(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 213 940 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.08.2010 Bulletin 2010/31

(21) Application number: **10000912.5**

(22) Date of filing: **29.01.2010**

(51) Int Cl.:
F23J 3/02 *(2006.01)* ***F24H 9/00*** *(2006.01)*
F28G 1/06 *(2006.01)* ***F28G 15/04*** *(2006.01)*
F24B 1/08 *(2006.01)* ***F24B 13/00*** *(2006.01)*

(84) Designated Contracting States:
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 SE SI SK SM TR
Designated Extension States:
AL BA RS

(30) Priority: **30.01.2009 SE 0900102**

(71) Applicant: **Ariterm Sweden AB**
39241 Kalmar (SE)

(72) Inventor: **Wikström, Ulf**
386 95 Färjestaden (SE)

(74) Representative: **Wallengren, Yngvar**
Patentbyran Y Wallengren AB
Box 116
331 21 Värnamo (SE)

(54) **Cleaning device for pellet-fired heaters**

(57) A pellet-fired stove or boiler with manual refuelling and with a mechanical device for clean-scraping of ash-coated convection ducts and for improving the heat transfer, and where the cleaning device is activated on opening and closing of the hatch for pellets refuelling.

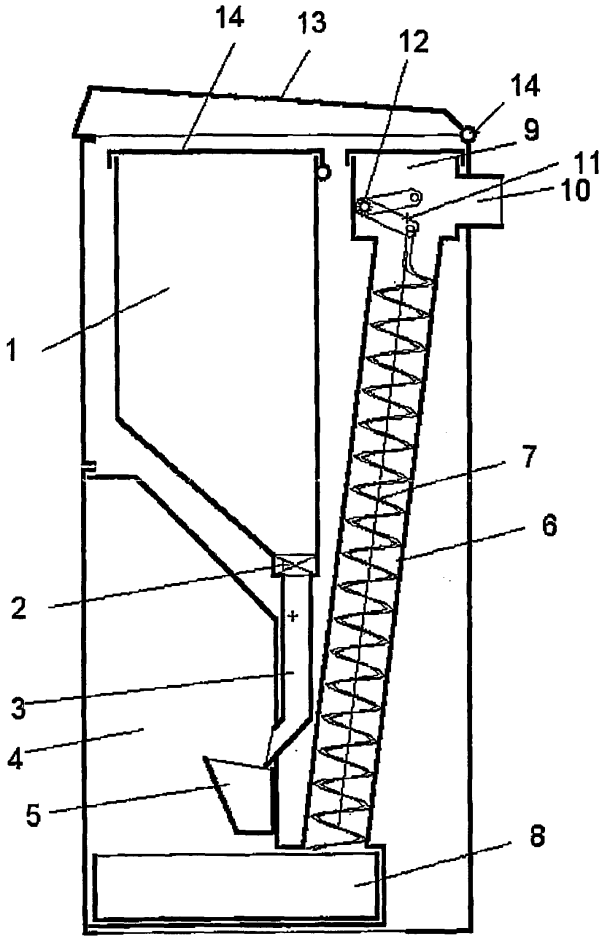

Fig 1

EP 2 213 940 A2

Description

TECHNICAL FIELD

[0001] The present invention relates to a pellet-fired stove or a boiler with a hatch for manual refuelling and with ash scrapers provided for cleaning the convection ducts of the boiler or the stove.

BACKGROUND ART

[0002] In heating with pellets of wood fuel, grain or the like, there inevitably occurs the formation of ash which readily deposits on wall surfaces which come into contact with the flue gases and which then cause deterioration in thermal transfer and, as a result, raise the flue gas temperature and lower the level of efficiency. As a result, the convection space in stoves fired with pellets or the like must be regularly cleaned at quite short time intervals.

[0003] In stoves with a convection space or chamber consisting of tubes, turbulators of bent sheet metal or helical springs are often employed to improve heat transfer. In pellet-fired hot water boilers, it is known to use these turbulators for scraping off ash as well.

[0004] If the ash scrapers are operated manually, experience has shown that cleaning will often be neglected. Automatic operation of the ash scrapers can take place using geared motors, electromagnets or using pneumatics which are then controlled by timers or connected so as to operate on stopping or starting of the burner. In heating stoves placed in rooms, cleaning by means of ash scrapers produces disturbing noises, which becomes even more disturbing if operation takes place under the control of a timer which is suddenly activated on unexpected occasions. The linking of the operation of the ash scrapers to starting or stopping of the burner also entails noise disturbance, and in addition the ash scrapers are operated far too often.

[0005] Ash also accumulates in the pot-shaped compartment of the burner, and this must be emptied and raked out at regular intervals. The problems inherent in ensuring regular operation and in avoiding noise disturbance are the same as in the cleaning of the convection chamber, even if the function of the burner is different from that of the convection ducts.

PROBLEM STRUCTURE

[0006] The object of the present invention is thus to realise a cleaning principally of the convection ducts at regular, quite brief time intervals and with a minimum of disturbing noise.

SOLUTION

[0007] The objects forming the basis of the present invention will be attained if the stove or boiler intimated by way of introduction is **characterised in that** the ash scrapers are connected to the stoking or refuelling hatch so that they carry out a scraping operation on movement of the refuelling hatch from opened to closed position or vice versa.

[0008] Further advantages will be attained if the stove or boiler moreover displays one or more of the characterising features as set forth in appended Claims 2 to 9.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0009] The present invention will now be described in greater detail hereinbelow, with reference to the accompanying Drawings. In the accompanying Drawings:

Fig. 1 is a vertical cross section of a stove according to one embodiment of the present invention; and

Fig. 2 is a partly exploded perspective view of an upper region of the stove according to Fig. 1.

DESCRIPTION OF PREFERRED EMBODIMENT

[0010] The present invention will be described hereinbelow in the form of one example relating to a stove with a hinged refuelling hatch and a tubular convection space with helical springs as combined turbulators and ash scrapers.

[0011] The above-outlined problems concerning unreliable manual operation of the ash scrapers or noise disturbances in motor-operation will be avoided if, according to the present invention, the operation of the ash scrapers is linked to refuelling in stoves where refuelling is carried out manually. In such instance, cleaning always takes place automatically at regularly adapted intervals at the same time as the noise from the ash scrapers coincides with the expected noise from the refuelling of pellets.

[0012] Fig. 1 shows a vertical cross section of the stove with a pellet hopper or store 1, a feeder 2, a drop shaft 3, a combustion chamber 4 and a burner 5. The convection space consists of one or more tubes 6 with turbulators/ash scrapers 7. The convection tubes 6 discharge at the bottom in an ash box 8 where scraped off ash is accumulated. At the top, the tubes 6 discharge in a header box 9 for the flue gases with a flue gas connection 10. The turbulators/ash scrapers 7 are moved up and down by means of rotary arms 11 secured on a stub shaft 12 which runs through the header box 9. On refuelling, the stoking hatch 13 is opened, with the hinge anchorage 14 in the rear edge of the stove. The hatch 13 can seal direct against the fuel store 1 or, as in the Figure, constitute an outer hatch, where an inner hatch 15 constitutes the actual seal member.

[0013] The feeder 2 releases pellets to the burner 5 via the drop shaft 3 at an adapted rate in order for effective combustion to take place, and for the best possible utili-

sation of the energy stored in the pellets.

[0014] The pellets store 1 will, as a result, be gradually emptied and must be replenished. Advantageously, the pellets store 1 is dimensioned so that replenishment need not take place too often, but the pellets stove continues to bum at least throughout one night so that its owner may rest undisturbed. Similarly, the owner could leave home for a few hours or a day without the stove extinguishing and the house becoming cold. It is particularly advantageous if the pellets store 1 is so large that several days may pass between refuelling.

[0015] On combustion of the pellets, ash is formed which, on the one hand, accumulates in the pot shaped burner 5 and, on the other hand, accompanies the flue gases and is deposited on the inside of the convection tubes 6 where heat exchange between the flue gases and their surroundings is to take place. For an efficient thermal transfer, the insides of the convection tubes 6 should be kept clean and free of ash.

[0016] The present invention entails a cleaning of the convection space of the pellets stove at regular and sufficiently short time intervals.

[0017] In the preferred embodiment, the convection tubes 6 are two in number, as is visible in Fig. 2. Each one of the turbulators/ash scrapers 7 is connected, in its one end, in the preferred embodiment in the upper end, to one of the rotary arms 11. The outer end of each respective rotary arm 11 is disposed on the stub shaft 12 so that the connection to the upper end of the ash scraper/turbulator is movable so as describe an arc of a circle which, in shorter distances, may be approximated to a line. In Fig. 1 can be seen two different positions for one and the same rotary arm 11.

[0018] In order for the rotary arm 11 to assume the upper illustrated position and for its associated ash scraper/turbulator 7 to move upwards in the convection tube 6 and scrape ash from the inside of the tube, the through-going stub shaft 12 on which all rotary arms 11 are disposed must be pivoted about its axis and thereby entrain the rotary arms 11 in the rotary movement. The rotary arms 11 are thus rigidly connected to the stub shaft 12.

[0019] Fig. 2 shows in perspective parts of the upper region of the stove, with the convection tubes 6, the header box 9 with the through-going shaft 12, the outer refuelling hatch 13 (where only a part of the hatch 13 is visible in the Figure), with the hinge 14 and the inner hatch 15. The outer hatch 13 is connected by a pull rod 16 to a rotary arm 17 fixedly mounted on the shaft 12 outside the header box 9, so that, on opening of the hatch 13 for refuelling, the shaft 12 is rotated and thereby the ash scrapers 7 of the convection tubes 6 in Fig. 1 are lifted. When the hatch 13 is closed, a helical spring 18 applies a retaining moment of force on the hatch 13.When the hatch 13 is opened a distance, the force of the spring 18 changes so as to provide a moment of force for continued opening of the hatch and thereby a force for scraping off ash. Correspondingly, a closure of the hatch 13 realises a return action of the ash scrapers in Fig. 1.

[0020] Thus, in order to pivot the shaft 12, an additional rotary arm 17 is provided and is rigidly connected to the shaft. This rotary arm 17 functions as an operating arm, and the other rotary arms 11 will, because of the rigid connection to the shaft 12, positively execute the same rotary movement as the rotary arm 17.

[0021] Thus, the refuelling hatch 13 is interconnected to the ash scrapers/turbulators 7 by the intermediary of the pull rod 16, the rotary arm 17, the shaft 12 and the rotary arms 11. In the preferred embodiment, the interconnection is thus mechanical.

[0022] When the refuelling hatch 13 had been lifted, the spring 18 initially delivers a resistance against this movement, since the spring 18 is extended or stretched further. At some point during rotation of the rotary arm 17, a maximum point is reached for the extension of the spring 18. This occurs when the extent of the spring 18 intersects the extension of the shaft 12, i.e. when the rotary arm 17 and the spring 18 are parallel with one another. This position is a dead point and when the dead point has been passed, the extended or stretched length of the spring 18 is reduced, which implies that the spring force from the spring 18 assists in drawing the rotary arm 17 upwards and thereby delivers increased force to the ash scrapers/turbulators 7. On closure of the refuelling hatch 13, the cycle is reverse and a new scraping movement is carried out in the opposite direction.

[0023] As illustrated in Fig. 1, the scraped off ash can fall down into the ash box 8.

DESCRIPTION OF ALTERNATIVE EMBODIMENTS

[0024] The design and construction illustrated in Figs. 1 and 2 constitute one example of the reduction of the present invention into practice. As will be apparent from the appended Claims, other designs and constructions are conceivable which realise the desired function with the automatic cleaning of the convection surface in connection with refuelling.

[0025] As was intimated by way of introduction, there may also be a need to remove ash from the burner 5. A corresponding scraper mechanism is, in a second embodiment, disposed in the pot-shaped burner 5. This scraper is also set in motion when the refuelling hatch 13 is opened and/or closed. A mechanical connection corresponding to that in the preferred embodiment is also provided for the scraper of the burner 5.

[0026] The connecting mechanism which was disclosed in the preferred embodiment may also be utilised for opening a hatch in the bottom of the burner 5 so that ash which has accumulated there is emptied into the ash box 8 which in turn is emptied manually when it is full.

[0027] In yet a further embodiment, there is disposed a grid in the bottom of the burner 5, whose openings are fully overlapped by closed portions of a second grid in a closed position. When the refuelling hatch 13 is opened, the two grids are displaced in relation to one another and the openings come into register with one another and

ash in the burner 5 falls down into the ash box 8.

[0028] In the preferred embodiment, the connection between the refuelling hatch 13 and the ash scrapers 7 is purely mechanical. In one alternative embodiment, the connection includes a motor, for example an electromotor, which is activated when the refuelling hatch 13 is opened or closed, preferably in that a switch is activated.

[0029] The connection may also include a compressed air-driven device which, in a corresponding manner, is activated on opening or closing of the refuelling hatch 13.

[0030] Finally, the present invention may also be varied in that the spring 18 is in the form of a gas spring instead of the illustrated helical spring.

[0031] The present invention may be modified further without departing from the scope of the appended Claims.

Claims

1. A stove or a boiler with a hatch (13) for manual refuelling and with ash scrapers (7) provided for cleaning the convection ducts (6) of the boiler or the stove, **characterised in that** the ash scrapers (7) are connected to the refuelling hatch (13) so that they carry out a scraping operation on movement of the refuelling hatch (13) from opened to closed position or vice versa.

2. The stove or boiler as claimed in Claim 1, **characterised in that** an additional ash scraper is provided for cleaning of the burner (5), this ash scraper also being connected to the refuelling hatch (13).

3. The stove or boiler as claimed in Claim 1 or 2, **characterised in that** the connection between the refuelling hatch (13) and the ash scrapers (7) includes an electromotor which is activated on opening and/or closing of the hatch (13) for refuelling.

4. The stove or boiler as claimed in any of Claims 1 to 3, **characterised in that** the connection between the refuelling hatch (13) and the ash scrapers (7) includes a compressed air-driven device which is activated on opening and/or closing of the hatch (13) for refuelling.

5. The stove or boiler as claimed in any of Claims 1 to 4, **characterised in that** the connection between the refuelling hatch (13) and the ash scrapers (7) is realised by means of a mechanical interconnection (11, 12, 16) between the hatch (13) for refuelling and the ash scrapers (7) so that clean-scraping takes place on opening and/or closing of the refuelling hatch (13).

6. The stove or boiler as claimed in any of Claims 1 to 5, **characterised in that** the convection ducts (6) are disposed in a heat transferring convection portion and are connected to a header box (9) which is passed through by a rotary shaft (12) with rotary arms (11) secured thereon and, on rotation of the shaft (12), realise a reciprocal scraping movement of the ash scrapers (7) for clean-scraping of the convection tubes, and the rotation of the rotary shaft (12) being realised by means of a linkage arm (17) connected to the rotary shaft (12) outside the header box (9).

7. The stove or boiler as claimed in Claim 6, **characterised in that** the linkage arm (17) is spring-biased in such a manner that the refuelling hatch (13), on opening, is initially affected by a closing moment of force which, on continued manual opening of the hatch, is converted into an opening moment of force in order to assist in the clean-scraping of the convection tubes (6) and to hold the hatch (13) open on refuelling.

8. The stove or boiler as claimed in Claim 1, **characterised in that** the ash scrapers (7) in the convection tubes (6) are designed as turbulators in order, in a position of rest, to improve the heat exchange between flue gases and convection tubes (6).

9. The stove or boiler as claimed in Claim 2, **characterised in that** the bottom of the burner has an opening mechanism which is connected to the refuelling hatch (13).

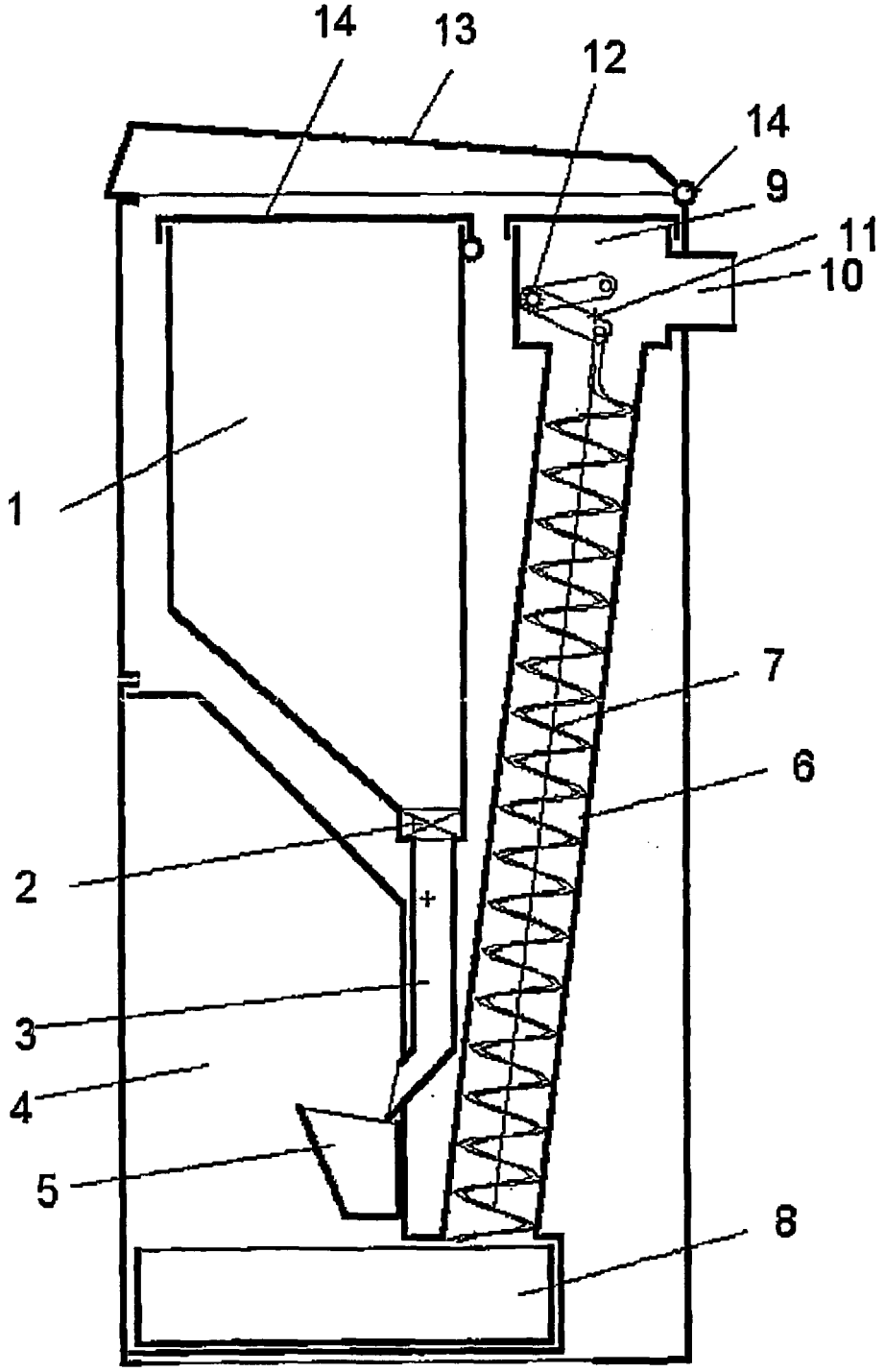

Fig 1

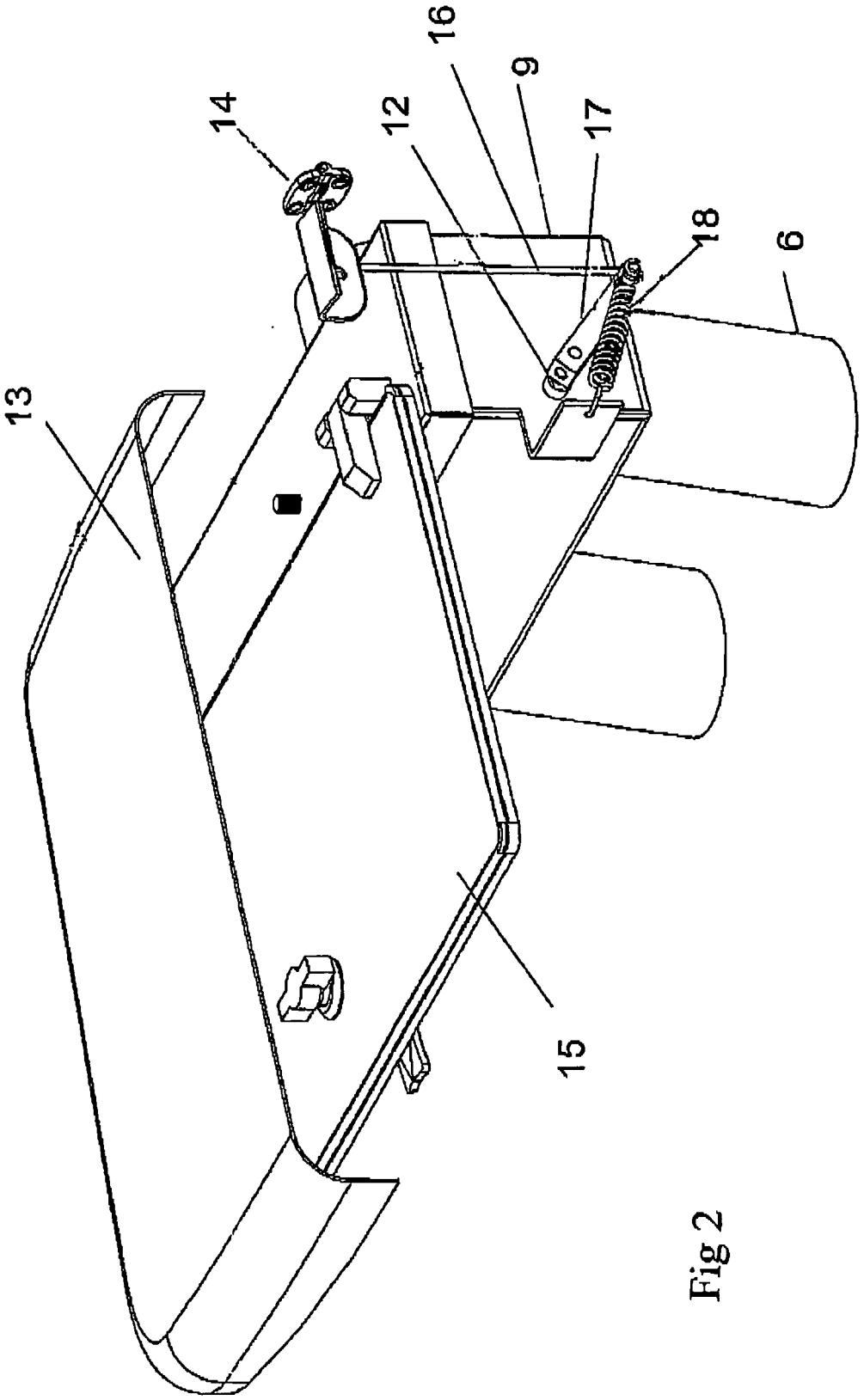

Fig 2