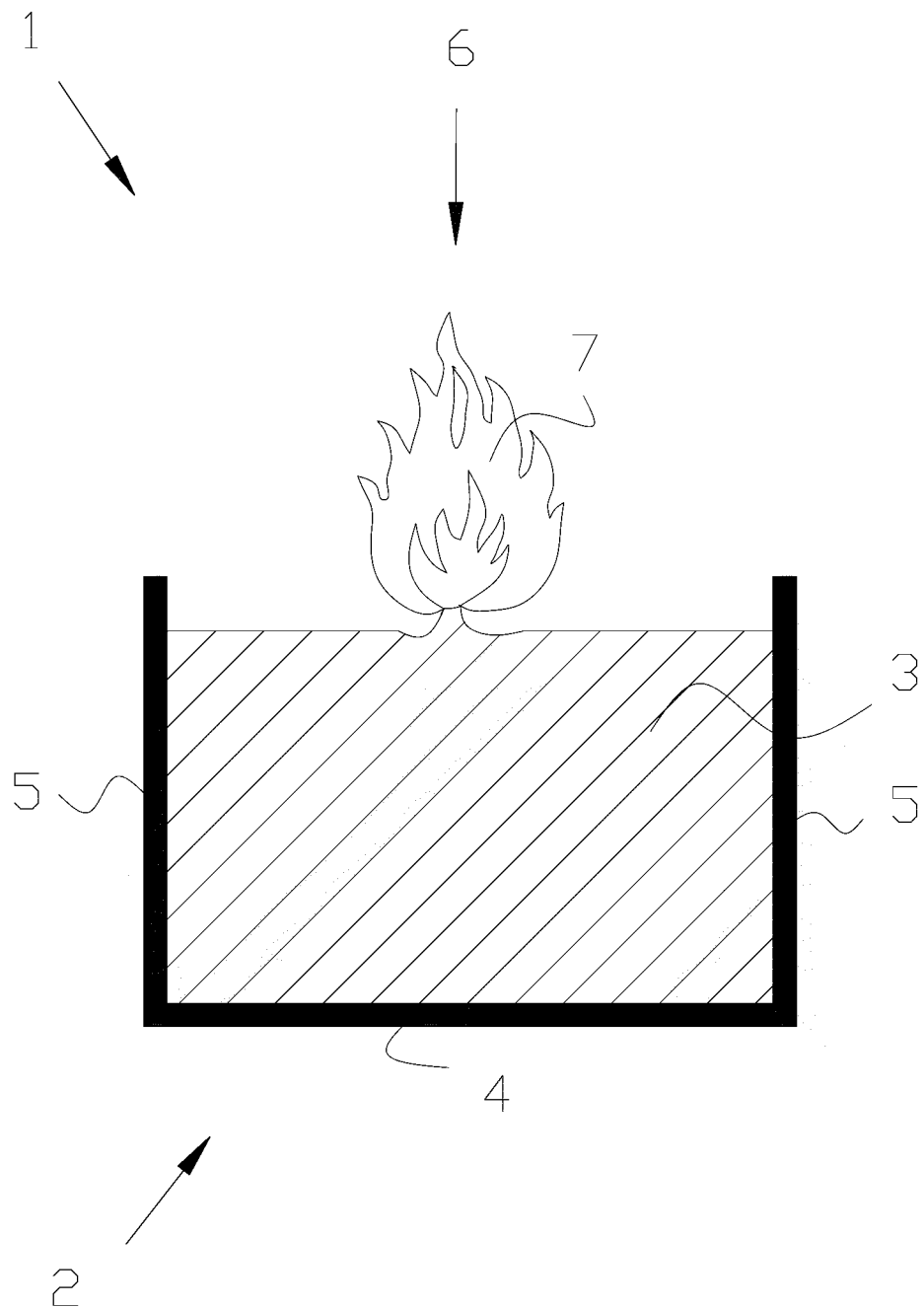


FIG 1

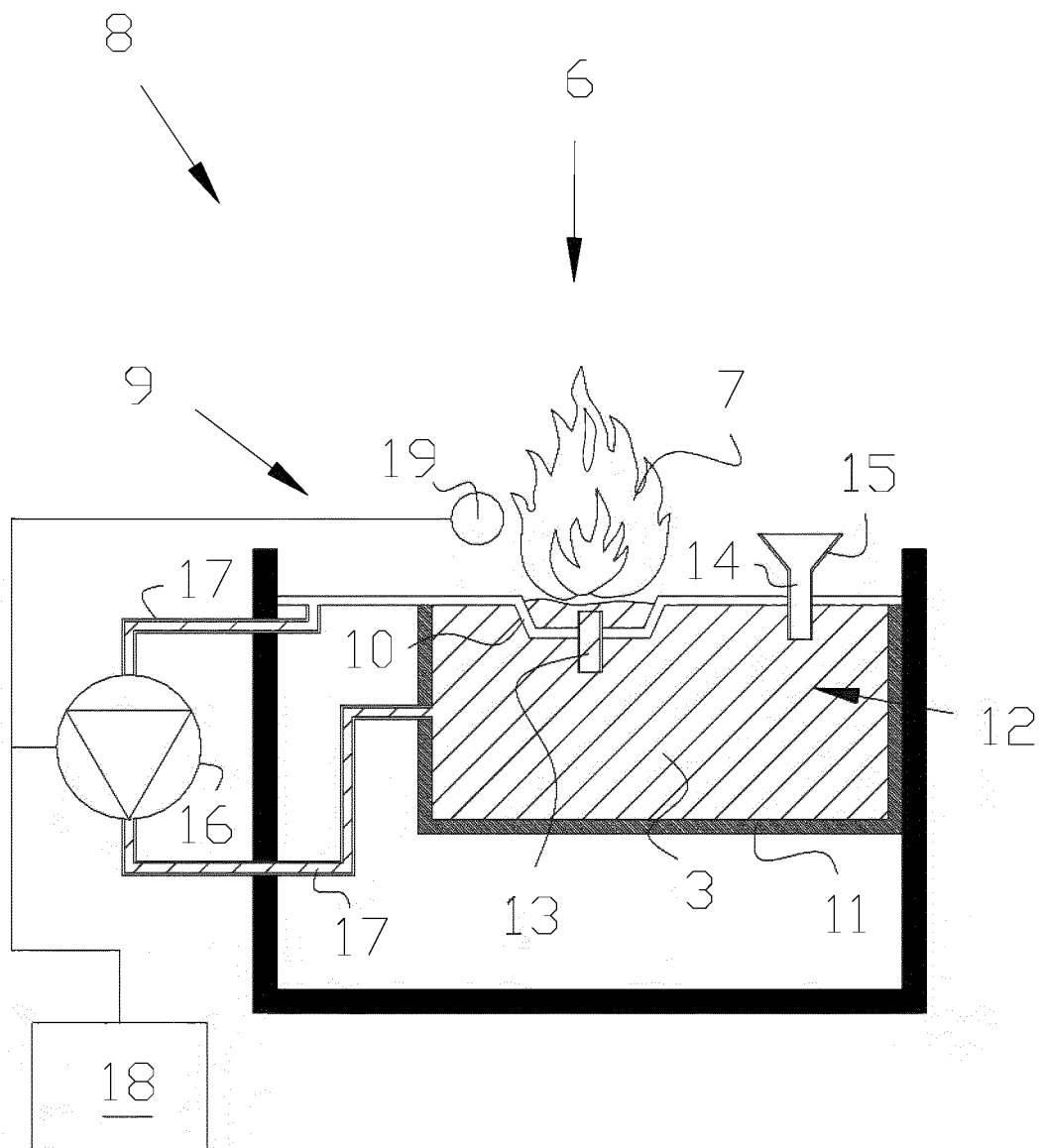


FIG 2

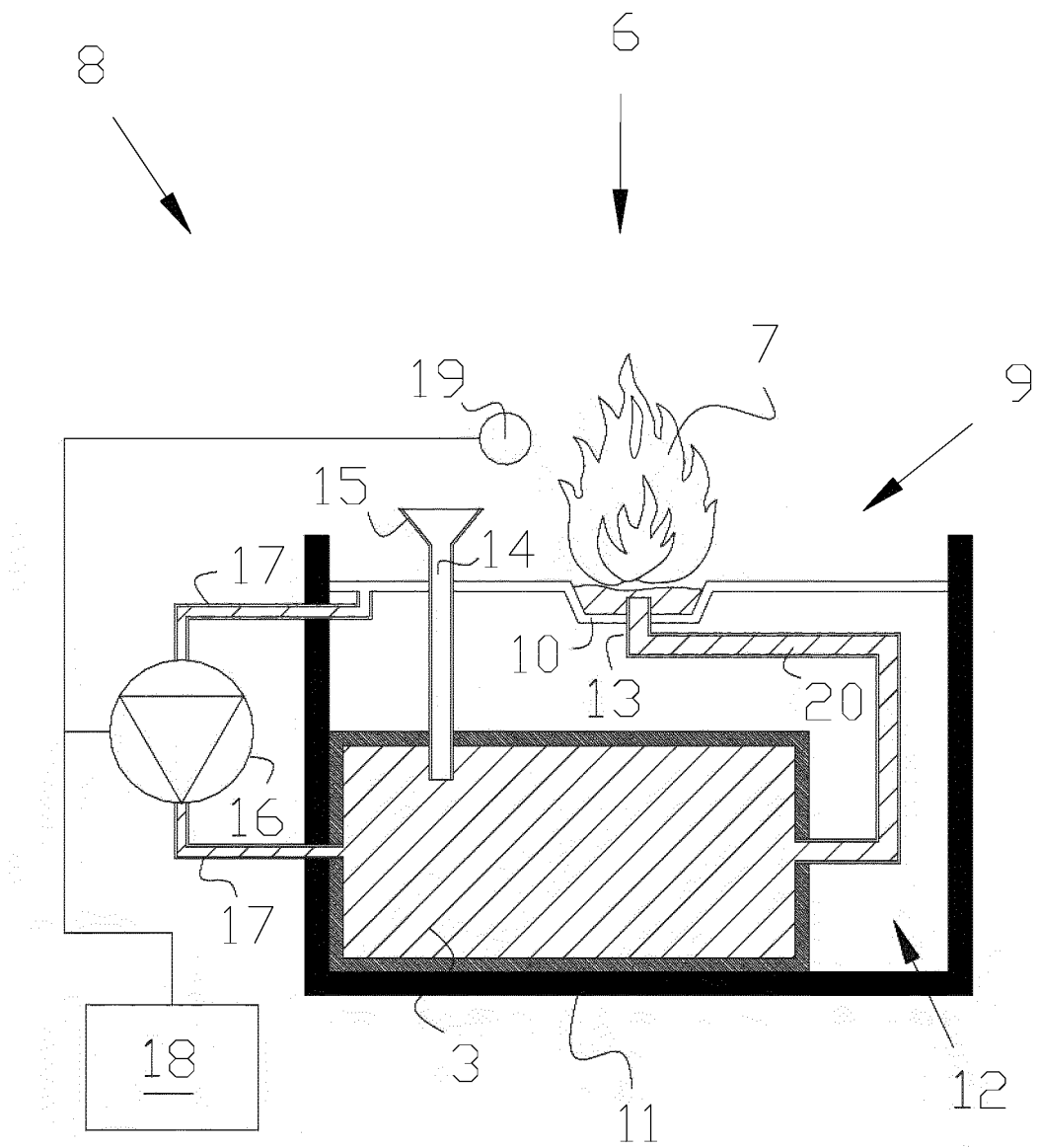
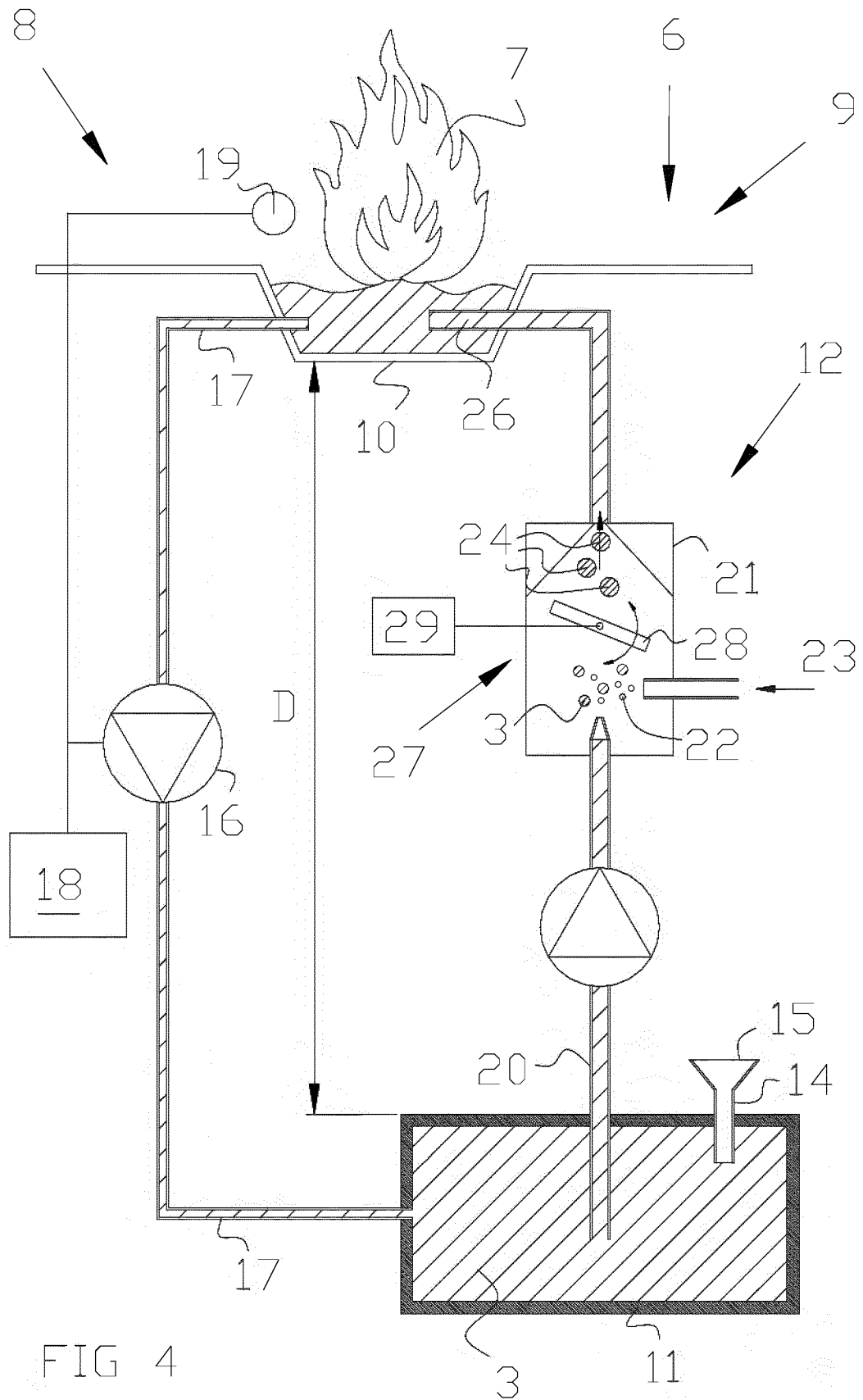


FIG 3



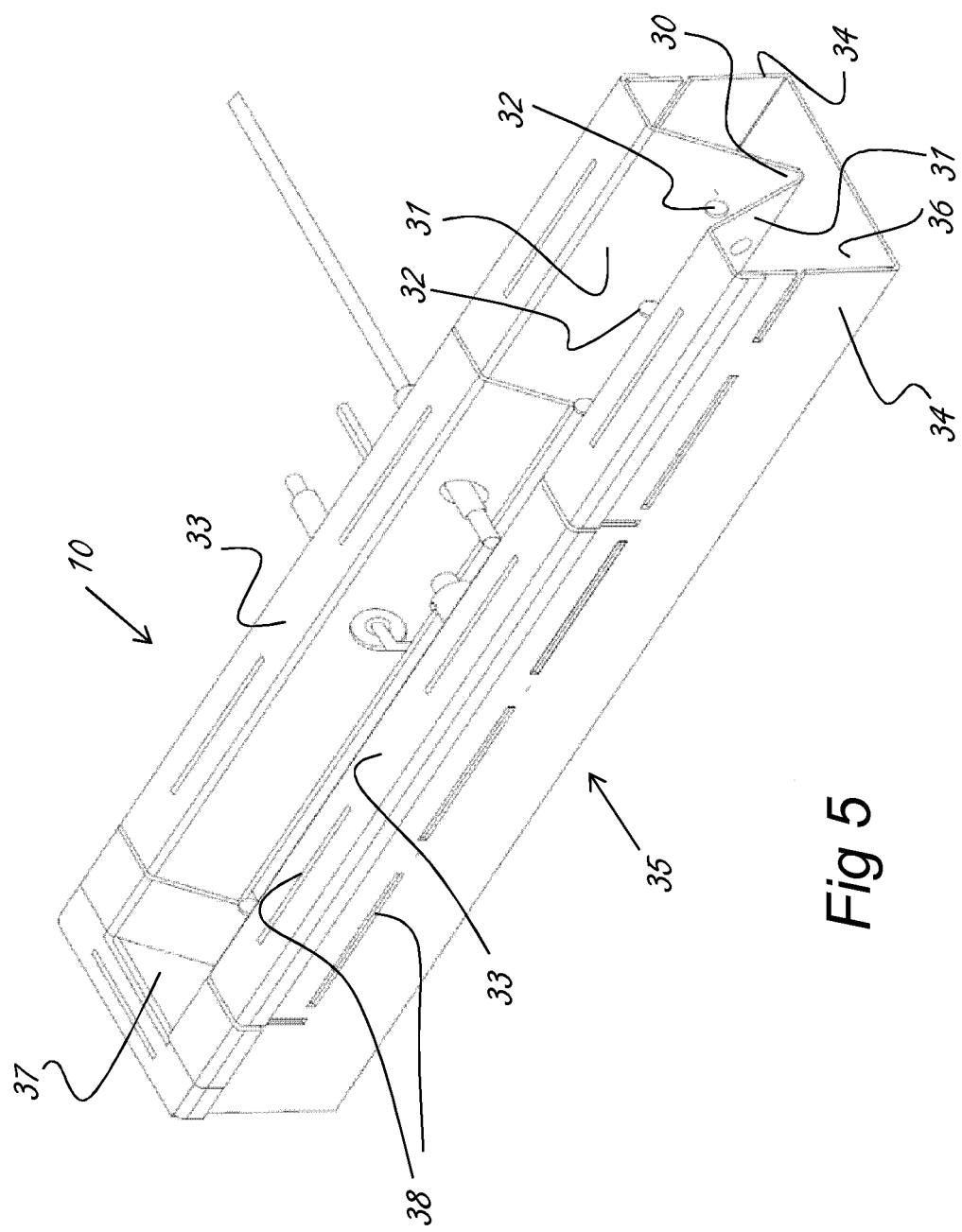


Fig 5



EUROPEAN SEARCH REPORT

 Application Number
 EP 17 15 7709

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 June 2017	Examiner Hauck, Gunther
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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