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(54) **ALCOHOL STOVE AND METHOD FOR IGNITING AN ALCOHOL STOVE**

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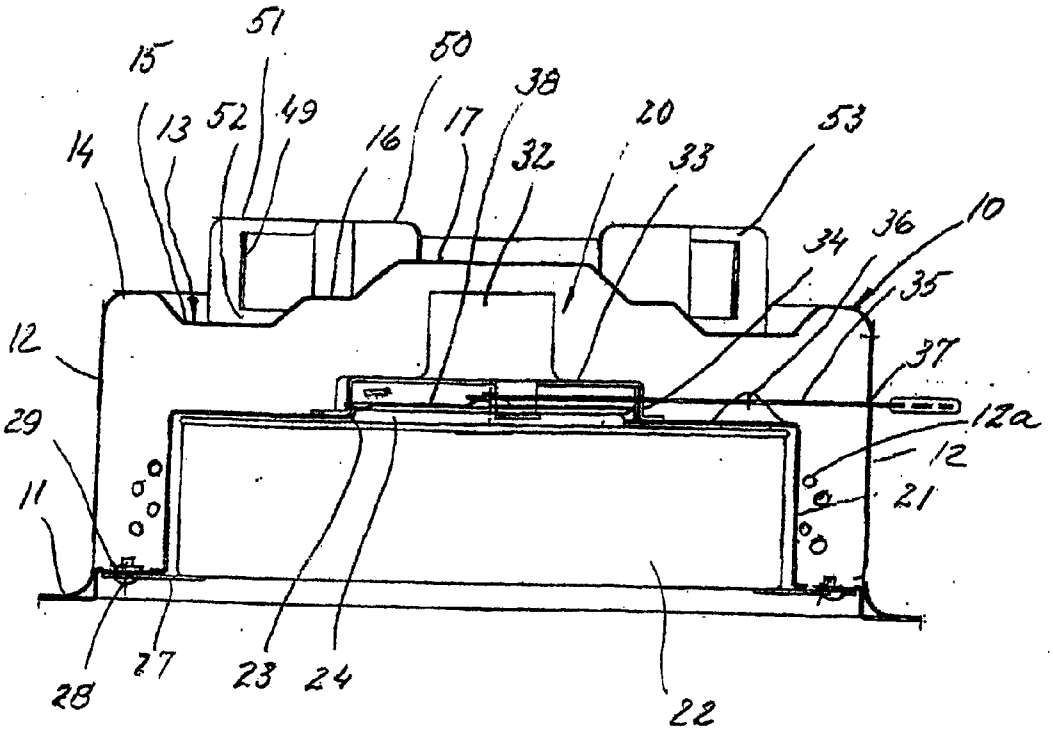
(57) **ABSTRACT**

The present invention relates to an alcohol stove comprising a casing (**10**), whereby the housing comprises one or several fire hearths (**17**) and encases a fuel container (**22**) and a burner arrangement (**20**), wherein a heating wire (**101**) is arranged above the opening (**25**) of the fuel container (**22**) and that the heating wire (**101**) is connected to a connectable electrical power source, which when connected causes the heating wire (**101**) to heat up so that the heating wire (**101**) by heat radiation evaporates the fuel in the fuel container (**22**) such that the alcohol stove is ignited by the fuel fume vapours being ignited as they pass the heating wire (**101**).



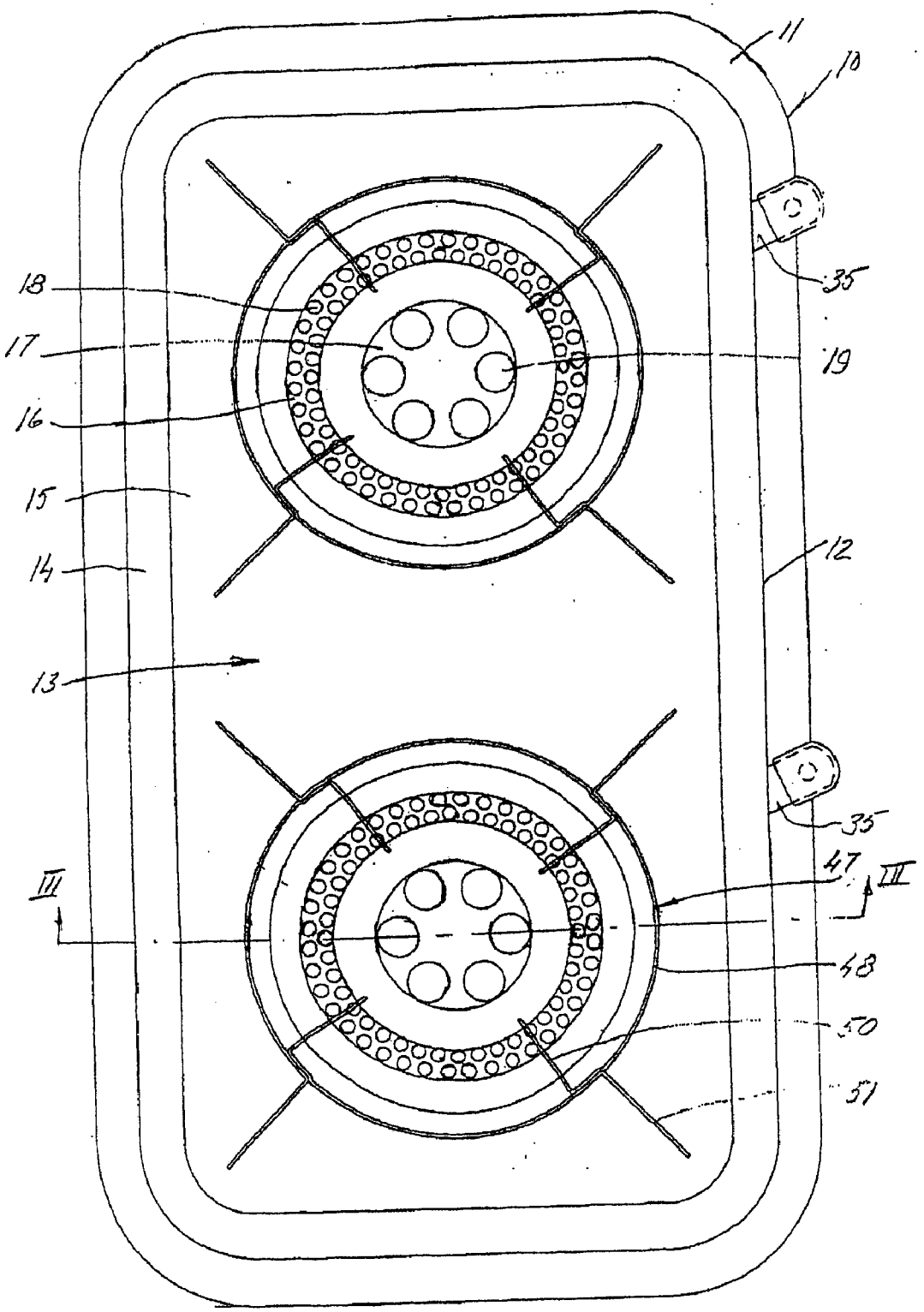


Fig. 1

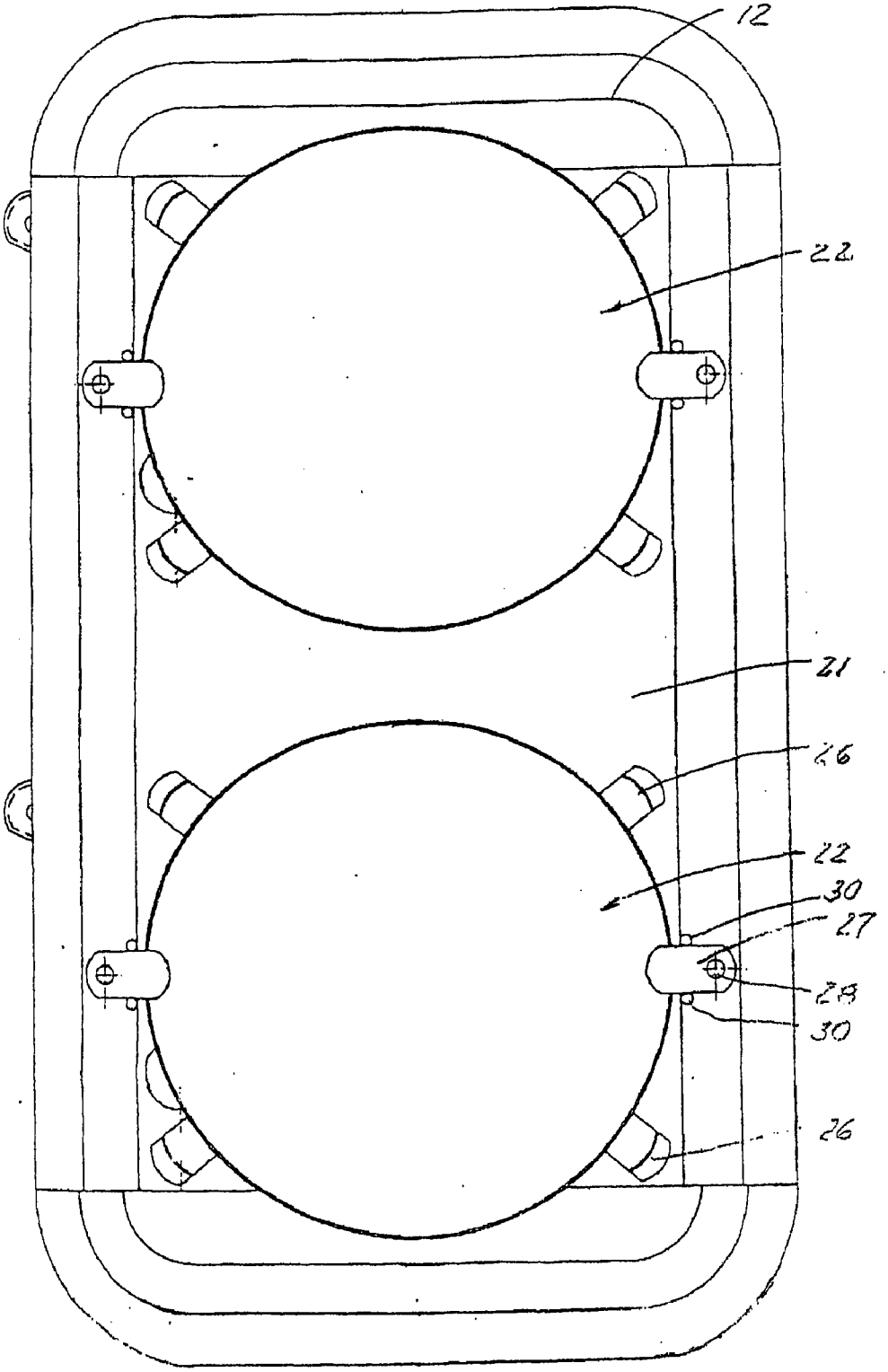


Fig. 2

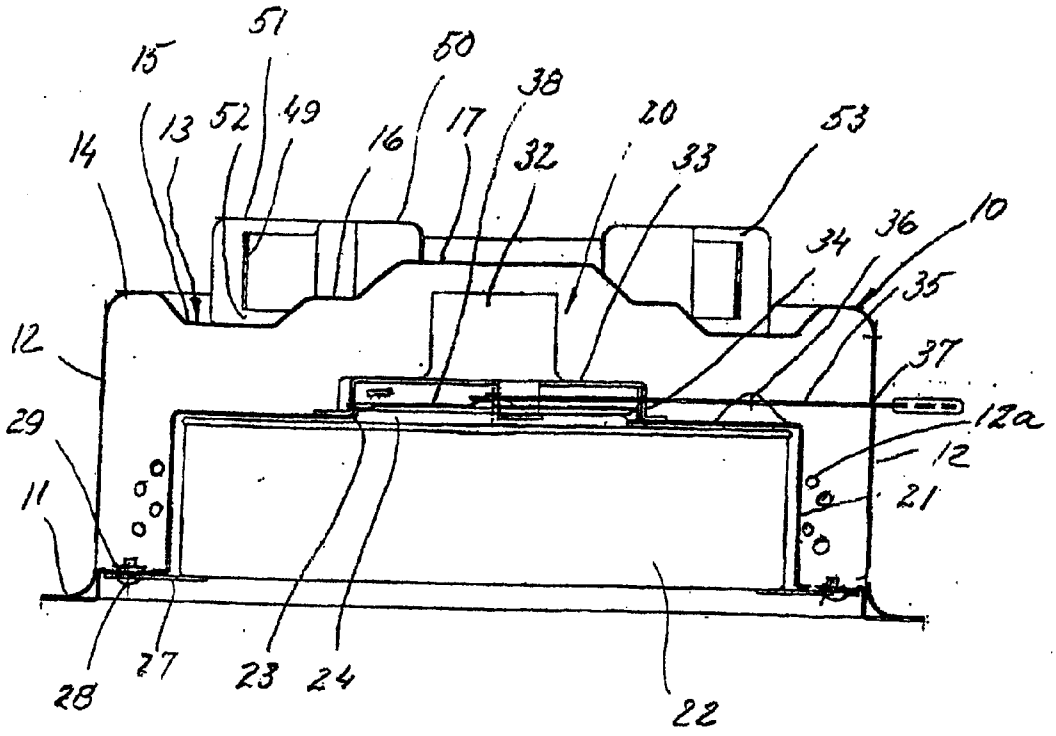

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Fig. 3

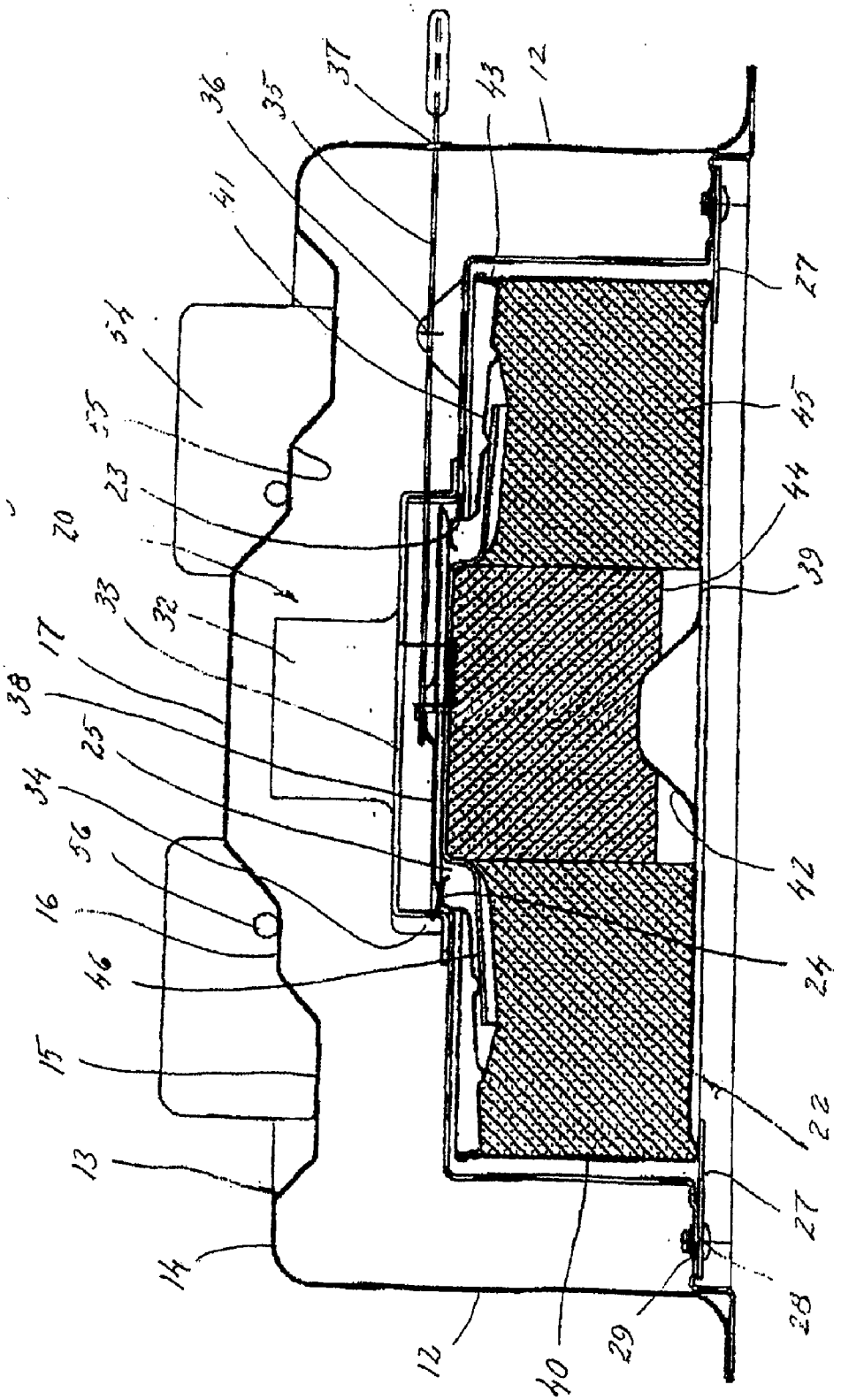
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Fig. 4

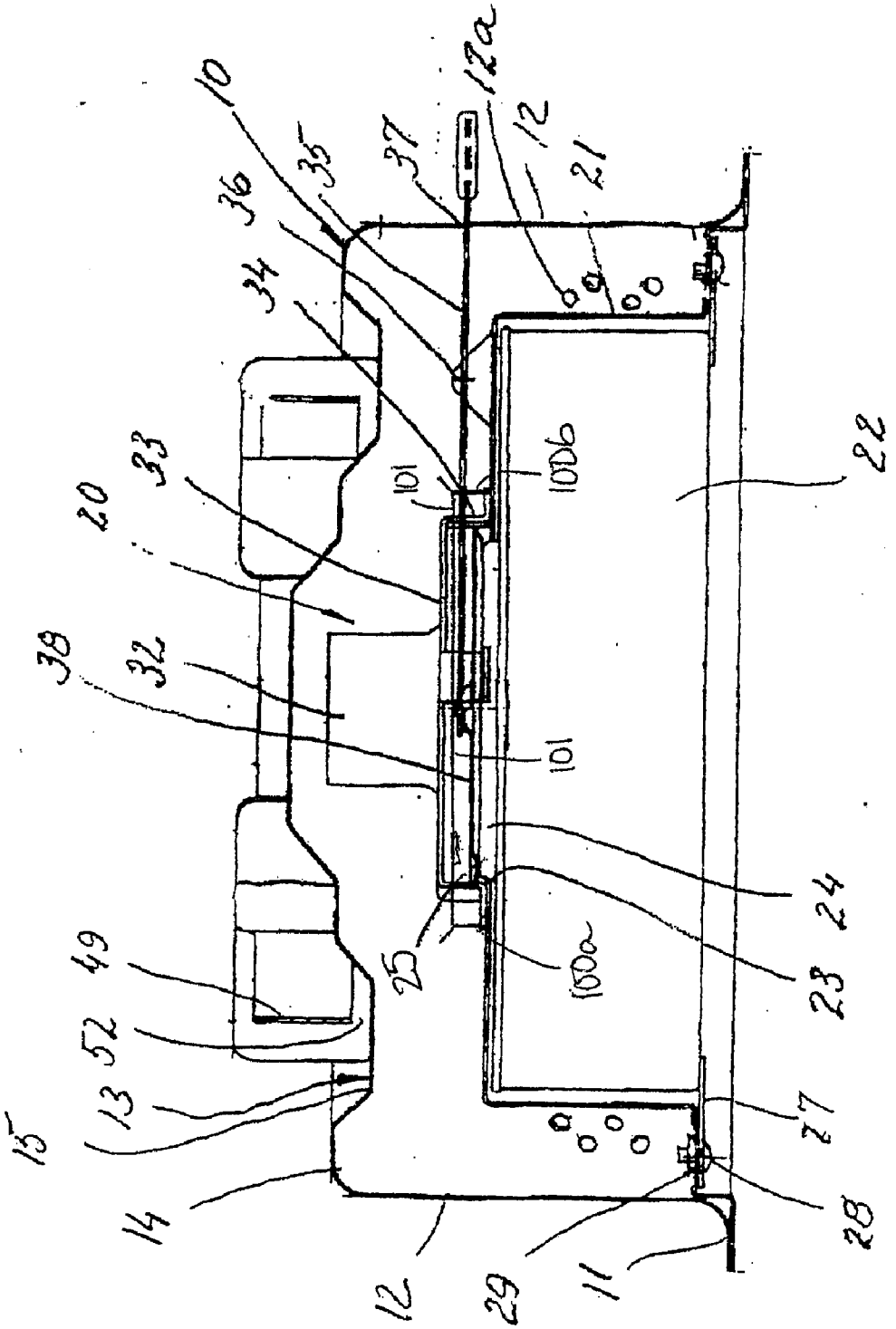
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Fig. 5

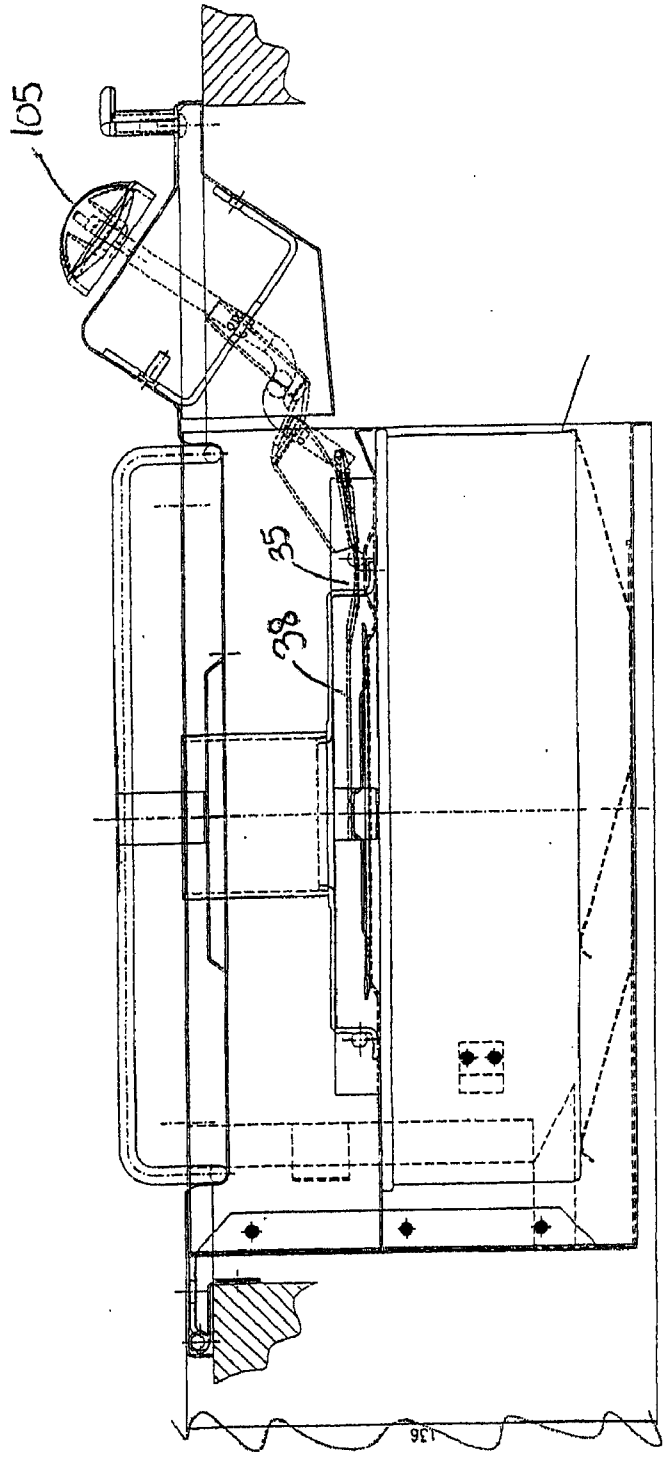

Fig. 6

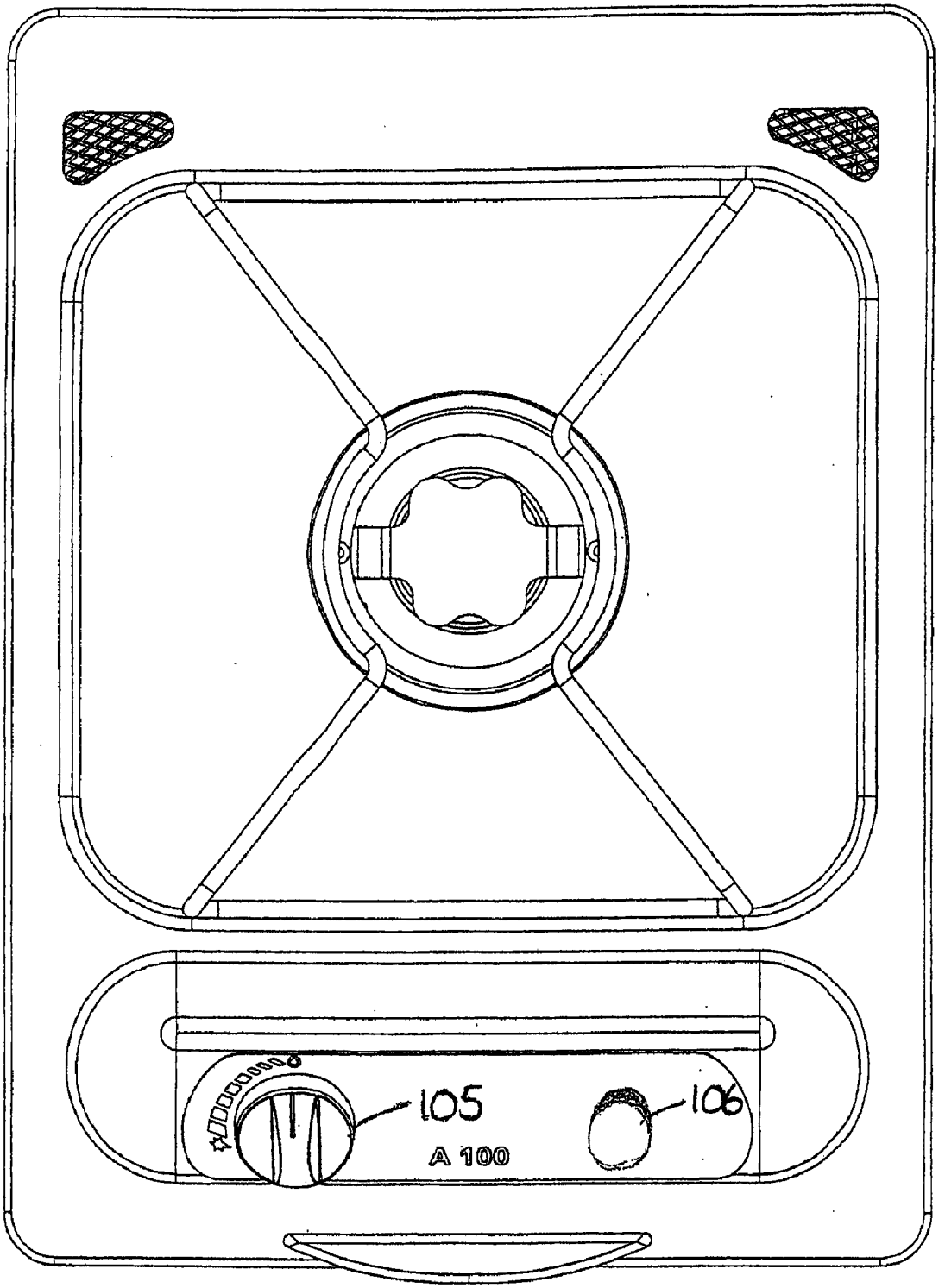

Fig. 7

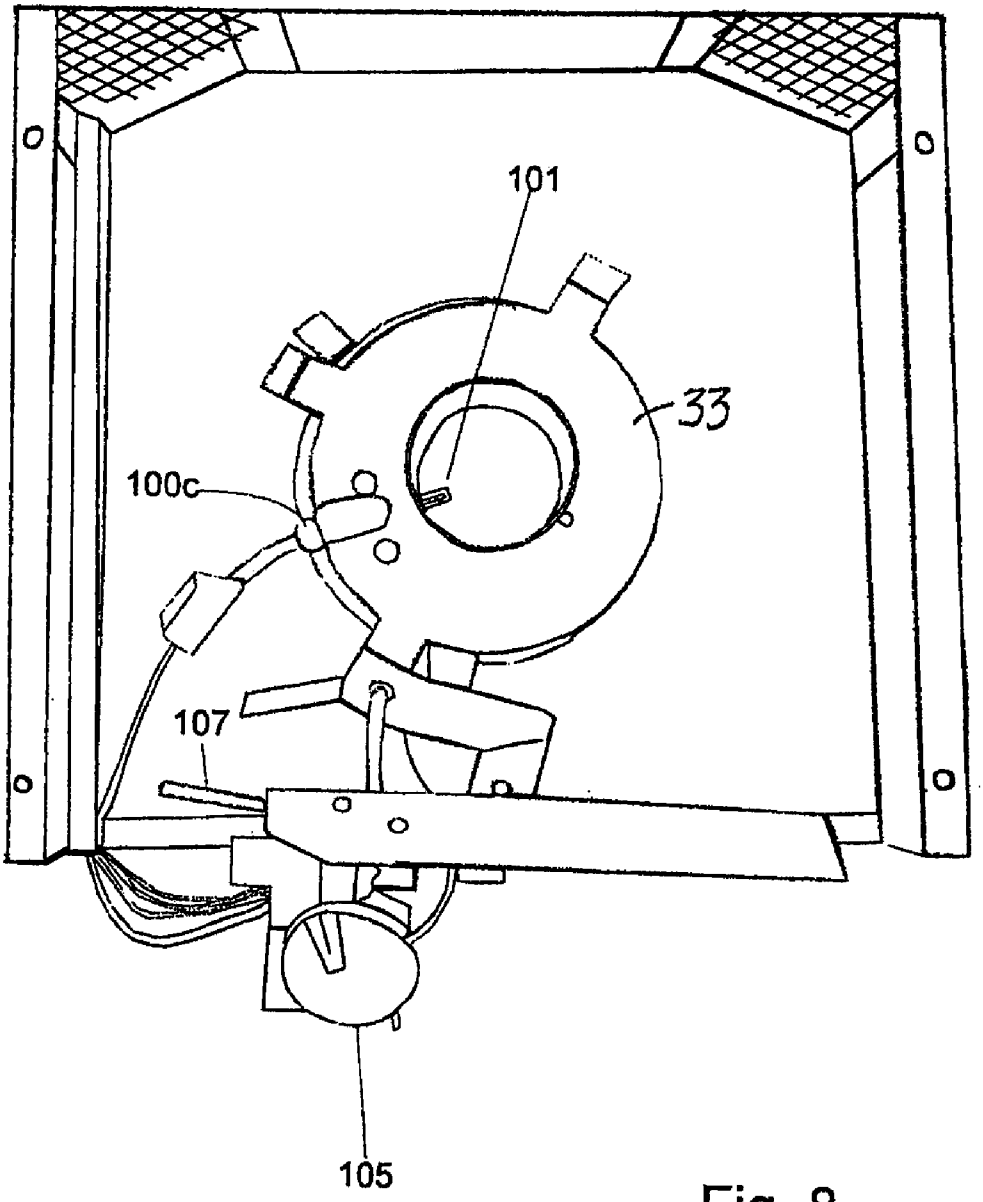

Fig. 8

ALCOHOL STOVE AND METHOD FOR IGNITING AN ALCOHOL STOVE

AREA OF THE INVENTION

[0001] The present invention is generally directed to alcohol stoves and more particularly to electric ignition of such an alcohol stove.

BACKGROUND OF THE INVENTION

[0002] Alcohol stoves for non-pressure burning are previously known in the art. A common principle for these apparatuses is that the fuel is stored in a container, which is filled with a fuel absorbing porous substance. The container comprises an upper opening from which the fuel evaporates during burning, wherein a cooking-utensil is placed above the opening. An example of such an alcohol stove is described in EP 294426. Another example of such an alcohol stove is described in the applicant's own patent document SE 523 105.

[0003] When the user wants to ignite his/her alcohol stove, he or she pushes to the side a disc or plate covering the opening of the fuel container. Thereafter, the alcohol stove is ignited by using a match or the like. This method of igniting comprises several disadvantages. For example, during windy circumstances it can be hard and awkward to manage to keep the match burning until it has reached the opening of the fuel container. Moreover, the fuel container is disposed a bit underneath the cooking-utensil stand, hence it is necessary to put the match or the lighter a bit downward in order to ignite the alcohol stove. This method of ignition also requires the user of the alcohol stove to have matches, a lighter or the like at hand if he/she wishes to use the alcohol stove. Moreover, all handling of matches and the like presents a safety risk.

SUMMARY OF THE INVENTION

[0004] The present invention provides a solution the problems described above and gives a substantial simplification and improvement of the use of alcohol stoves. An alcohol stove comprises, among other things, a fuel container containing fuel. By arranging an electric ignition device above the fuel container, an alcohol stove that is both safe and easy to use is obtained. The electric ignition device comprises an electric switch that is connected to a built in battery in the alcohol stove or to an external power source and to an electrically conducting heating wire. The electric ignition device works such that, when the switch is closed, the heating wire is heated up such that it in turn radiates heat down into the opening if the fuel container. This heat radiation leads to the fuel or alcohol in the container to heat up and start evaporating. As these fume vapour rises, they pass the heating wire which then ignites the fume vapour, which leads to the ignition of the alcohol stove.

[0005] According to an embodiment of the present invention, the heating wire is arranged at a distance of 1 to 10 mm above the opening of the fuel container, preferably approximately 5 mm. This gives a good and efficient heat radiation down into the fuel container for heating up and evaporating the fuel in the fuel container so that the fume vapours are easily ignited as they pass the heating wire and thereby ignite the alcohol stove.

[0006] According to an embodiment of the present invention, the heating wire is composed of a ceramic composite material, metal or any other electrically heatable material. Preferably, a ceramic composite material is used as this both has good electrically heating capabilities and is also heat durable. The heating wire is subjected to high temperatures as it is constantly disposed in the flame when the alcohol stove is used, which demands for the heating wire to be able to withstand high temperatures for a very long time with out being damaged or destroyed.

[0007] According to an embodiment of the present invention, the electric switch is composed by a micro switch that is closed when a knob, which is arranged in the housing of the alcohol stove, is turned to the maximum and remains closed as long as the knob is kept in this position and that is opened as the knob is released. This provides a simple, robust and inexpensive solution for obtaining an electric ignition of the alcohol stove. The user simply turns the knob to the maximum and holds it in this position until the alcohol stove is ignited, whereupon the user releases the knob causing the voltage to the heating wire to be disrupted.

[0008] According to an embodiment of the present invention, the electric ignition device comprises an electric circuit, which comprises logic with timing capabilities so that the electric circuit is automatically activated when the knob is turned and simultaneously a countdown of a predetermined length is initiated. When the countdown expires, the voltage to the heating wire is disrupted. This embodiment enables the user to not having to hold the knob in the maximum turned position, which provides a more automated alcohol stove.

[0009] The invention also relates to a method for igniting an alcohol stove. With the method according to the invention, corresponding objects and advantages are achieved as described above. Further objects and advantages of the invention will be evident from the following detailed description of the invention and the patent claims.

[0010] The invention will now be described by an exemplary embodiment and with reference to the accompanying drawings.

SHORT DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** shows a plan view of an alcohol stove viewed from above, at which the present invention can be implemented.

[0012] FIG. **2** shows a corresponding plan view from underneath.

[0013] FIG. **3** is a cross section along line in FIG. **1**.

[0014] FIG. **4** shows, in a bigger scale, a cross section through the stove and the fuel container, but with another type of cooking-utensil stand than shown in FIG. **3**.

[0015] FIG. **5** shows an electric ignition device in the form of a heating wire arranged above a fuel container.

[0016] FIG. **6** shows a cross section viewed from the side of an alcohol stove.

[0017] FIG. **7** shows an alcohol stove according to the present invention.

[0018] FIG. **8** illustrates a preferred embodiment of the device of the electric heating wire.

DETAILED DESCRIPTION OF THE INVENTION

[0019] In the following, firstly an alcohol stove is described at which the present invention can be implemented. It shall be noted that the electric ignition device according to the invention can be used with a plurality of different types of alcohol stoves and is not limited to the one hereinafter described. The exemplified alcohol stove in FIG. **1** comprises a box shaped

frame **10** without a bottom part. This frame is made in one piece, preferably by deep drawing and consists, for example, by stainless steel in order to withstand corrosion as much as possible. The frame rests at its lower part on a corbelled-out foot section **11** and displays a circumferential substantially vertical wall **12** that transitions into a horizontal hearth **13**, wherein the hearth comprises a raised edge section **14** and inside this, an existing bottom section **15**. The gables of the vertical wall **12** have a number of small openings **12***a*, see FIG. **3**, through which combustion air flows into the frame. The bottom section transitions in turn into two step-shaped circular raises that each displays a first ring-shaped ledge **16** and a second central ledge **17**. The rings-shaped ledge **16** has a number of relatively small perforations **18**, intended to limit the heat transfer between the central ledge **17** and the other parts of the frame, while the central ledge **17** displays a number of circular openings **19** that form a flame spreader for a burner **20** placed underneath the hearth. The showed embodiment thus displays a two-flame alcohol stove, but the invention is of course intended to be applied at alcohol stoves with one or more than two flames.

[0020] Reference is now made also to FIG. **2-4**. The frame **10** incorporates a substantially U-shaped heat-shielding plate **21** that is turned upside down and that is fixed at the foot section **11** and that partly surrounds two cylindrical fuel containers **22**. It shall be noted in this context that although the illustrated alcohol stove comprises two cylindrical fuel containers, these may of course be replaced by a single container of arbitrary shape or several such containers. The heat-shielding plate **21** that prevents radiated heat from the hearth to reach the fuel container (which could cause the fuel in the fuel container to boil) extends along the major portion of the frame in the longitudinal direction and exhibits two circular openings **23** that are coaxially arranged with regard to the central ledges **17** and that surrounds a, through the opening protruding, ring-shaped edge section **24** of each of the fuel containers **22**, wherein the edge section **24** in turn surrounds a central opening **25** of the fuel container. Each of the fuel containers is adjusted with regard to the openings **23** by means of a number of guiding elements **26** that are punched out in the heat-shielding plate, wherein these guiding elements are somewhat tilted towards a vertical plane. Each of the fuel containers **22** are supported and fixed to the frame by means of a couple of locking plates **27**, which are arranged to be turnable around vertically arranged axis **28**, wherein the locking plates are arranged somewhat flexibly in the vertical direction by means of a elastic washer **29** or similar. The locking plates **27** are retained in their locking positions by means of grinders **30**, see FIG. **2**, arranged on the heat-shielding plate.

[0021] The heat-shielding plate **21** also supports two vertical burner pipes **32**, each of the burner pipes is connected to a ring-shaped footplate **33** with a number of downwards projecting distance elements **34**, which are fixated in immediate connection to the circumference of the openings **23**. Further, the heat-shielding plate **21** supports two arms **35**, which are rotatably attached around vertical axis **36**, wherein one end of each arm **35** extends through a respective slot **37** arranged in the vertical wall **12** of the frame, wherein the other end of the arms extends between two of the distance elements **34** and each supports an extinguishing plate or control plate **38**. The control plate **38** is circular and is arranged to expose, alternatively totally or partly cover the opening **25** of the fuel container **22** by manual actuation of the arm **35** from the outside of the frame. The control plate **38** functions such that it to a major or smaller degree, depending upon its position, hinders the heat radiation from the flame to reach the opening **25** and thereby the surface where the fuel evaporates, which results in that the size of the flame becomes a direct function of the size of the exposed surface, which in turn results in that the size of the flame can be regulated.

[0022] The fuel container **22** comprises a circular container with a bottom **39**, a side wall section **40** and a top part **41**, wherein the top part surrounds the opening **25** of the fuel container and transitions into the ring-shaped edge section **24**. The bottom **39** comprises a central inwards projecting protrusion **42** and the top part **41** has a circumferential flange-like upwards-projecting edge section **43** that connects the top part **41** with the sidewall section **40**. The fuel container **22** contains a porous liquid absorbing substance, which consists of a cylindrical part **44** and, placed outside of this, a ring-shaped part **45**, wherein the substance partly is covered by a net **46** that prevents the substance from falling out through the opening and which is pulled in under the top part. At the mounting of the fuel container, the protrusion **42** will push the central part upwards in relation to the ring-shaped part **45** such that the central part **44** is brought to be aligned against the net **46**, whereby an evaporation surface is formed in connection to the upper part of the fuel container for the existing fuel in the fuel container.

[0023] At the alcohol stove that is depicted in FIGS. **1-4**, two cooking-utility stands are provided on the top of the hearth. Each of the cooking-utility stands comprises four band-shaped sections **48** that are fixed to each other to form a ring-shaped structure with a tubular circular windshield part **49**, a number if inwards projecting parts **50** and a number of outwards projecting parts **51**, wherein the outwards projecting parts have a longer vertical propagation than the windshield part such that a lower opening **52** is formed, see FIG. **3**, between the bottom part **15** of the hearth and the windshield part **49** and an upper opening **53** between the windshield part and a cooking utensil that is resting on the cooking-utensil stand. The lower edges of the inwards projecting parts **50** and the outwards projecting part **51** are designed such that the shape of the cooking-utensil stand corresponds to the shape of the hearth, whereby the cooking-utensil stand easily can be centred around the central ledge **17**.

[0024] In the alcohol stove that is showed in FIG. **4**, the cooking-utensil stand comprises four radial plates **54** with a step-shaped lower edge section **55**, which is adapted to the shape of the hearth, wherein the plates are fixed to a ring **56** that surrounds the central ledge.

[0025] It is also possible to replace the locking plates **27** with one or several through-shaped collection boxes, which are placed underneath the fuel containers so that the boxes collect fuel that may leak from the fuel container while the boxes are rotatably hanging in the frame and can be locked in a horizontal position and thereby press the fuel containers against the heat-shielding plate.

[0026] According to the present invention and with reference to FIGS. **5-8**, an electric ignition device comprising a heating wire **101**, an electric switch **107**, for example a micro switch **107** and an electrical power source is provided. The electric ignition device constitutes a closed electric circuit comprising the connected heating wire **101**, the electric switch **107** and the power source. The function of the heating wire **101** is that when it is supplied with voltage, it will heat up in order to radiate heat. The heating wire **101** can be made of a ceramic composite material, metal or other electrically con-

ducting/heatable material. In connection with the opening **25** of the fuel container, a fastening arrangement is provided, with which the heating wire can be kept at an appropriate position above the opening **25**. The fastening arrangement can, for example, consist of one or more holders **100***a*, **100***b* as is shown in FIG. **5**. In another embodiment, showed in FIG. **8**, the fastening arrangement comprises a holder **100***c* arranged in the footplate **33** of the vertical burner pipe **32**. With reference to FIG. **5**, these holders are arranged at said holders **100***a*, **100***b* so that the electrically conducting/heatable heating wire **101** extends over and above the opening **25** of the fuel container. The holders **100***a*, **100***b* are designed such that the vertical distance between the opening **25** of the fuel container or the corresponding control plate **38** and the electrically conducting/heatable heating wire **101** is in the range of 1-10 mm, preferable close to 5 mm. The heating wire **101** is in a preferred embodiment U-shaped, but other embodiments are possible, such as a wire all across the opening **25** or in different shapes, for example S-shaped, pleated and so on.

[0027] The electrically conducting heating wire **101** is connected to an electric switch **107** and a power source (not shown). The power source is typically 12 Volts but other voltages are possible and it can comprise a built-in battery or it can comprise an external power source to which the alcohol stove can be connected. In is simplest form, the electric switch **107** comprises a micro switch **107**. The electric switch functions such that when it is closed, voltage is supplied to the heating wire, whereby the heating wire is heated.

[0028] The electric switch **107** is preferably arranged at the arm **35** that controls the movement of the control plate **38** over the opening **25** of the fuel container **22** or in connection to a knob **105** (will be described below) that controls the movement of the arm **35**.

[0029] In the preferred embodiment that is shown in FIG. **8**, the heating wire is arranged in the footplate **33** of the vertical burner pipe **32**. The footplate **33** is designed with a recess **100***c*, which comprises said holder, in the horizontal part of the footplate **33** where the heating wire can be inserted and kept in place so that the heating wire extends above the opening **25** of the fuel container **22** and at an appropriate distance in the vertical direction above the opening **25**. The footplate is arranged at a certain distance above the fuel container **22** by the distance elements **34**, which are vertically upstanding from the heat-shielding plate **21**. The distance elements **34** are arranged in this embodiment such that the heating wire **101** is positioned at an appropriate distance above the opening **25** of the fuel container **22**.

[0030] In the embodiment shown in FIG. **5**, the fastening arrangement can comprise one or several separate holders. Arranged such that the heating wire can be placed directly below the footplate **33** such that the distance in the vertical direction between the heating wire **101** and the opening **25** is within the range 1-10 mm. In this embodiment, also the heating wire is provided with heat-shielding insulation of the part that is placed along the underside of the footplate **33**, as this part will be subjected to heat radiation when the alcohol stove is in use. The holder **100***a* or the holders **100***a, b* are in this embodiment preferably arranged on the heat-shielding plate **21**. The holders **100***a, b* can also be arranged in one or several of the vertical distance elements **34**.

[0031] When voltage is being supplied the heating wire by the electric switch **107**, the heating wire is heated. In connection with supplying voltage to the heating wire, the control plate **38** is opened to its maximum so that the opening **25** of the fuel container **22** is entirely exposed. The heat from the heating wire radiates down towards the fuel/alcohol in the fuel container, which results in heating of the fuel, whereby it starts to evaporate. As the fuel evaporates, the fume vapour rises and passes the heating wire, which then ignites the fuel fume vapour. This results in that the existing fuel in the fuel container **22** ignites and a flame is formed that extends from the net **46** in the opening **25**, up through the burner pipe **32** and through the openings of the flame spreader, where it thus is spread in a number of smaller flames that spread along the underside of the cooking-utensil. The size of the flames can thereafter be controlled by means of the control plate **38** by actuating the arm **35** and the flames can be extinguished after use, by bringing the control plate to completely cover the opening **25** of the fuel container **22**.

[0032] According to an alternative embodiment, which is not shown in any figure, a reflector plate can be arranged vertically above the heating wire to reflect down more heat towards the fuel in the fuel container **22**. Such a reflector plate may, in such a case be designed in several different ways. It may completely or partially cover the heating wire and if may be formed of a solid piece or with holes, slits or other openings in the reflector plate to allow for passage of air and/or fuel fume vapours.

[0033] The powering of the heating wire can be activated in different ways, more or less automatically or entirely manually. The movement of the control plate **38** across the opening **25** is actuated by the arm **35**. The arm in turn, may preferably be actuated by the control knob **105** arranged on the housing **10** of the alcohol stove, for example a knob **105** of conventional sort. This is illustrated in FIG. **6**. In a preferred embodiment, the knob **105** is designed as follows. Firstly, it is turned maximally in order for the control plate **38** to completely expose the opening **25**. Further, the knob **105** is provided with a spring arrangement such that the last part of the turning of the knob **105** causes the spring arrangement to be a bit stressed and simultaneously the switch **107** is closed to supply voltage to the heating wire **101**. The user keeps the knob **105** turned until he or she sees that the alcohol stove is ignited and then releases the knob **105**, which then springs back just a little without affecting or diminishing the strength of the flame. As the knob **105** springs back, the switch **107** opens to no longer supply any voltage to the heating wire **101**. The opening **25** is still maximally exposed and the user can regulate the heat, that is the size of the flame, by turning the knob **105**, which then will push the control plate **38** across the opening **25**. To extinguish the flame and thereby switch off the alcohol stove, the knob **105** is turned to its original position, which results in the control plate **38** entirely covering the opening **25** of the fuel container **22**.

[0034] Alternatively, the electric ignition device may also be designed to comprise further components. For example, components can be added in order to implement a function, which activates the electric ignition device as the knob **105** is turned and then supplies a voltage to the heating wire **101**. Simultaneously, a countdown procedure is initiated having a predetermined length. When the countdown ends, the voltage to the heating wire **101** is automatically disrupted so that there will be no risk for the heating wire to be constantly supplied with a voltage, which could lead to it being destroyed or damaged. As the voltage is disrupted, the heating of the heating wire **101** is terminated. In the case that the power source is a battery, it is also preferable not to supply voltage to the

heating wire **101** more than necessary in order to maximise the service life of the battery. In this embodiment, the predetermined time that is allowed to pass before the circuit is opened should be chosen such that the alcohol stove most probably will be ignited.

[0035] Another alternative to activate the heating wire is that the above-mentioned knob **105**, only controls the control plate **38**. A separate activation arrangement such as a button, a knob or similar **106** is arranged on the alcohol stove that will close the switch **107**, which then will supply voltage to the heating wire as the button **106** is pressed or turned. This is illustrated in FIG. **7**. In order to ignite the alcohol stove in such an embodiment, the first knob **105**, which will open the opening **25**, must first be turned. Thereafter, the button **106** is pressed until the alcohol stove is ignited, or when the activation arrangement is a knob **106** the knob **106** is turned until the alcohol stove is ignited. As the button **106** is released, the switch disrupts the voltage to the heating wire **101**.

[0036] Yet another alternative is that the first knob **105** is both turned and pressed. The pressing of the knob will close the micro switch **107** and activate the supply of voltage to the heating wire **101**, and when the knob **105** is released so that it can spring back out, the micro switch **107** disrupts the voltage to the heating wire **101**.

[0037] The heating wire **101** is chosen such that it possesses a required or appropriate resistance so that when voltage is supplied via the micro switch **107**, it will heat up and radiate enough heat towards the fuel in the fuel container **22** in order to heat up, evaporate and via the fume vapours ignite the fuel in the fuel container. Also the distance from the heating wire to the fuel is of importance in order to radiate enough heat in order to heat up, evaporate and via the fume vapours ignite the fuel in the fuel container.

What is claimed is:

1. An alcohol stove comprising a housing (**10**), wherein the housing comprises at least one fire hearth (**17**) and encases a fuel container (**22**) and a burner arrangement (**20**) characterized in an electric ignition device, which is connectable to an electrical power source, wherein said ignition device comprises a heating wire (**101**) and a switch (**107**) arranged to be enabled to be connected together to constitute a closed electric circuit, wherein the heating wire (**101**) is arranged above an opening (**25**) of the fuel container (**22**) and connected to said power source via said switch (**107**), wherein the heating wire (**101**) is arranged to be heatable in order to, by heat radiation, evaporate fuel in the fuel container (**22**) such that said alcohol stove is ignited by ignition of fuel fume vapours as they pass the heating wire (**101**).

2. An alcohol stove according to claim **1**, characterized in that the heating wire (**101**) is arranged 1-10 mm above the opening of the fuel container (**22**).

3. An alcohol stove according to claim **1**, characterized in that the heating wire (**101**) is arranged approximately 5 mm above the opening of the fuel container (**22**).

4. An alcohol stove according to any of the preceding claims, characterized in that said power source consists of a built-in battery.

5. An alcohol stove according to any of claims **1-3**, characterized in that said power source consists of an external power source to which the alcohol stove can be connected.

6. An alcohol stove according to any of the preceding claims, characterized in that heating wire (**101**) is made from any of a ceramic composite material, metal or other electrically heatable material.

7. An alcohol stove according to any of the preceding claims, characterized in that said switch (**107**) consists of a micro switch (**107**) that is closed automatically when a knob (**105**) arranged in said housing (**10**) is turned maximally, remains closed as long as the knob (**105**) is kept in this position and opens when the knob (**105**) is released.

8. An alcohol stove according to any of claims **1-6**, characterized in that the electric ignition device further comprises an electric circuit comprising logic with timing capabilities, wherein said electric circuit is automatically activated when a knob (**105**), arranged in said housing (**10**), is turned and initiates simultaneously a countdown of a predetermined length and supplies voltage to the heating wire (**101**), remains active as long as the countdown proceeds and disrupts the supply of voltage to the heating wire (**101**) as the countdown has been completed.

9. An alcohol stove according to any of claims **1-6**, characterized in that said switch (**107**) consists of a micro switch (**107**) that is arranged to be closed automatically when an activation arrangement, such as a knob (**106**) or a button (**106**) arranged in said housing (**10**), is activated, remains closed as long as the knob (**106**) is kept in its turned position or the button (**106**) is being pressed and opens when the knob (**106**) is turned back or the button (**106**) is released.

10. Method for igniting an alcohol stove comprising a housing (**10**), wherein the housing comprises at least one fire hearth (**17**) and encases a fuel container (**22**) and a burner arrangement (**20**) characterized in connecting a heating wire (**101**) arranged above the opening (**25**) of the fuel container (**22**) via a switch (**107**) to a power source that when connected brings the heating wire (**101**) to heat up so that the heating wire (**101**) by heat radiation evaporates the fuel in the fuel container (**22**) so that the alcohol stove is ignited by the fuel fume vapours being ignited as they pass the heating wire (**101**).

* * * * *