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(54) **PORTABLE MULTIPURPOSE KITCHEN**

(57) Portable multi-purpose cooker comprising a burner with a first combustion chamber and a second combustion chamber, a cooking zone located above the burner with a worktop and at least one hob. The first combustion chamber comprises a first air inlet, a first opening for horizontal loading of fuel and a second opening for the vertical loading of fuel. The cooker comprises a frame enclosing the burner and supporting the components of the cooker. The second combustion chamber is of vertical tubular shape and is located between the first combustion chamber and the cooking zone and comprises a second air inlet. The cooker includes a flue and means for regulating the quantity of combustion gases reaching the cooking zone or going directly to the flue via a bypass duct.

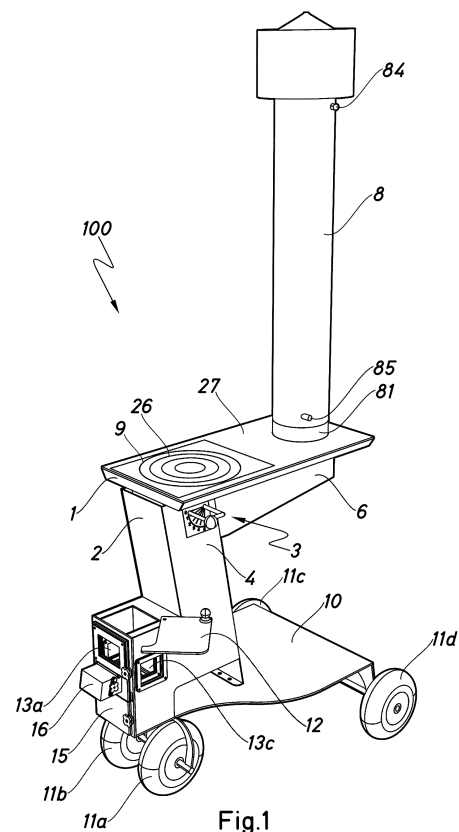


Fig.1

EP 4 579 132 A1

Description

[0001] The present invention relates to a multi-purpose cooker. Particular embodiments of the present invention relate to a portable cooker. In such embodiments, the cooker may be suitable for indoor as well as outdoor use.

[0002] The art of cooking with fire has been perfected since prehistoric times, and with it the tools used for cooking have evolved. Despite significant advances, fire remains one of the preferred methods for most cooks regardless of the culture they come from.

[0003] Various devices or gadgets for cooking have been invented over many years. Some of these well-known devices are, for example, the so-called "Rocket Stoves" and Bilbao Stoves.

[0004] "Rocket stoves" are mainly used for outdoor cooking or sometimes as simple stoves. They are devices that use a compartment through which the fuel is introduced, the fuel remaining in the lower part of an elongated combustion chamber, above which there is an opening that allows hot air to escape at a high temperature (even in the form of a flame). Once a suitable temperature has been reached, the thin elongated shape of the combustion chamber facilitates combustion of the particles raised by the gases produced by the fuel, so that fairly efficient combustion is achieved, achieving high temperatures with very little residual smoke. "Rocket Stoves" for use in cooking are well known and comprise a support for the base of a frying pan or pot on top of the combustion chamber, so that its base receives the flame directly.

[0005] On the other hand, another well-known device is the Bilbao Stove, which is usually much larger. This usually has a hearth in the lower part, either in the centre or to one side, and the upper part comprises a flat surface with a certain number of holes. This configuration creates something very similar to today's cooking ranges, in different sizes. In order to create the effect of cookers of different sizes in an even more versatile way Bilbao stoves are also known in which the hobs consist of a set of concentric rings, which can leave a small open hole in the centre. This hole can be made larger or smaller by removing or adding rings, allowing the flame or gases to contact the cooking utensil on the cooker directly.

[0006] Although these cookers are functional, there are several drawbacks to each of them. "Rocket Stove" type cookers, in spite of achieving more efficient combustion than a simple open fire, still generate smoke, which can quickly dirty the pans. They are more polluting and partly for this reason they are not well recommended for use indoors. In addition to this, regulation of the flame, and therefore of the heat used for cooking, must be directly regulated with a greater or lesser quantity of fuel, which means that they are not very variable and are difficult and slow to regulate.

[0007] Bilbao stoves are not designed to be portable, as they are usually designed for indoor use and, for this purpose, require a fixed installation for the smoke outlet,

i.e. a built-in chimney. In the same way as with "Rocket Stoves", the intensity of the fire is also difficult to regulate in Bilbao stoves.

[0008] It is one object of the present invention to disclose a portable multi-purpose cooker that does not present the disadvantages indicated above.

[0009] More particularly, the present invention discloses a portable multi-purpose cooker comprising a burner with a first combustion chamber, an ash pan for collecting ash located below said first combustion chamber, a cooking zone located above the burner and a flue for exhaust of the combustion gases produced in the burner. The cooking zone comprises a worktop which, in turn, comprises at least one hob heated by combustion gases from the burner. The first combustion chamber comprises a first air inlet, a first opening for horizontal loading of fuel and a second opening for the vertical loading of fuel. The cooker also comprises a frame enclosing the burner and supporting the components of the cooker. The burner comprises a second combustion chamber of a vertical tubular shape, the second combustion chamber being located between the first combustion chamber and the cooking zone. The second combustion chamber comprises at least a second air inlet, a first combustion gas outlet leading to the cooking zone and a second combustion gas outlet leading to a first bypass duct connecting an upper end of the second combustion chamber to the flue without passing through the hob. In addition, the cooker comprises means for regulating the quantity of combustion gases reaching the cooking zone.

[0010] The fact that the burner has a double combustion chamber provides a better and more complete reaction of the fuel, so that the amount of suspended fuel particles in the combustion gases is greatly reduced. With the second combustion, not only is it possible to reuse the suspended particles and obtain more heating capacity and thus greater efficiency, but gases that are toxic to humans and animals, such as carbon monoxide, are also eliminated.

[0011] Once the second combustion has taken place, the air can leave the second combustion zone through two different outlets. The first outlet leads the flame or combustion gases to the cooking zone, which are used to heat utensils and/or food, and the second outlet goes to the first bypass duct, which leads directly to the flue.

[0012] The frame has several functions. The first is a structural function, giving solidity to the cooker. The second is a design function. The design derives not only from a desired appearance and structural necessity, but also the desired thermal efficiency. Factors to take into account when designing the frame for good thermal efficiency are, among others, the combustion inside the burner, the channelling of the flame or combustion gases and possible heat transfer losses. The shape of the burner is determined by said combustion channelling and the efficiency of combustion, while the frame is consistent with this shape and its structural integrity. For the efficiency and the optimisation of structure and materials,

external appearance may substantially reflect the interior design.

[0013] The means for regulating the quantity of combustion gases reaching the cooking zone regulates the passage of said gases to the cooker, allowing much greater control of the heat and thermal energy emanating from the cooker and thus the variability of the heat output applied to the food without the need to modify the burner's fire, either through a frying pan, directly or in any other way.

[0014] Below the first combustion chamber is an ash compartment or ash pan. This ash pan may be separated from the combustion chamber by a grate, which allows only the residual ash from the fuel that is smaller than the spaces formed by the grate to fall through. This ash pan may be accessed through an opening so that the ash can be removed when necessary to avoid choking the fire.

[0015] In a preferred embodiment, the means for regulating the quantity of combustion gases reaching the cooking zone comprises a valve. This valve is in the form of a plate that gradually rotates relative to an axis between a maximum angular position covering the outlet of the first bypass duct, and a minimum angular position covering the outlet to the cooking zone. In this way, the valve directs the gases from the second combustion chamber towards the cooking zone or the bypass duct according to its position.

[0016] The valve is the element that enables control or regulation of the amount of combustion gases that reach the cooker, which is a great help for being able to cook according to the recipe or food. The plate directs the flow of combustion gases. The plate may either block the outlet to the cooking zone completely, which forces all the combustion gases to pass through the first bypass duct, or block the outlet of the first bypass duct, which forces all the combustion gases to pass through the cooking zone. Being able to regulate the thermal energy transferred to the utensils or to the food provides the invention with great versatility, allowing much greater control of the heat applied at any given moment and thus responsiveness for complex cooking recipes.

[0017] In a still more preferred embodiment, the plate may be fixed at at least one intermediate point of its pivot angle, so that the first and second outlets are open and the combustion gas flow is distributed between each outlet in a manner equivalent to the opening ratio of each outlet.

[0018] With the plate at an intermediate point between the two positions of maximum and minimum angle, the plate allows the gases to pass in both directions, distributing the total flow of combustion gases between the outlet for the cooking zone and the outlet for the first bypass duct. This distribution is in relation to the proportions between the openings for each outlet.

[0019] In an even more preferred embodiment, the plate has a number of positions in which it may be fixed along its rotational path.

[0020] Having different intermediate points gives more

control over the amount of heat passing towards the cooking zone and/or the first bypass duct, allowing control of the heat in the cooker and providing a reference for different strengths of the fire in each intermediate position.

[0021] In a preferred embodiment, the cooker comprises a practicable door for closing off the first opening for horizontal fuel loading and a practicable flap for closing off the second opening for vertical fuel loading, the first air inlet being adjustable and located in the practicable door for closing off the first opening for horizontal fuel loading.

[0022] The practicable door for closing off the first horizontal refuelling opening is a side door that opens or closes off access to the first combustion chamber through the first horizontal refuelling opening. This door allows the burner to be opened or closed as desired, providing the ability to add further fuel horizontally and to a large extent stoke the fire when opening it, and to reduce heat losses and smother the fire if necessary when in the closed position.

[0023] Conversely fuel may also be loaded vertically through a hatch or flap. This allows fuel to be loaded from two different angles, so that loading is more convenient depending on the condition of the fire or the type of fuel being used. The positioning of fuel is also a factor in achieving good combustion. Positioning of branches, logs or small elongated elements vertically when burning helps to obtain greater calorific efficiency from their combustion, achieving gradual and orderly burning of the fuel. This is the reason why the burner is designed to have a double combustion chamber with a first zone where the fuel is located. An adjustable air inlet makes it possible to control the amount of fresh air that enters the reaction, which allows the fire to be smothered or to be stoked quickly when necessary, which usually results in a lower or higher combustion temperature.

[0024] In an even more preferred embodiment, the second opening for vertical fuel loading allows for the attachment of a hopper.

[0025] Fuel may be loaded vertically either manually or by gravity, as the flap and second opening are configured to be able to accommodate, for example, a hopper. This allows a constant supply of fuel to the fire, thus achieving a stable output of heat over time.

[0026] In preferred embodiment, at least one side of said first combustion chamber comprises at least one flame viewing window.

[0027] In a preferred embodiment, the practicable door for closing off the first opening for horizontal fuel loading comprises at least one flame viewing window.

[0028] In a yet more preferred embodiment, the flame viewing windows on at least one side of the first combustion chamber and on the practicable door are made of ceramic glass.

[0029] These viewing windows allow the interior of the first zone of the combustion chamber to be seen, so that the state of the fire can be monitored at all times.

[0030] In a still more preferred embodiment, the flame viewing windows are double-glazed, a first pane being located on a side surface of the first combustion chamber and a second pane on the outer wall of the frame and comprising an air gap between the first and second panes of each flame viewing window.

[0031] A double-glazed viewing window that provides for an air space between the two panes of glass offers greater insulation and prevents heat loss, as well as high temperature surfaces within reach of the user.

[0032] In a preferred embodiment, the ash pan comprises a practicable flap to allow the ash pan to be closed or opened as required.

[0033] In an alternative embodiment, the ash pan is covered by the practicable door to close off the first horizontal opening for loading fuel.

[0034] A practicable ash pan door helps to prevent heat loss as well as ashes escaping or falling out of the cooker and dirtying the floor or surrounding area. The practicable door may be a single door to give access to the horizontal fuel loading and ash pan, which simplifies the design, or a door for each cavity, allowing for better control and adaptability when performing different tasks (loading or emptying the ash pan).

[0035] In a preferred embodiment, the cooker comprises thermal insulation located between the burner and at least one outer wall of the frame.

[0036] In order to ensure adequate thermal efficiency, thermal insulation is provided around all the external surfaces of the burner, which in turn are surrounded by the frame. This thermal insulation is located between the burner and the walls of the frame, the other side of which is in direct contact with the environment. This avoids unnecessary heat loss.

[0037] In a more preferred embodiment, the burner comprises a constriction for the passage of the gases between the first combustion chamber and the second combustion chamber.

[0038] This constriction is located between the first combustion chamber and the second combustion chamber, that is between one end of the first combustion chamber and an initial or lower end of the second combustion chamber. This constriction allows the creation of a Venturi effect as the combustion gases pass through the constriction, which in turn causes a pressure drop and an increase in the velocity of the gases or hot air passing from the first combustion chamber to the second combustion chamber.

[0039] In a preferred embodiment, said at least one second air inlet comprises a secondary duct between an outer wall of the frame and the first combustion chamber running adjacent to the first combustion chamber and connecting a secondary opening in the outer wall of the frame through which outside air enters to at least one opening in the second combustion chamber through which the air is introduced into the second combustion chamber.

[0040] Having a secondary air duct helps with oxygenation of the fire, and therefore of the combustion reaction, by providing another means for fresh air with oxygen from the environment to enter. The fact that the secondary duct runs adjacent to the combustion chamber, specifically between the outer wall of the frame and the first combustion chamber, means that the air that can enter through the secondary duct is in contact with a surface of the first combustion chamber at a raised temperature, so that the fresh air passing through the duct is heated as it moves along its path. In this way, preheated oxygenated air is brought to the combustion reaction in the second combustion chamber, so that in addition to feeding and oxygenating the fire, it means a lower temperature drop in the reaction, thus facilitating combustion with greater thermal energy.

[0041] In a more preferred embodiment, the cooker comprises at least one opening in the first combustion chamber. Said at least one opening in the first combustion chamber is located adjacent to the constriction. On the other hand, said at least one opening in the second combustion chamber is located on the periphery of the lower end of said second combustion chamber, also adjacent to the constriction. Thus, said at least one opening in the first combustion chamber and said at least one opening in the second combustion chamber lie one on each side of the constriction. Furthermore, the secondary duct connects the secondary opening with said at least one opening in the first combustion chamber and at least one opening in the second combustion chamber.

[0042] In combination with the above, placing at least one opening allowing the injection of air into the lower part of the second combustion chamber, adjacent to the constriction, decreases the pressure in this area by a Venturi effect and therefore causes suction of the air around this area, that is the air inside the secondary duct, and this increases the flow of preheated air reaching the second combustion area. On the other hand, the presence of at least one opening in the first combustion chamber means that some of the air drawn through the secondary duct also reaches the top or end of the first combustion chamber oxygenated and preheated, where, as it meets the combustion gases in an area before the constriction with some turbulence, it mixes more easily with the combustion gases before passing through the constriction and reaching the second combustion chamber. Once the combustion gases and some of the preheated oxygenated air have passed through the constriction into the second combustion chamber, another quantity of preheated oxygenated air enters through the at least one opening at the lower end of the second combustion chamber. This quantity of air, being at a high temperature, helps the reaction to continue burning any fuel residues remaining in the form of particles floating in the gases from the first combustion. In other words, this oxygenated air at high temperature helps to burn the fumes. If combustion is not efficient enough, toxic particles, such as carbon monoxide (CO), can remain floating in the flue gases, as can small unburned particles of the fuel itself,

4

and it may be dangerous and polluting to breathe such smoke. By adding another combustion, with more oxygen and at elevated temperature, these particles floating in the combustion gases in the form of smoke are encouraged to react again and burn completely, leaving simple carbon dioxide and water vapour ($\text{CO}_2 + \text{H}_2\text{O}$). All this in combination makes the combustion achieved highly efficient, which reduces pollutants and increases the resulting thermal energy used for cooking.

[0043] In a preferred embodiment, said at least one hob comprises a set of at least two concentric circular removable rings of different sizes, with matching inner and outer diameters, so that they fit one inside the other. The set of rings comprises a smaller central ring in the form of an entirely solid disc and a larger ring having an upper outer diameter greater than the diameter of the hob and a lower outer diameter equal to the diameter of the hob.

[0044] Together with the double combustion, a first function of the set of at least two rings is to further prevent the release of undesired smoke which could foul the utensils and/or be harmful to users. A second function is to adjust the combustion gas outlet to the different sizes of cooking utensils that may be used. This is achieved by placing rings on the hob, starting with the largest ring, which fits into the original opening in the hob, and covers an annular surface of this opening, covering it from its inner diameter to its outer diameter and leaving a circular opening with a diameter equal to its inner diameter. In turn, a ring with an outer diameter matching the inner diameter of the ring can be fitted, leaving a hole of even smaller size. This can be done in succession until the last ring of smaller size, which is solid without any hole, is reached. Conversely, if these rings cover the entire hole, cooking is still possible, although the transmitted heat is less and is transmitted by conduction, with the utensil in direct contact with the rings.

[0045] In a preferred embodiment, the cooker comprises a third duct for collecting residual gases from the at least one hob located under the worktop and configured parallel to the first bypass duct and leading to the first bypass duct at a final end adjacent to the flue.

[0046] In the cooking zone, the combustion gases can escape through the hob and heat the cooking utensil or the food, but it is difficult for the full amount of these gases to escape through the hob and fulfil their purpose of transmitting their thermal energy to the food, either because the hob is blocked by the set of rings or the utensil, or because the air flow is too high to be able to escape completely. In order to collect and guide the gases that do not exit through the hob, the area under the hob comprises the third duct. This duct is configured parallel to the first bypass duct and runs from the hob to one end of the first bypass duct. These gases still have residual heat that has not been used for their primary purpose of cooking the food. This third duct flows into the bypass duct, which leads these gases with residual heat out via the flue.

[0047] In a preferred embodiment, the cooker com-

prises a heat exchanger in the form of a coil located within the flue for the escape of smoke. This coil collects the residual heat from the gases passing through the flue. In addition, the cooker includes, as an attachment, a heat accumulator connected to the said heat exchanger to store the aforementioned residual heat from the gases.

[0048] The cooker is able to generate a large amount of thermal energy, so to ensure the least possible losses there is thermal insulation around the entire combustion chamber and its path and the worktop. This also avoids having very high temperatures on the outside surfaces which, for users, can lead to burns. Even so, the amount of energy that cannot achieve its purpose of heating food, as in most fire cookers, is high. Thus a heat accumulator which can store some of said energy remaining from the combustion reaction can be attached to the cooker to improve its energy efficiency. This energy can be drawn from waste gases or solid surfaces at high temperature, that is by convection or conduction.

[0049] One way in which the residual energy can be stored is to use a heat exchanger, so that the remaining energy from combustion is fed into the heat accumulator and can be used at another time or for other purposes. Having the exchanger in the flue ensures that the energy collected by the exchanger is already waste energy, which will only be lost to the environment, thus avoiding stealing energy from the process before it has fulfilled its main function of cooking food.

[0050] A coil provides a large contact surface area, which allows for better heat transfer between a heat storage material in liquid form and high temperature gases passing through the flue, in small volume.

[0051] In a preferred embodiment, the cooker comprises an attachable oven. Said attachable oven in turn comprises thermal insulation on all its surfaces except on a base connected to said at least one hob radiating the thermal energy received by convection from the combustion gases coming from the burner towards the interior of the oven.

[0052] To be able to attach an oven to the cooking zone makes it possible to cook food in different ways and have more versatility. One possible design is an oven that attaches to the hob once all the rings have been removed. The oven can have a base that receives the combustion gases or flame coming from the second combustion chamber of the burner to the oven, heating the base and radiating the heat inside. Furthermore it may include thermal insulation on its side walls and its roof or upper surface in order to avoid energy losses when exposed to the environment. This provides another way of cooking food and allows for roasting and baking, providing the portable cooker with great adaptability and cooking versatility.

[0053] In a preferred embodiment, the cooker has wheels for improved portability.

[0054] In a preferred embodiment, the cooker comprises a handle for pulling or pushing the cooker to improve its portability.

[0055] In a preferred embodiment, the frame comprises a surface for storing tools and/or kitchen utensils.

[0056] For a better understanding, drawings of embodiments of the present invention are attached by way of explanation but not as limiting examples.

Figure 1 shows a perspective view of the portable multi-purpose cooker.

Figure 2 shows a detail view of the combustion chamber covered by the outer surface of the frame and its various fuel inlets.

Figure 3 shows a detail view of the combustion chamber through the outer wall of the frame.

Figure 4 shows a detail view of the cooking zone and the potentiometer.

Figure 5 shows the same view as figure 4 but without the outer wall of the frame, allowing the potentiometer valve to be seen.

Figure 6 shows a cross-section view of the cooker in side elevation.

Figure 7 shows a cross-section view of the cooker in front elevation.

Figure 8 shows a perspective view of the cooker with a hopper installed for vertical fuel loading.

Figure 9 shows a detail view of the hopper.

Figure 10 shows a detail view of the flue with the heat exchanger installed inside.

[0057] Figure 1 shows an embodiment of the portable multi-purpose cooker 100. The figure shows the various external elements that make up this embodiment. Starting with a cooking zone 1 with a worktop 27 comprising a hob 9 in the shape of a hole and rings 26 that restrict or cover the hole in hob 9. Said rings 26 can easily be removed so as to be able to provide hob 9 with different sizes and make it adjustable to different sizes of utensils to be used for cooking. Located below cooking zone 1 is the means for regulating the quantity of combustion gases 3 reaching the cooking zone. In this embodiment, said means 3 has the appearance of a potentiometer, but other options are possible. Connected to worktop 27 via a smoke outlet socket 81 is a flue 8 for the escape of smoke. Below the worktop there is a first bypass duct 6 and below hob 9 there is a "J" shaped burner 2, both elements enclosed and reinforced by a frame 4 that provides the structure for the body of cooker 100. Said frame 4 includes a surface 10 on its lower part for the storage of utensils, which in turn serves as a base structure platform to which wheels 11a, 11b, 11c and 11d are attached. This

structure and the presence of wheels facilitate the portability of cooker 100 so that it can be positioned or moved at the user's convenience. On one side surface of frame 4 surrounding burner 2 there is a flame viewing window 13b, while at the front there is a practicable door 15 giving access to an ash pan, a door 14 for access to horizontal fuel loading comprising a flame viewing window 13a and a first adjustable air inlet 16 to burner 2. On another upper horizontal surface of the lower part of burner 2, there is a flap 12 giving access to burner 2 for vertical fuel loading. This figure also shows two projections 84 and 85 on flue 8 for attaching a heat accumulator (not shown).

[0058] Figure 2 shows in detail burner 2 covered by frame 4 and the different entrances to burner 2. In this figure, it can be seen how burner 2 comprises a first combustion chamber 21 in a horizontal position, which can be accessed through different entrances. On the one hand, it has two entrances for fuel loading, a first entrance 19 for horizontal fuel loading, which can be opened and closed by means of door 14 located on the front surface of first combustion chamber 21 and a second entrance 17 for vertical fuel loading, which can be opened or closed by means of flap 12 located on a surface above first combustion chamber 21. Furthermore there is an ash pan 5 located below first combustion chamber 21, partly separated from first combustion chamber 21 by a grate 205. Grate 205 allows ash to pass through once it has been reduced to a size small enough to slip between its openings. Ash from combustion is stored in ash pan 5 until the user needs or wants to remove them. Ash pan 5 is accessible through a hatch 15 which can be opened and closed. Also in the same front part there is a first adjustable air inlet 16 that allows air to pass to the burner to provide draught if the fire needs it. On each side, at the height of first combustion zone 21 in combustion chamber 2, there are flame viewing windows 13b and 13c so that the fire can be observed and desired reaction can be taken, by adding fuel, stoking it or choking it by letting in more or less air through first air inlet 16, directly via flap 12 or via hatch 15, even removing ashes from ash pan 5 if it is thought that there are too many. Door 14 also has a flame viewing window 13a so that the fire can be observed from the front. Also visible in this view are a secondary opening 18b of a second air inlet, the front wheels 11a and 11b of cooker 100 attached to frame 4 and surface 10.

[0059] Figure 3 shows a perspective view with the side wall of frame 4 removed, so that the inner walls of burner 2 can be seen. In this view, the most notable feature is that it clearly allows first combustion chamber 21 and second combustion chamber 22 of vertical tubular shape to be distinguished and shows a secondary air duct 28a located between an outer side wall (not seen) of frame 4 and the wall of burner 2, and following the path of first combustion chamber 21, so that air can enter from the outside through a secondary opening 18a of a second air inlet until it reaches openings 23a and 23b located at the bottom of the second combustion chamber 22 and at the top of first combustion chamber 21 respectively. Further-

more, it can also be seen that burner 2 is surrounded by thermal insulating material 29 located between said burner 2 and the outer walls of frame 4. Obviously, this structure may be symmetrical and comprise another secondary air duct and openings on the opposite side of burner 2, although having it on only one side, the one shown in this figure or the opposite side, is also entirely possible and functional. This figure also shows many of the elements mentioned and shown previously, such as flap 12, flame viewing windows 13a and 13b, door 14, hatch 15, first adjustable air inlet 16, ash pan 5, surface 10 and front wheels 11a and 11b.

[0060] Figure 4 shows a detail view of cooking zone 1 and the means for regulating the quantity of combustion gases 3 reaching the cooking zone, which are located at an upper end of the burner's second combustion chamber. In this figure it can be clearly seen that said means 3 comprises a strength indicator 25 in the form of a plate attached to frame 4 and a handle 24 which offers a secure grip to act on means 3 to regulate the fire. In cooking zone 1, rings 26 can be seen on hob 9 located on worktop 27. First bypass duct 6 can be seen beneath worktop 27 and adjacent to means 3. In the background flap 12, second inlet 17 for vertical fuel loading, the interior of first combustion chamber 21, viewing window 13b and surface 10 for depositing cooking utensils can also be seen.

[0061] Figure 5 shows a very similar figure to the previous one, but the outer side wall of frame 4 and strength indicator plate 25 of means 3 have been hidden, so that the internal elements of cooker 100 can be seen. This helps to better understand the operation of means 3 in particular. As can be seen, said means 3 is located at the end, or upper part, of the second combustion chamber, so that hot gases or flames reach it from below, and it is at this point that a valve 30 in the form of a plate with the ability to rotate with respect to an axis allows said gases to pass in one direction or another depending on its position. If valve 30 is in a substantially horizontal position, it covers first outlet 201 towards cooking zone 1 by allowing passage or guiding of all the gases towards second outlet 206 towards first bypass duct 6. If, on the other hand, valve 30 is in a substantially vertical position, then it closes off second outlet 206 towards first bypass duct 6, allowing all the flow of combustion gases to pass through first outlet 201 towards cooking zone 1, so that they reach hob 9. If valve 30 is in an intermediate position, the flow of combustion gases is guided towards both outlets 201 and 206 with a flow rate proportional to the opening left in each outlet 201 and 206 by valve 30. In this figure some of the other elements already mentioned, such as worktop 27, thermal insulating material 29 between second combustion chamber 22 and frame 4, flap 12, handle 24 of means 3, surface 10 for depositing cooking utensils, second inlet 17 for the vertical loading of fuel and even a rear wheel 11c, can also be seen.

[0062] Figure 6 shows a cross-section view of cooker 100 in side elevation. This figure makes it possible to see the internal configuration of cooker 100, to identify the

various internal components and, at the same time, to point out the whole path 121 of the gases produced by combustion. This path 121 originates where the fuel is located, that is near fuel loading inlets 17 and 19 in first combustion chamber 21, either the horizontal loading inlet or the vertical loading inlet, which are accessed through door 14 and flap 12 respectively. Fresh air can join this combustion through adjustable air inlet 16. Directly below this area, separated by a grate 205, is ash pan 5, which is accessed through door 15. At this point, the flow of combustion gases moves substantially laterally through first combustion chamber 21 to a more inward zone driven by the draught provided by the flue and the difference in pressures inside and outside the burner. In this way the flow of combustion gases reaches the junction between first combustion chamber 21 and second combustion chamber 22, where there is a constriction 20 through which the combustion gases pass. This causes a Venturi effect, further amplifying the pressure difference, which in turn causes air to be sucked in through openings 23a located in the lower or initial area of second combustion chamber 22. This suction of air draws in air from outside through secondary opening 18a, this air from outside passing through secondary air duct 28a. As it passes through secondary duct 28a it comes into contact with the side wall of first combustion chamber 21 and is preheated before entering second combustion chamber 22 through openings 23a and first combustion chamber 21 through openings 23b. The configuration of openings 23a and 23b, being one on each side of and adjacent to constriction 20 and being in turn connected to the same secondary duct 28a, means that the suction through openings 23a achieved by the Venturi effect also causes a quantity of the outside air passing through secondary duct 28a to reach first combustion chamber 21 before the constriction. In this way, said quantity of preheated and oxygenated air is mixed with the combustion gases before reaching second combustion chamber 22. On the other hand, another quantity of the preheated and oxygenated air arrives directly into second combustion chamber 22. With this, the total quantity of this preheated air enters the combustion reaction and oxygenates said combustion which was already oxygen-depleted, thus managing to react with remaining fuel particles (such as for example smoke) and managing to reach even higher temperatures. The flow of combustion gases continues to rise until it reaches valve 30 of means 3. Depending on its position, valve 30 directs the gases or flame to first outlet 201, towards the cooking zone 1 and/or to second outlet 206 towards first bypass duct 6. If one of the two outlets 201 or 206 is blocked by valve 30, the entire flow exits through the other outlet. If valve 30 is in an intermediate position, as shown in the figure, the flow is divided between the two outlets 201 and 206 in proportion to the openings left to each outlet by valve 30. The air flow out of first bypass duct 6 follows the path of the first bypass duct 6 and reaches socket 81, which guides it towards flue 8 for discharge of the flue

gas. These combustion gases will not contribute to the cooking of any food, so that the strength of the heat in cooking zone 1 is controlled by means 3 causing valve 30 to divert some of the thermal energy of combustion by reducing the flow of gases reaching this zone. However, the thermal energy contained in this quantity of gases diverted towards first bypass duct 6 is utilised once it reaches flue 8 for the escape of smoke by coming into contact with heat exchanger 83 located within flue 8. On the other hand, the flow of gases that reaches cooking zone 1 either exits directly through the opening that makes up hob 9 and/or possible rings 26 located therein, thus heating any utensil that is located above hob 9, or the latter is covered by the rings, heating said rings 26, which in turn transfer the heat to the utensil placed above said rings 26 when in direct contact. Thus, this heat transfer may be direct by convection, the flow of gases passing through the opening and coming into contact with the utensil, or indirect, the flow of gases meeting rings 26, which completely cover the opening of the hob 9, heating said rings 26 by convection and said rings transferring the heat by conduction to the utensil placed on top of them. In either case, there is a quantity of residual combustion gases that would be trapped under the hob, so a third duct 40 is provided to collect the residual gases that pass beneath worktop 27 and is configured in parallel with first bypass duct 6. This third duct 40 for collecting the residual gases flows into the end of first duct 6, which in turn will guide the flow of residual gases towards flue 8, thus ensuring that the waste heat in the gases is reused with the heat exchanger 83. Finally, the flow coming from first duct 6 and third duct 40 continues on its upwards route due to the pressure difference and exits from the top of flue 8. This figure also shows elements such as thermal insulation 29 between the walls of burner 2 and frame 4, surface 10 for the storage of cooking utensils, flap 12 and wheels 11b and 11c.

[0063] Figure 7 shows a cross-section view in front elevation from which it is possible to see from another angle the end or upper area of second combustion chamber 22, where means 3 acts through valve 30 and the components of cooking zone 1. This angle helps to provide a better view of the interior of cooking zone 1 and third duct 40 under worktop 27. Furthermore, as valve 30 is in an intermediate position, it offers access to first outlet 201 located above valve 30 and to second outlet 206, which can be seen to be located behind the valve 30. This figure also shows frame 4, the handle 24 of means 3, rings 26, hob 9, flue 8 and even a projection 85 from heat exchanger 83 (not shown) for coupling the heat accumulator (not shown).

[0064] Figure 8 shows cooker 100 in a configuration where a hopper 300 is installed for vertical fuel loading. In this configuration flap 12 has been fully opened so that hopper 300 is connected to second inlet 17 for vertical fuel loading. This configuration makes it possible, if desired, to load the fuel horizontally independently via door 14 and first inlet 19, to observe the fire through viewing

windows 13a, 13b and 13c and to empty ash pan 5 via hatch 15. The figure also shows frame 4, grating 205, means 3 with its handle 24 and indicator 25, surface 10 and front wheels 11a and 11b.

[0065] Figure 9 shows a detail view of hopper 300 which can be attached to cooker 100. Hopper 300 comprises a tank 31 of square cross-section in which fuel is stored, for example pellets or olive stones, a lid 32, a funnel 33 that ends in a passage 34 that connects with the first combustion chamber, a regulation handle 35 that regulates the position of a plate (not shown) by means of a thread as a horizontal slide that allows or does not allow fuel to pass towards the combustion chamber. Hopper 300 also comprises a platform 37 which engages and seals second inlet 17, a tube 38 of square cross-section with openings 313a, 313b and 313c for viewing the fire and bars 39 for collecting the fuel in pellet form as it falls through passage 34. Openings 313a, 313b and 313c may be covered with ceramic glass, so as to allow the fire to be viewed through viewing windows 13a, 13b and 13c, but not allow the passage or back-flow of air. Opening 313a may not even be present, so that the fire cannot be seen through viewing window 13a and may only be seen through viewing windows 13b and 13c when hopper 300 is attached.

[0066] Figure 10 shows a detail view of flue 8 for the escape of smoke with heat exchanger 83 in the form of a coil installed within it, with projections 84 and 85 for connecting the heat accumulator (not shown) and providing an inlet and outlet for a flow responsible for collecting this heat to be accumulated in the form of thermal energy.

[0067] Although the invention has been presented and described with reference to embodiments of the same, it will be understood that these do not limit the invention, so that many construction or other details may vary, as may be obvious to those skilled in the art after interpreting the matter disclosed in the present description, claims and drawings. In particular, in principle, all the features of each of the different embodiments and alternatives shown and/or suggested may be combined with each other. Thus, all variants and equivalents will be included within the scope of the present invention if they can be considered to fall within the broader scope of the following claims.

Claims

1. Portable multi-purpose cooker comprising a burner with a first combustion chamber, an ash pan for collecting ash located below said first combustion chamber, a cooking zone located above the burner, a flue for exhaust of the combustion gases produced in the burner, said cooking zone comprising a worktop which, in turn, comprises at least one hob heated by combustion gases from the burner, said first combustion chamber comprising a first air inlet, a first

- opening for the horizontal loading of fuel and a second opening for the vertical loading of fuel, said cooker comprising a frame enclosing the burner and supporting the components of the cooker, said cooker **characterized in that** the burner comprises a second combustion chamber of a vertical tubular shape, the second combustion chamber being located between the first combustion chamber and the cooking zone, said second combustion chamber comprising at least a second air inlet, a first combustion gas outlet leading to the cooking zone and a second combustion gas outlet leading to a first bypass duct connecting an upper end of the second combustion chamber with the flue without passing through the hob and **in that** the cooker comprises means for regulating the quantity of combustion gases reaching the cooking zone.
2. Cooker according to the preceding claim, **characterized in that** the means for regulating the quantity of combustion gases reaching the cooking zone comprises a valve in the form of a plate which gradually rotates relative to an axis between a maximum angular position covering the outlet of the first bypass duct and a minimum angular position covering the outlet to the cooking zone so as to direct the gases coming from the second combustion chamber towards the cooking zone or the bypass duct according to its position.
 3. Cooker according to the preceding claim, **characterized in that** the plate has a number of positions in which it may be fixed along the rotational path.
 4. Cooker according to any one of the preceding claims, **characterized in that** it comprises a practicable door for closing off the first opening for horizontal fuel loading and a practicable flap for closing off the second opening for vertical fuel loading, the first air inlet being adjustable and the first air inlet being located in the hinged door for closing off the first opening for horizontal fuel loading.
 5. Cooker according to any one of the preceding claims, **characterized in that** it comprises a hopper attached to the second opening for vertical fuel loading.
 6. Cooker according to any one of the preceding claims, **characterized in that** it comprises thermal insulation located between the burner and at least one outer wall of the frame.
 7. Cooker according to any one of the preceding claims, **characterized in that** the burner comprises a constriction for the passage of gases between the first combustion chamber and the second combustion chamber.
 8. Cooker according to any one of the preceding claims, **characterized in that** said at least one second air inlet comprises a secondary duct between an outer wall of the frame and the first combustion chamber running adjacent to said first combustion chamber and connecting from a secondary opening in the outer wall of the frame through which outside air enters via at least one opening in the second combustion chamber through which the air is introduced into the second combustion chamber.
 9. Cooker according to Claims 7 and 8, **characterized in that** it comprises at least one opening in the first combustion chamber located adjacent to the constriction, said at least one opening in the second combustion chamber being located on the periphery of the lower end of said second combustion chamber adjacent to the constriction, said at least one opening in the first combustion chamber and at least one opening in the second combustion chamber being on each side of the constriction and the secondary duct connecting the secondary opening with said at least one opening in the first combustion chamber and at least one opening in the second combustion chamber.
 10. Cooker according to any one of the preceding claims, **characterized in that** said at least one hob comprises a set of at least two concentric circular removable rings of different sizes, with matching inner and outer diameters, so that they fit one inside the other, with a smaller central ring being in the form of an entirely solid disc and a larger ring having an upper outer diameter greater than the diameter of the hob and a lower outer diameter equal to the diameter of the hob.
 11. Cooker according to any one of the preceding claims, **characterized in that** it comprises a third duct for collecting residual gases from the hob located under the worktop and configured parallel to the first bypass duct and leading to the first bypass duct at one end adjacent to the flue.
 12. Cooker according to any one of the preceding claims, **characterized in that** it comprises a heat exchanger in the form of a coil located within the flue for the escape of smoke to collect waste heat from the gases passing through the flue and comprises, as an attachment, a heat accumulator connected to the said heat exchanger to store the said waste heat from the gases.
 13. Cooker according to any one of the preceding claims, **characterized in that** it comprises an attachable oven comprising thermal insulation on all its surfaces except on a base which can be attached to the hob radiating the thermal energy received by

convection from the combustion gases coming from the burner towards the interior of the oven.

14. Cooker according to any one of the preceding claims, **characterized in that** it has wheels to facilitate portability. 5
15. Cooker according to any one of the preceding claims, **characterized in that** it comprises a handle for pushing or pulling the cooker. 10

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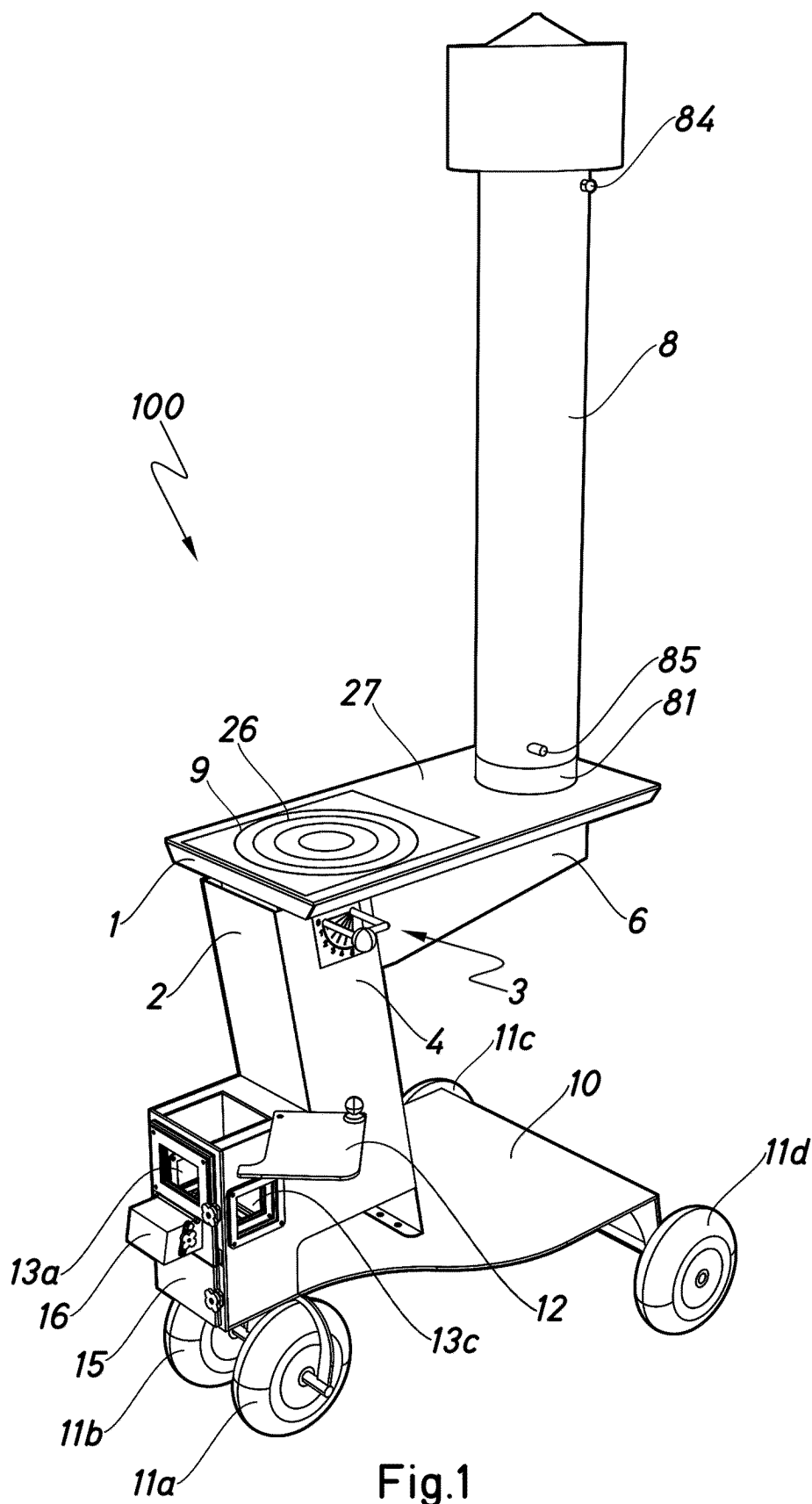


Fig.1

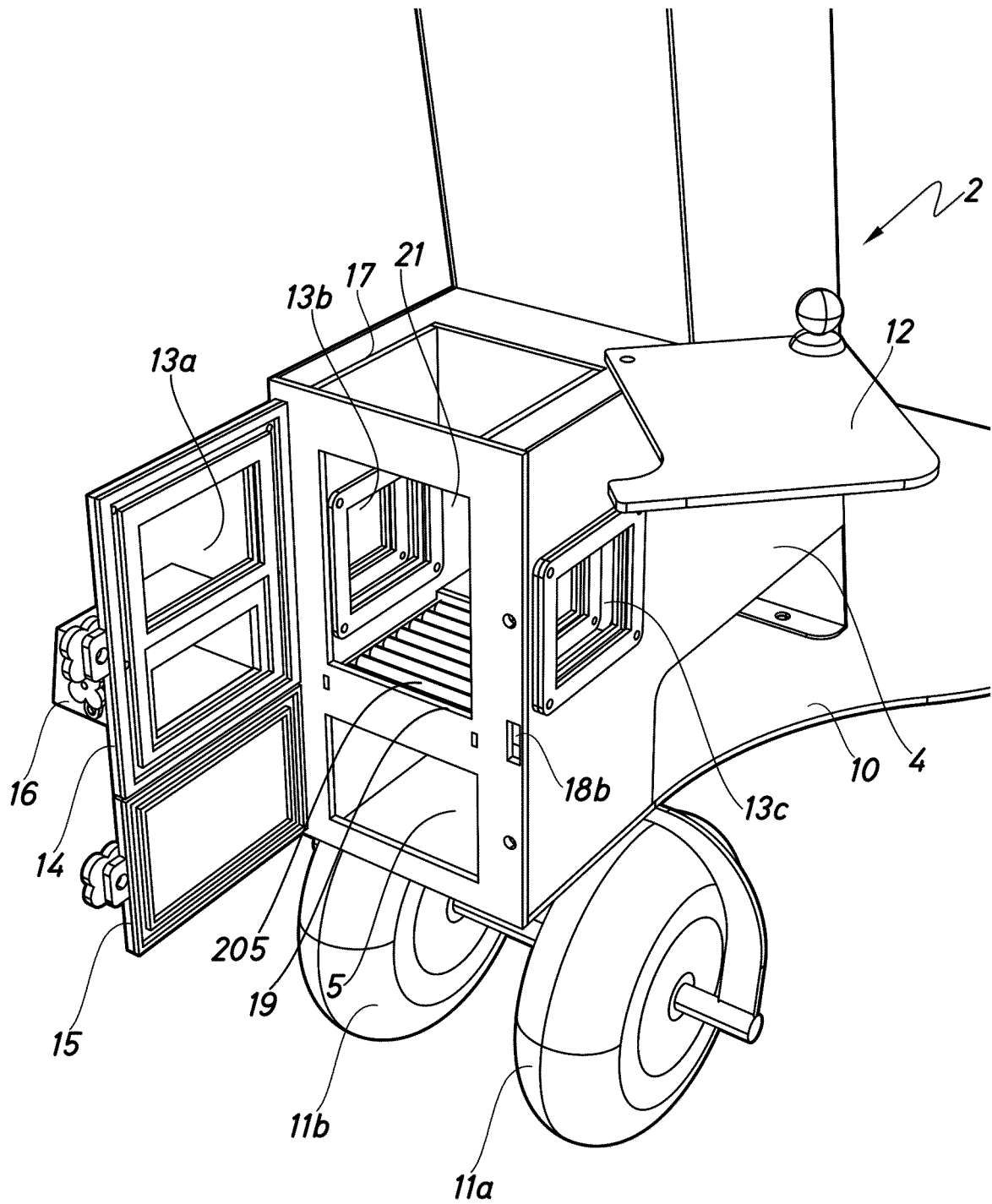


Fig.2

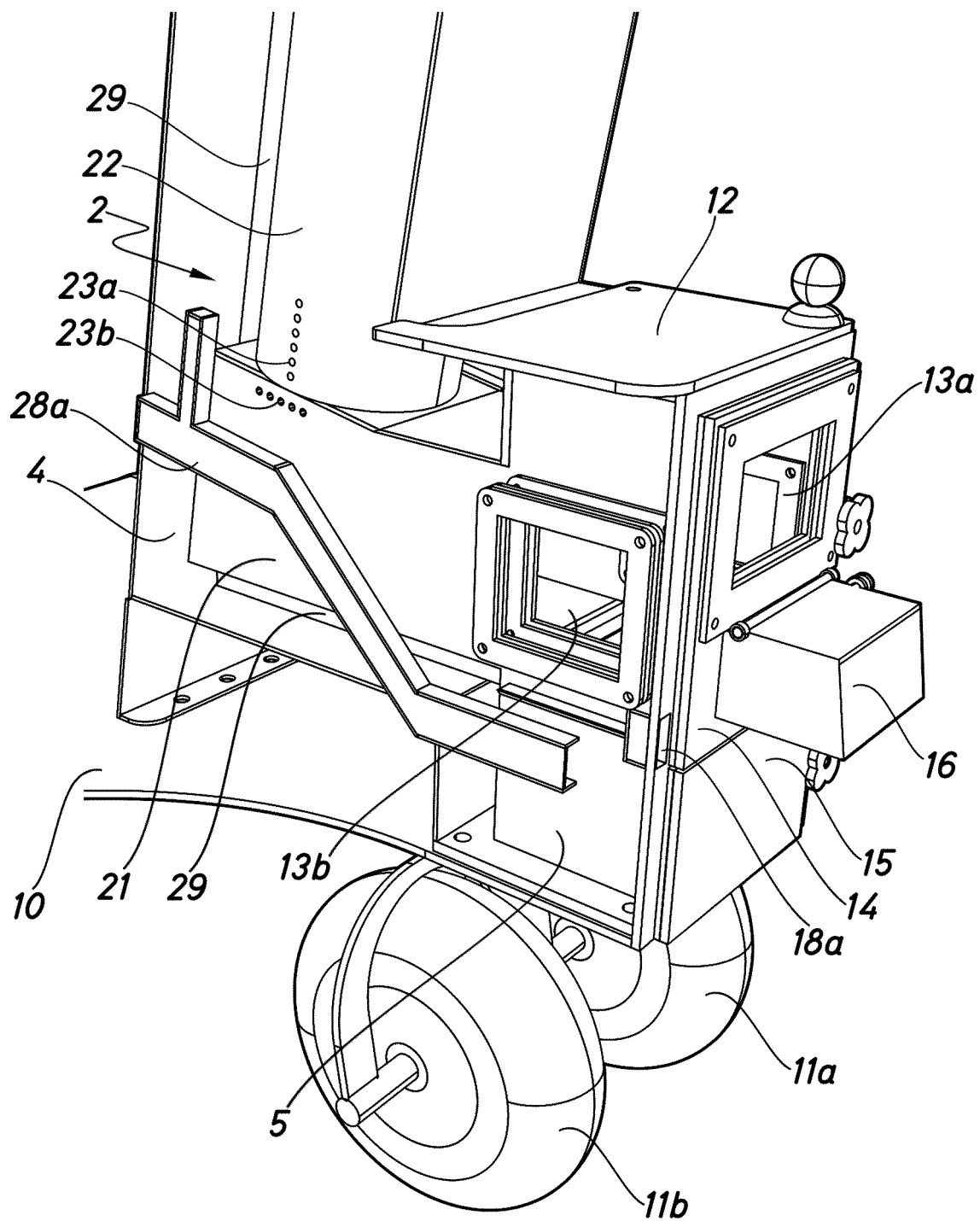


Fig.3

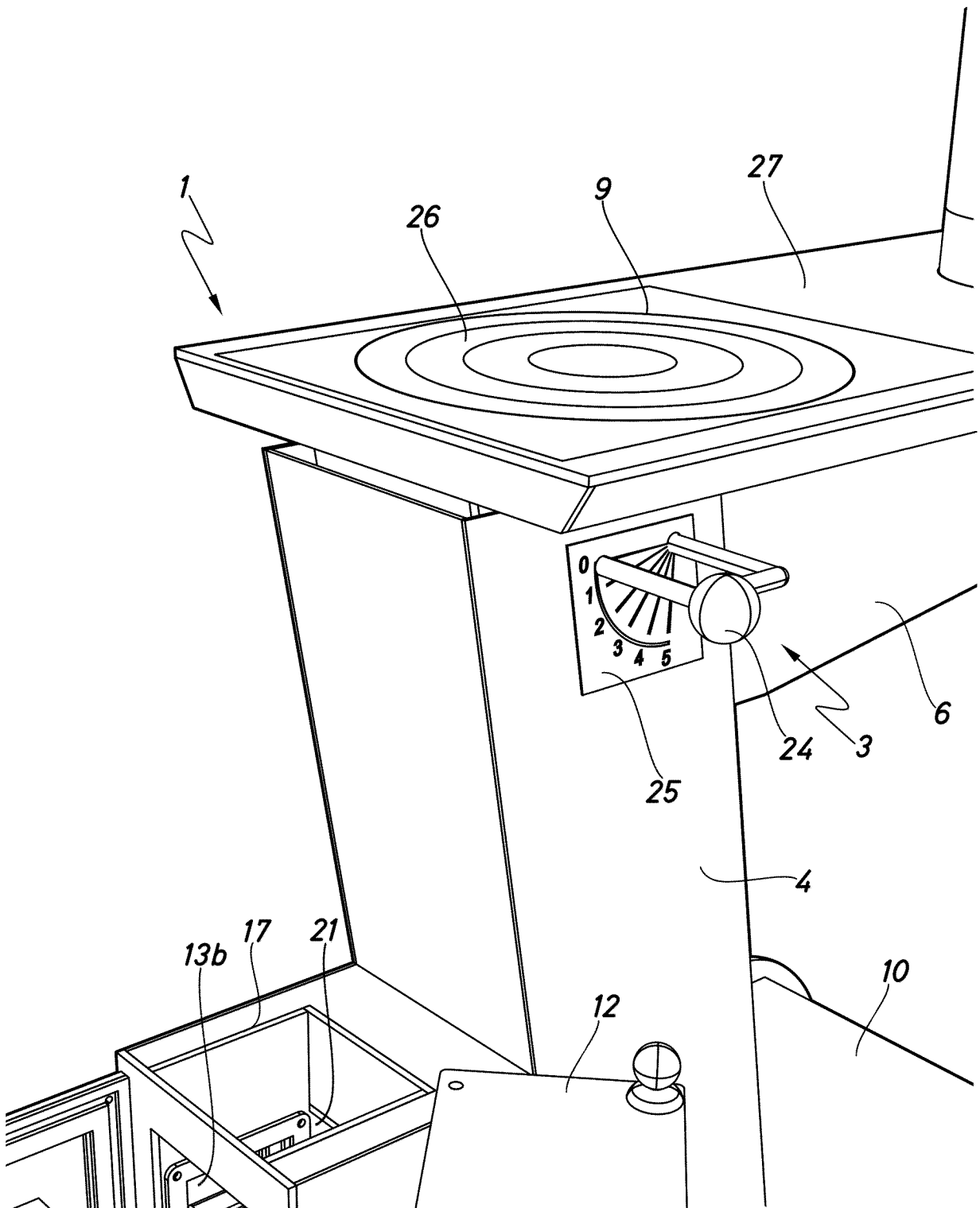


Fig.4

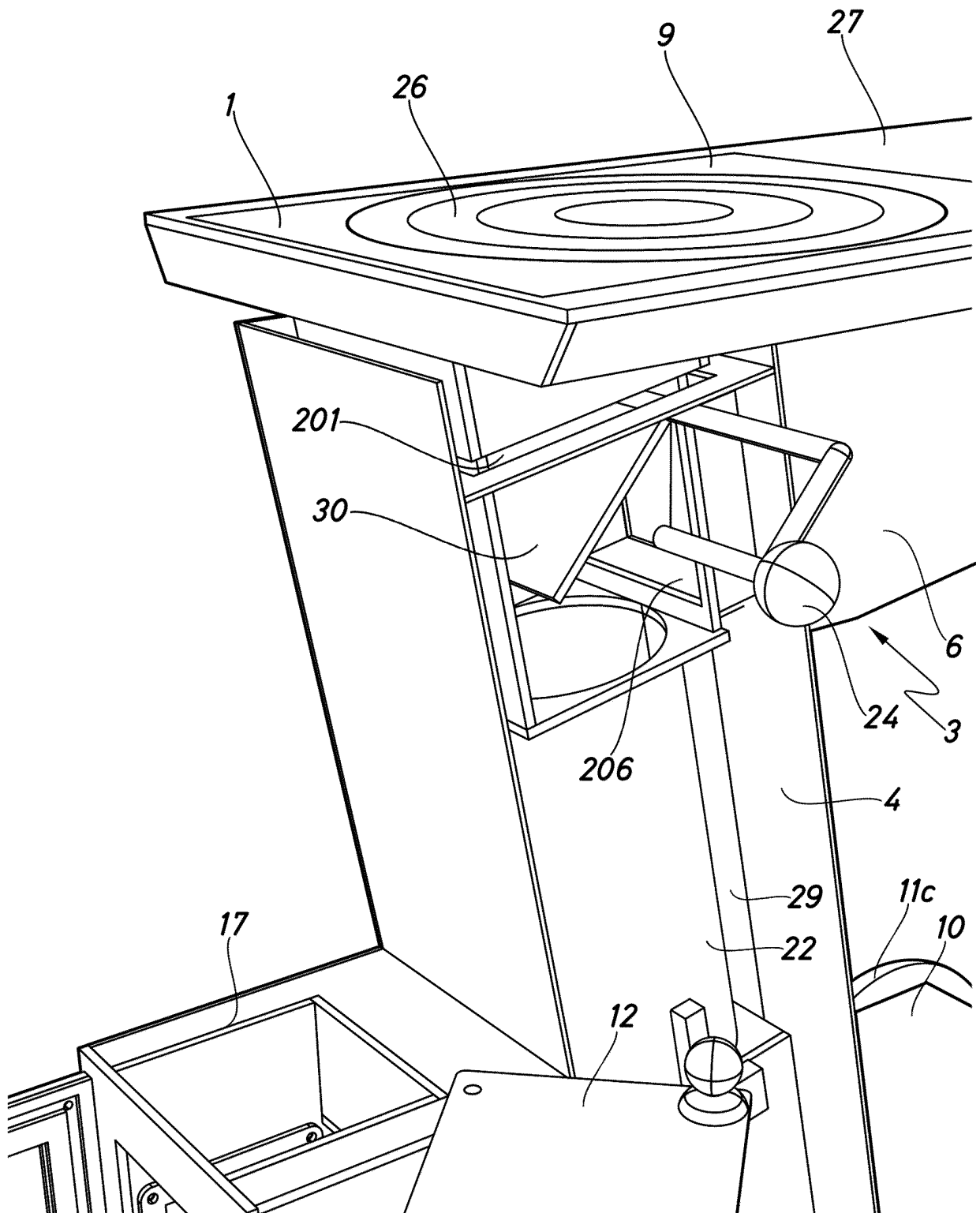


Fig.5

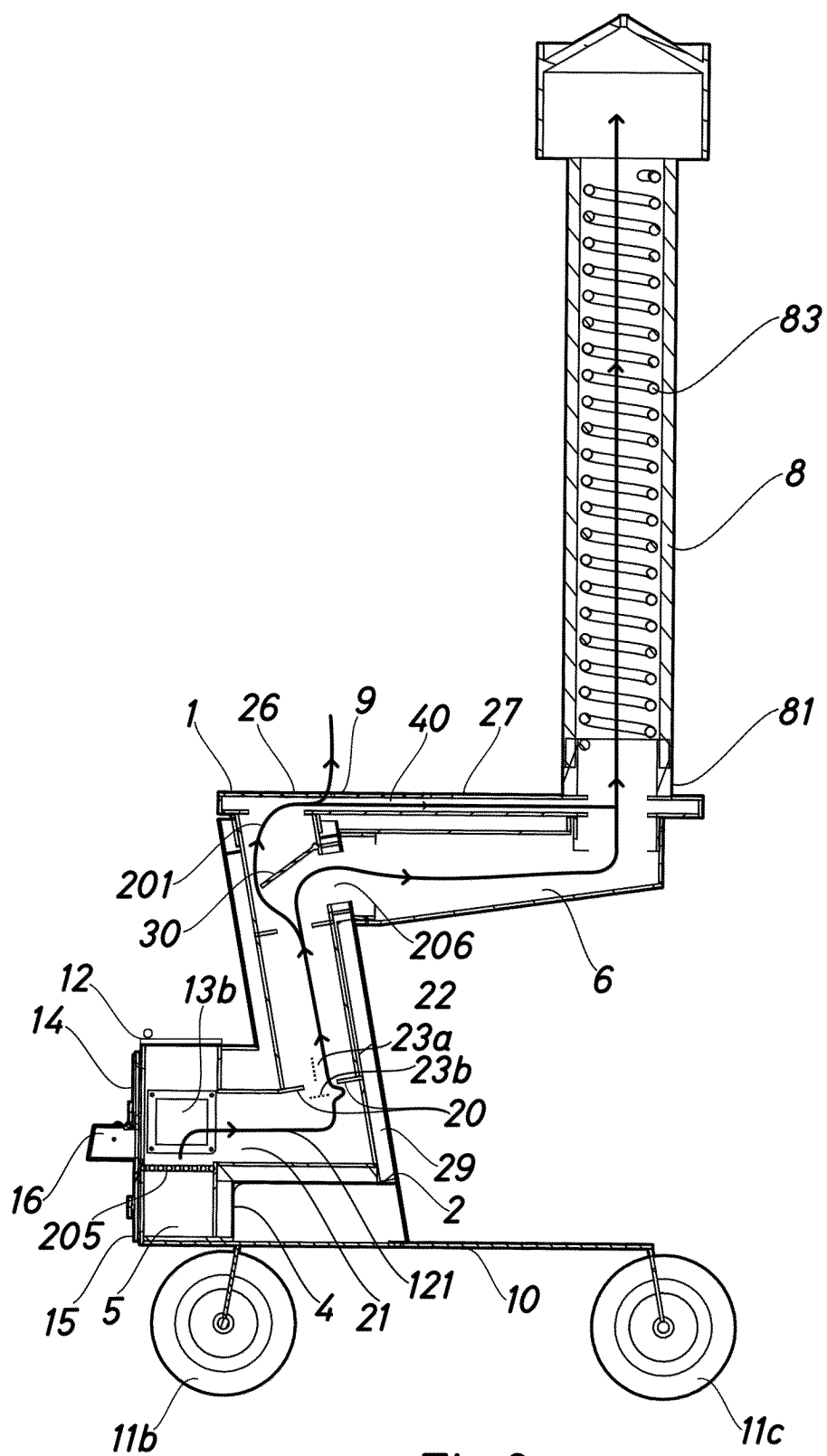


Fig.6

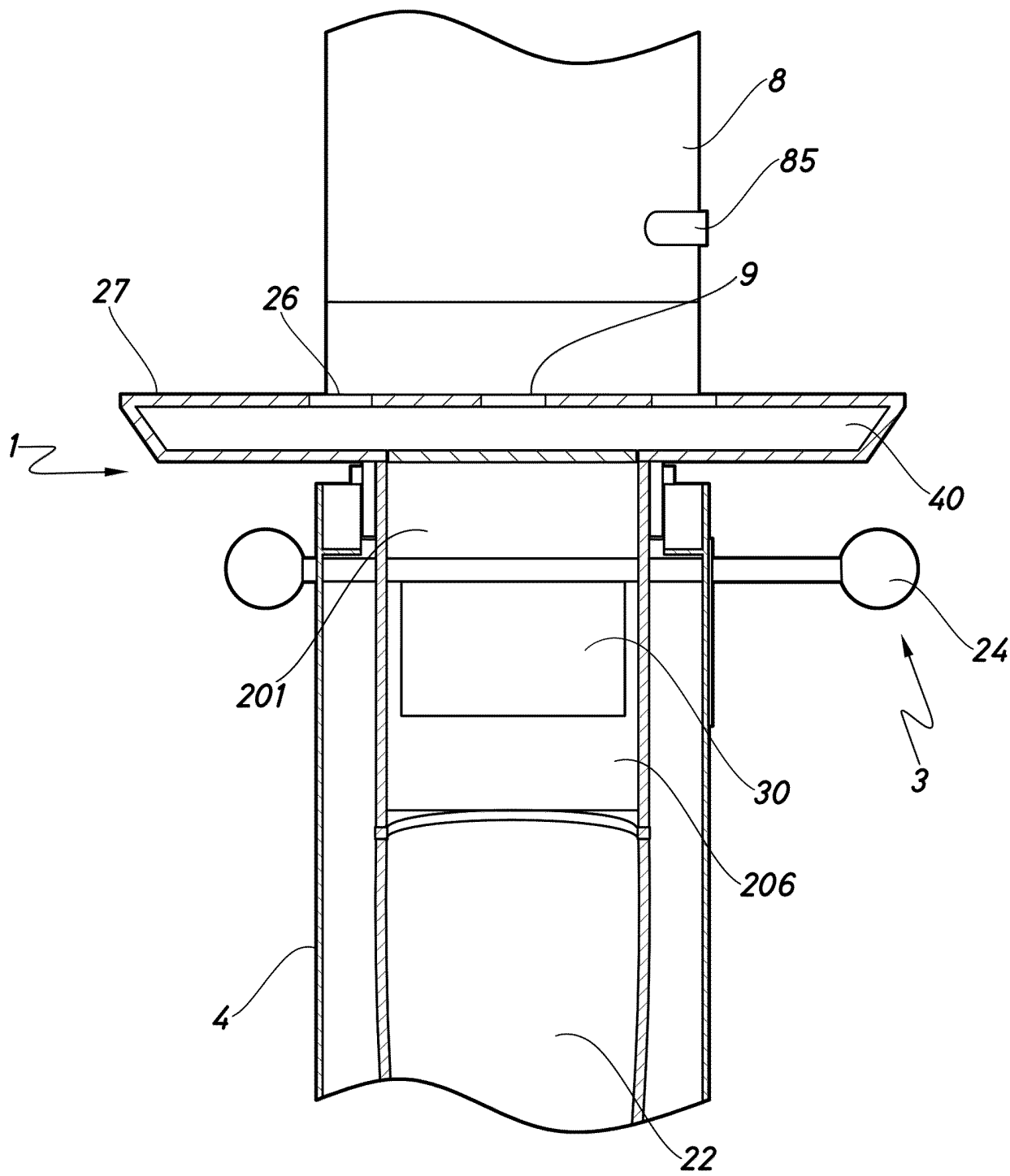


Fig.7

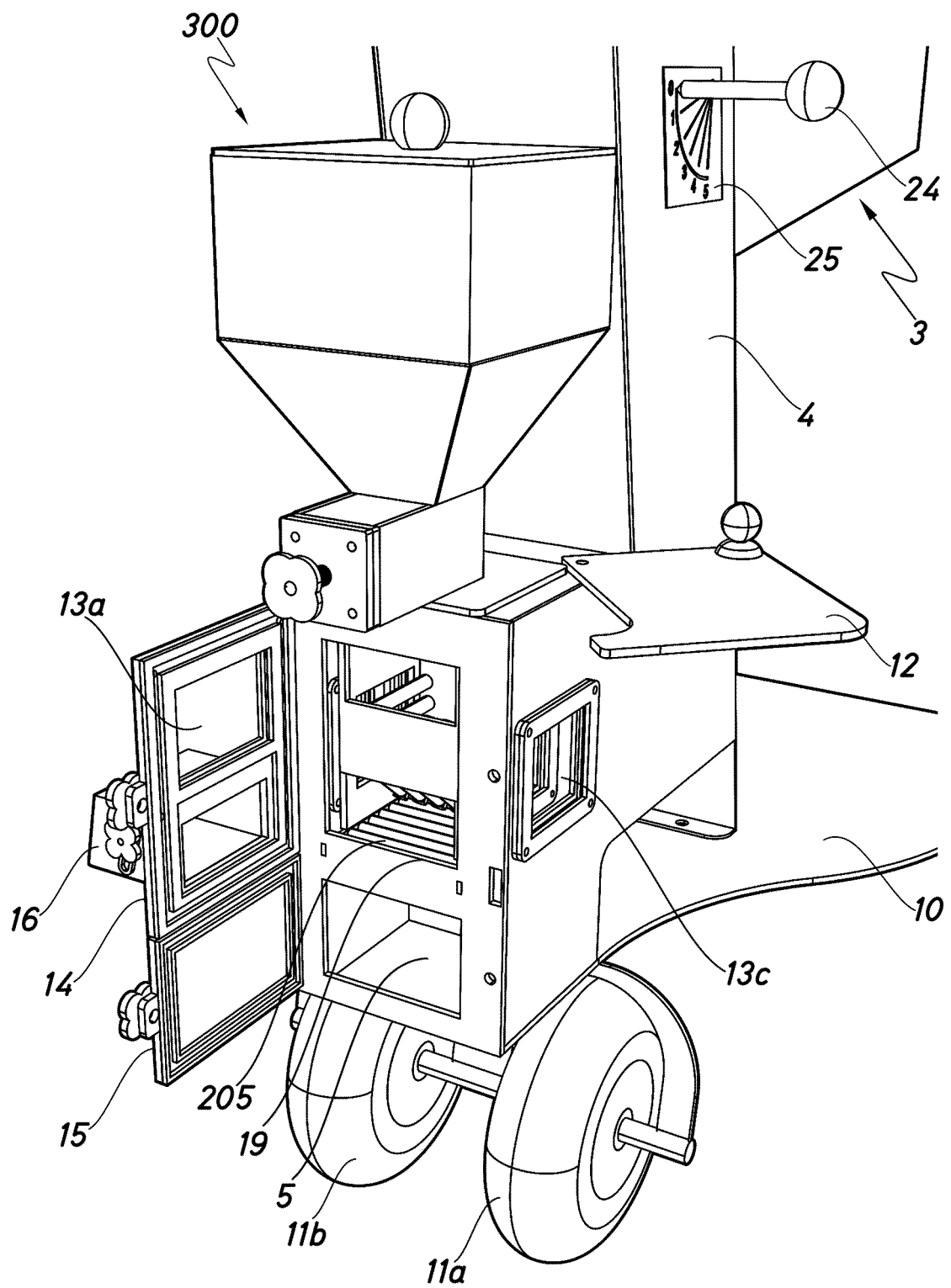


Fig.8

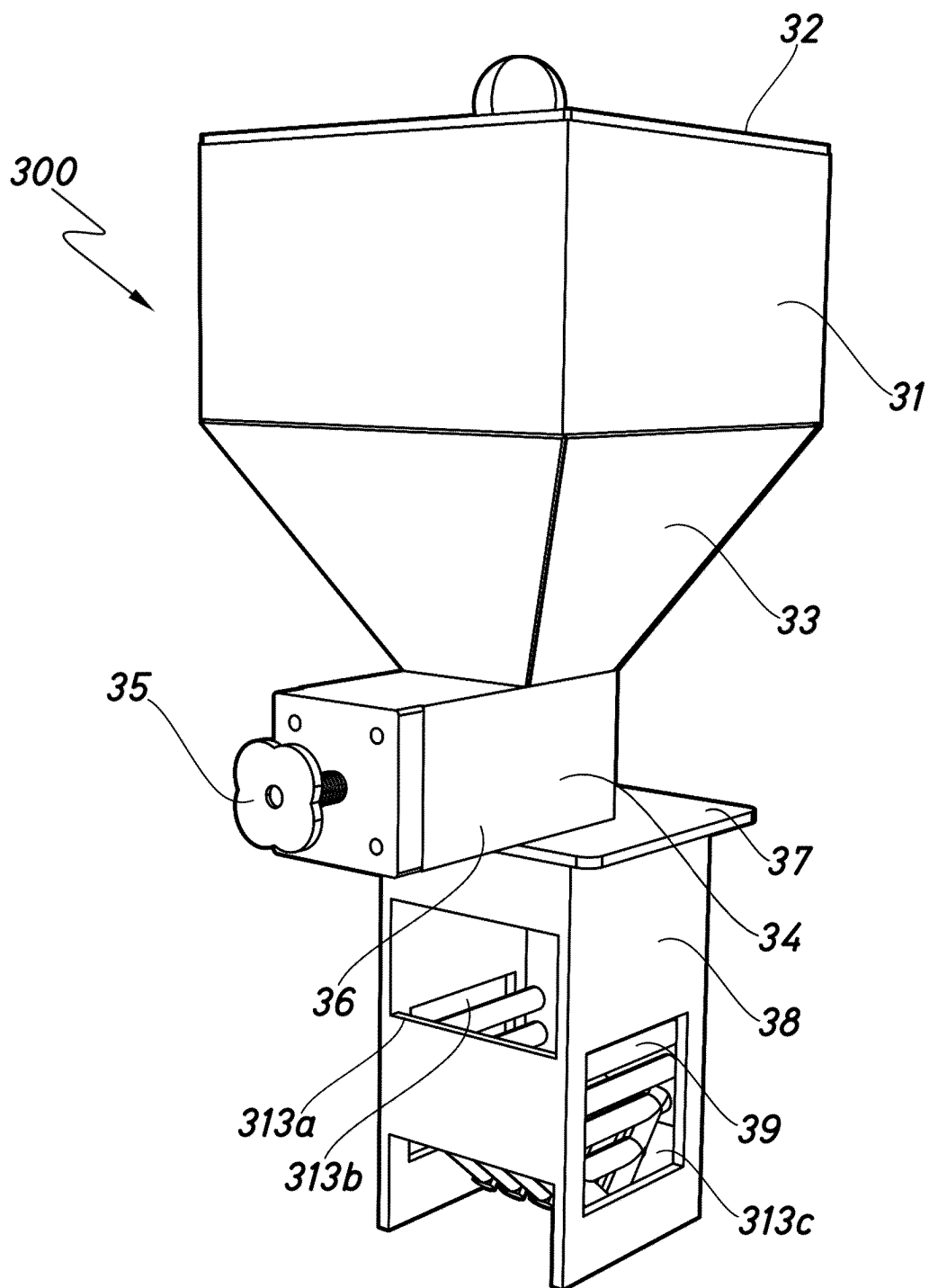


Fig.9

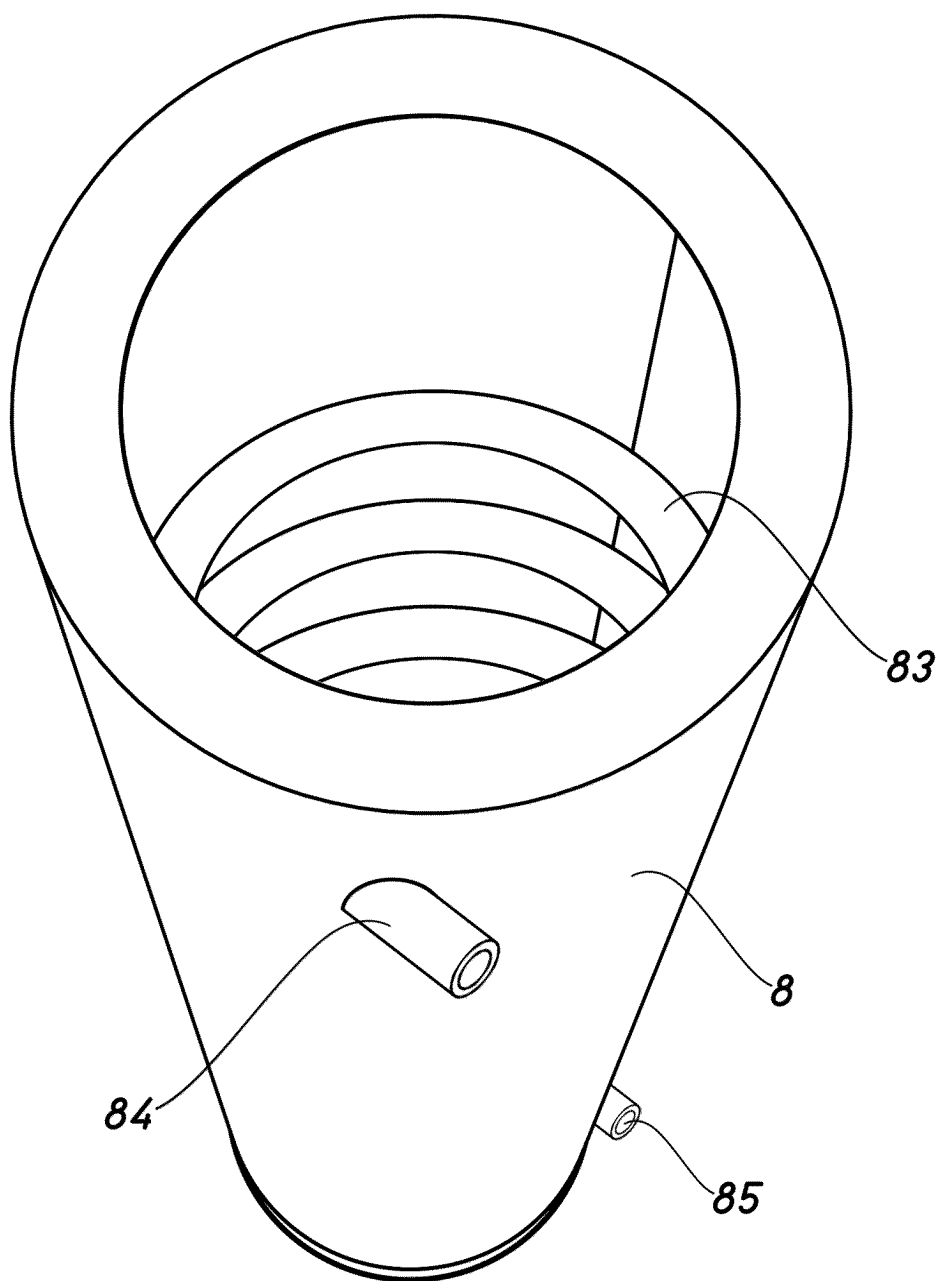


Fig.10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2023/070521

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24B, F23B

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)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4359040 A (MARTENSON DONALD S) 16/11/1982, column 6, lines 26 - 30.	1-15
Y	US 4404954 A (STEEL JAMES S) 20/09/1983, claims 8,23.	1-15
A	GB 2172989 A (GLYNWED CONSUMER & BUILDING) 01/10/1986, page 2, lines 40 - 44.	7
A	US 5014680 A (SIEMER DARRYL D) 14/05/1991, figure 1.	1-15

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

☒ See patent family annex.

* Special categories of cited documents:

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

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

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"&" document member of the same patent family

Date of the actual completion of the international search
06/10/2023

Date of mailing of the international search report
(09/10/2023)

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2023/070521

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CLASSIFICATION OF SUBJECT MATTER

F24B5/02 (2006.01)
F24B7/04 (2006.01)
F23B10/02 (2011.01)