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(71) Applicant: **Bonferraro S.p.A.**
37060 Bonferraro (VR) (IT)

(72) Inventor: **Gobbi, Ezio**
46037 Roncoferraro (MN) (IT)

(74) Representative: **Concone, Emanuele et al**
Società Italiana Brevetti S.p.A.
Via Carducci 8
20123 Milano (IT)

Remarks:

Amended claims in accordance with Rule 137(2) EPC.

(54) **Hood-type industrial dishwasher**

(57) In a hood-type industrial dishwasher including a hood (1) mounted on vertical guides arranged on the rear wall of the stationary lower part of said dishwasher, so as to slide vertically along the guides with the help of balancing springs (8) suitable to limit the hood opening/closing effort, the guides are telescopic guides (3) including sliding parts (2) on which the hood (1) is secured. The movement of the sliding parts (2) is driven by cables (4) on which the balancing springs (8) act through mobile pulleys (6) arranged on plates (7) that are mounted in a rotatable way on the dishwasher structure and drivable by a piston (10), the whole hood moving mechanism being arranged on the back of the dishwasher. In this way, it is possible to dispense with the bulky and potentially dangerous lateral levers and springs of conventional hood-type dishwashers by achieving the hood moving through a mechanism fully arranged on the back of the machine. This results in a smaller width of the dishwasher, an increased safety and a great easiness of the external cleaning operations.

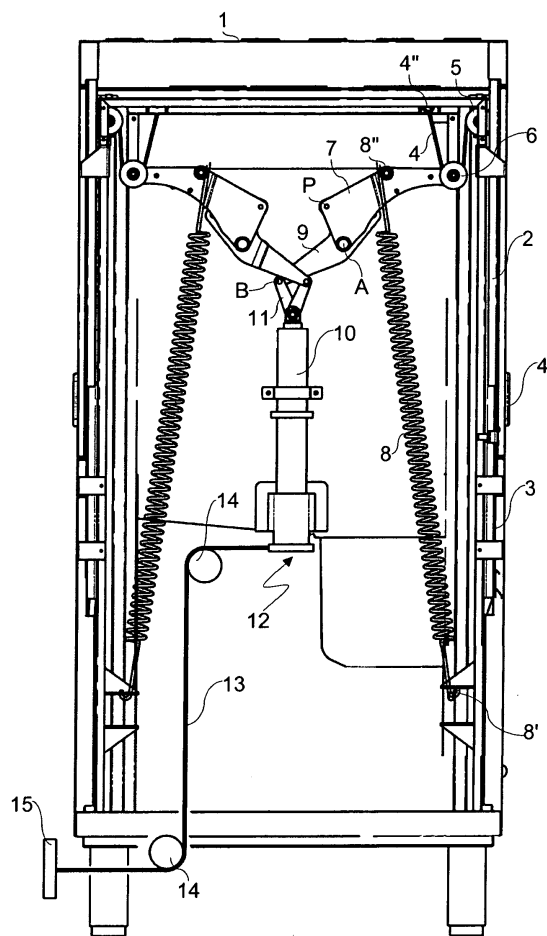


Fig.3

Description

[0001] The present invention relates to industrial dishwashers, and in particular to a hood-type dishwasher with an improved hood opening/closing mechanism.

[0002] It is known that a hood-type dishwasher is substantially divided into a stationary lower half and a mobile upper half (hood) that slides vertically along guides formed in the rear wall of the stationary part. The conventional moving mechanism of the hood includes pins arranged on the two right and left sides thereof which engage corresponding slots formed in a pair of long levers pivoted to the sides of the above-mentioned rear wall. Moreover, in order to limit the hood opening/closing effort to a few kilos, strong balancing springs are pivoted between said rear wall and the rear end of the levers. This conventional mechanism, though effective, has various drawbacks both in manufacturing and use.

[0003] In the first place the lateral levers with the relevant balancing springs are bulky, they make the external cleaning operations difficult and may pose a risk during the hood moving phases.

[0004] Secondly, the balancing springs must be very strong and therefore heavy and expensive, since the lever arm of the hood is many times greater than the reaction lever arm of the springs with respect to the fulcrum of rotation of the lateral levers. For example, considering a hood that weighs 30 kg with a lever arm variable between 360 and 340 mm (depending on the closed or open position of the hood), two springs pivoted on the lateral levers with a lever arm variable between 40 and 60 mm must exert a force variable between 270 and 170 kg. This gives rise to high stress of the involved mechanical parts, in addition to difficulties in mounting and maintenance.

[0005] Therefore the object of the present invention is to provide a hood-type industrial dishwasher which overcomes the above-mentioned drawbacks. This object is achieved by means of a hood-type industrial dishwasher provided with a hood moving mechanism including vertical rear telescopic guides driven by cables on which the balancing springs act through mobile pulleys mounted on rotatable plates driven by a piston. Other advantageous features of the present industrial dishwasher are specified in the dependent claims.

[0006] The main advantage of the dishwasher according to the present invention is that of dispensing with the bulky and potentially dangerous lateral levers and springs by achieving the hood moving through a mechanism fully arranged on the back of the machine. This results in a smaller width of the dishwasher, an increased safety and a great easiness of the external cleaning operations.

[0007] A further advantage of this dishwasher is the significant reduction in the maximum load of the springs, thanks to the use of the pulley and to the advantageous reaction lever arm. As a consequence, it is possible to use less strong, lighter and cheaper springs and therefore achieve less difficulties in mounting/maintenance

and lower mechanical stress, thus increasing reliability.

[0008] Still another advantage of the above-mentioned dishwasher is that of being able to automatically open and close the hood through a single-piston device of limited length and force and therefore inexpensive. In this way, the machine can open the hood exactly at the end of the wash cycle, making even more evident to the operator that the dishwasher has finished its work and therefore facilitating the loading/unloading operations.

[0009] Furthermore, it should be noted that the manual moving of the hood both in opening and closing is possible even in the presence of the automatic moving piston, thanks to the presence of a second pair of rotatable plates located between the piston and the pulley-carrying plates. Moreover, an emergency piston release system allows to continue to operate the machine with the manual opening and closing even if the piston locks with its stem extended.

[0010] These and other advantages and characteristics of the industrial dishwasher according to the present invention will be clear to those skilled in the art from the following detailed description of an embodiment thereof, with reference to the annexed drawings wherein:

Fig.1 is a diagrammatic side view showing a hood-type dishwasher according to the invention in a closed position for the washing of the dishes;

Fig.2 is a diagrammatic side view showing said dishwasher in an open position for the loading/unloading of the dishes;

Fig.3 is a diagrammatic rear view of the dishwasher showing the moving mechanism;

Fig.4 shows the manual opening operation of the mechanism of Fig.3;

Fig.5 shows the automatic opening operation of the mechanism of Fig.3;

Fig.6 is a view similar to Fig.5 showing the operation of an emergency release mechanism in case the piston locks in the open hood position;

Fig.7 is a view similar to Fig.6 showing the manual closing operation of the moving mechanism after the operation of the emergency release mechanism;

Fig.8 shows a detail of the emergency release mechanism, in a front and top view, in the normal piston supporting position; and

Fig.9 is a view similar to Fig.8 showing the above-mentioned detail in the piston release position.

[0011] Referring to Figs.1-2, there is seen that a hood-type industrial dishwasher according to the present invention conventionally includes a hood 1 mounted on vertical guides arranged along the rear wall of the stationary lower part of the dishwasher. Hood 1 slides vertically along said guides with a run Y sufficient to allow a smooth loading/unloading of the dishes.

[0012] The novel aspect of the industrial dishwasher according to the present invention is the use of telescopic guides 3 including a sliding part 2 to which hood 1 is

secured. Said telescopic guides 3 are obviously sized to support the weight of hood 1 when the sliding parts 2 project at the top for a length Y equal to the opening run of hood 1.

[0013] The movement of hood 1 is driven through a mechanism fully arranged on the back of the dishwasher, in order to achieve the above-mentioned object of dispensing with the lateral levers and balancing springs. Since, as shown in Fig.3, said moving mechanism includes two identical devices preferably arranged mirror-like with respect to the vertical midplane of the dishwasher, the following description refers to one of the devices only.

[0014] An inextensible cable 4 is secured between a bottom attachment 4', arranged at the bottom end of the sliding part 2 of the telescopic guide 3, and a top attachment 4'' fixed on the dishwasher structure. In its path between the two end attachments 4', 4'' the cable first passes over an idler wheel 5 fixed on the dishwasher structure, then under a pulley 6 arranged on a plate 7 that is in turn mounted in a rotatable way on the dishwasher structure (at a position lower than wheel 5) through a fulcrum A.

[0015] Furthermore, a balancing spring 8 is pivoted between a bottom attachment 8', fixed on the dishwasher structure close to the bottom, and a top attachment 8'' fixed on plate 7 at a position intermediate between fulcrum A and pulley 6. The position of the top attachment 8'' is designed so as to obtain an extension and an angle of spring 8 suitable to balance the weight of hood 1 with respect to fulcrum A depending on the angular position of pulley 6, i.e. of plate 7.

[0016] Like in conventional dishwashers with lateral levers, but in this case even more precisely and in a simpler way, the positions of the attachments and the spring loads are calculated to obtain:

- in the closed position, a reaction of springs 8 insufficient to balance the weight of hood 1 in order to prevent its rise during the wash cycle, whereby the operator must exert a raising effort on the handle between 2 and 4 kg to raise hood 1;
- during the rise, for a length of run between about 150 and 250 mm, a reaction of springs 8 greater than the weight of hood 1 that therefore tends to rise by itself;
- beyond an opening height of 300 mm, a reaction of springs 8 substantially equal to the weight of hood 1 that therefore remains open (due to the frictions) until the operator has completed the loading/unloading operations.

[0017] The automatic drive of hood 1 is achieved by means of a second rotatable plate 9, pivoted on the same fulcrum A of the first plate 7, driven by a piston 10 whose stem is connected thereto through a rod 11 pivoted between the stem of piston 10 and a pin B located at the bottom end of the second plate 9. It should be noted that, in the preferred embodiment with symmetrical structure of the mechanism, a single vertical piston 10 arranged

at a central position is sufficient to drive both moving devices that make up the mechanism.

[0018] As previously mentioned, this mechanism is made so as to allow the manual drive of hood 1 even in the presence of piston 10 for the automatic drive. To this purpose, with reference also to Fig.4, the connection between the first plate 7 and the second plate 9 is achieved through a pin P fixed on plate 7 which slidably engages a slot S formed in plate 9. More specifically, slot S is shaped like an arc of circle centered on fulcrum A and pin P is located on plate 7 so as to abut on the internal end of slot S when hood 1 is closed (Fig.3).

[0019] Finally, there is provided an emergency release mechanism for piston 10 to be used in case piston 10 locks with the stem extended in the open hood position after the automatic opening of hood 1. This release mechanism includes a mobile support device 12, better described further on, that acts as a base for piston 10 and can be driven by a cable 13 that slides on wheels 14 secured to the dishwasher structure and ends with a handle 15.

[0020] It should be noted that the above-illustrated arrangement of the elements is given only by way of example since several other arrangements, even non-symmetrical, are possible if multiple pistons are used. For example, the sequence from the side towards the center of elements 2, 5, 6, 4'', 8'', A and 9 is a consequence of the arrangement of guides 3 close to the dishwasher sides, but if guides 3 were arranged at a more central position the relevant moving devices could be arranged more outwardly and the above sequence of elements would be reversed.

[0021] Similarly, the whole opening mechanism could be mirrored in the vertical direction, by adding a further idler wheel, simply changing the fixing points of elements 4, 5, 7, 8 and 9 on the dishwasher structure. Moreover, the bottom attachment 4' of cable 4 may also be arranged higher than the bottom end of the sliding part 2, as long as it remains at a distance from the idler wheel 5 greater than run Y.

[0022] The simple and effective operation of the hood moving mechanism of the dishwasher according to the present invention will be readily understood from the description given above.

[0023] If the operator decides to open hood 1 manually, as in Fig.4, the sliding part 2 will be moved upwards through a distance equal to run Y while pulley 6 will be moved downwards through a distance equal to Y/2, due to the rotation of plate 7 around fulcrum A under the action of spring 8. In this case plate 9 connected to piston 10 remains still, this being made possible by the fact that pin P slides along slot S allowing the rotation of plate 7 through the whole foreseen run Y without any interference by plate 9. Obviously, in case of manual opening of hood 1 also the subsequent closing must be performed manually by the operator since piston 10 has not extended its stem.

[0024] On the contrary, if the operator decides for the

automatic opening of hood 1, as in Fig.5, at the end of the wash cycle piston 10 extends its stem pushing into rotation plate 9 around fulcrum A through rod 11 and pin B. As a consequence, plate 9 rotates plate 7 through the internal end of slot S that pushes on pin P. At the end of the opening run, plate 7 has reached the same position illustrated in Fig.4 but in this case the stem of piston 10 is extended and plate 9 is rotated whereby pin P is still abutting on the internal end of slot S.

[0025] As a consequence, also in the case of automatic opening the subsequent closing must be performed manually by the operator, since when piston 10 rotates plate 9 in the opposite direction, slot S slides with respect to pin P without causing the rotation of plate 7. To obtain also the automatic closing of the hood it is necessary to have plates 7 and 9 connected through a bidirectional restraint rather than the simple abutment of slot S on pin P; suitable means may be provided to this purpose to give the operator the choice of the type of hood drive.

[0026] However, in case of automatic closing the second plate 9 could be completely dispensed with, i.e. it would be possible to combine the two plates into a single plate 7 shaped to have an extension 9 to which rod 11 is pivoted. Moreover, in order to prevent damages to people or things during the automatic closing of the hood, there is provided a control system that stops the drive of piston 10 in case the hood finds an obstacle during its descent.

[0027] On the other hand, if one desires to retain the possibility of manual drive of hood 1 it is necessary to take into account the possibility that piston 10 locks with the extended stem in the position of Fig.5. In this case not even the manual closing of hood 1 would be possible since pin P of plate 7 would be locked by slot S of plate 9. Therefore, an emergency release mechanism for piston 10 has been provided that can be used in such a contingency, whereby the dishwasher can continue to be used in manual mode while waiting for the repair or replacement of piston 10.

[0028] Such a mechanism is illustrated in greater detail in Figs.8 and 9, where there is seen that the mobile support device 12 acting as a base for piston 10 includes a spring 16 that keeps taut cable 13 on which a mobile plate 17 is secured that has a hole 17a sized so as to allow the passage of piston 10. Said mobile plate 17 slides within a similar double fixed plate 18 provided with a hole 18a having the same size of hole 17a.

[0029] In the normal piston-supporting position, illustrated in Fig. 8, spring 16 maintains the mobile plate 17 partially outside of the double fixed plate 18 so that the two holes 17a, 18a are not aligned and the mobile plate 17 can support piston 10. In order to release the latter, it is sufficient for the operator to pull cable 13 through handle 15 so as to overcome the resistance of spring 16 and take the two holes 17a, 18a into alignment as shown in Fig.9, whereby piston 10 can descend by gravity through plates 17, 18. The descent of piston 10 is obviously equal to at least the extension of its stem, and is

limited by a stop collar 19.

[0030] The result of this emergency maneuver is illustrated in Fig. 6, where there is seen that the descent of piston 10 has caused the reverse rotation of plate 9 around fulcrum A thus restoring the position of the moving mechanism illustrated in Fig.4, same as if hood 1 had been opened manually. As a consequence, even if the stem of piston 10 remains extended, it is possible to perform the manual closing of hood 1 by rotating plate 7 as illustrated in Fig.7, thus returning to the initial position of the moving mechanism illustrated in Fig.3.

[0031] It should be noted that although plate 9 is illustrated arranged between plate 7 and the dishwasher back in order to facilitate the mounting of spring 8 on the outside of plate 7, it would also be possible to change the relative positions of these three elements as long as their rotation is unhampered.

[0032] As clearly illustrated in the above-mentioned figures, in this novel moving mechanism for hood 1 the arms of the forces exerted by the balancing springs 8 are not many times smaller than the arms of the weight of hood 1 as in conventional dishwashers. As a consequence, in order to move a hood of the same weight it is possible to use less strong and therefore cheaper and more reliable springs.

[0033] It is clear that the above-described and illustrated embodiment of the dishwasher according to the invention is just an example susceptible of various modifications. In particular, in addition to the possible modifications mentioned above, the exact number, shape and arrangement of the elements could be changed according to specific manufacturing needs, e.g. by changing the path of cable 4 with further idler wheels, as long as the passage over pulley 6 carried by rotatable plate 7 is retained. Furthermore, the mechanism could include more than two moving devices if hood 1 is mounted on a corresponding number of telescopic guides 3.

[0034] Similarly, piston 10 could be of any type (electric, hydraulic, pneumatic) as well as springs 8, and these elements could be replaced by other technically equivalent elements such as other types of actuators or other types of resilient members. By the same token, the emergency release mechanism for piston 10 can be made with other technically equivalent solutions, such as a lever system that drives the mobile plate 17 instead of cable 14 pulled taut by spring 16, and so on.

[0035] Finally, it should be noted that there are preferably provided, though not illustrated in the drawings, means for adjusting the length of cables 4, springs 8 and rods 11 (e.g. at one or more of the attachments 4', 4", 8', 8" and/or at pins B and C) in order to achieve a perfect alignment of the two devices making up the moving mechanism.

Claims

1. Hood-type industrial dishwasher including a hood (1)

- mounted on at least two vertical guides arranged on the rear wall of the stationary lower part of said dishwasher, said hood (1) sliding vertically along said guides with the help of balancing springs (8) suitable to limit the hood (1) opening/closing effort, **characterized in that** the at least two guides are telescopic guides (3) including sliding parts (2) on which the hood (1) is secured, the movement of said sliding parts (2) being driven by cables (4) on which said balancing springs (8) act through mobile pulleys (6) arranged on plates (7) that are mounted in a rotatable way on the dishwasher structure, as well as by at least one actuator (10) suitable to drive the rotation of said rotatable plates (7), said elements (2, 3, 4, 6, 7, 10) making part of the hood (1) moving mechanism being arranged on the back of the dishwasher.
2. Hood-type industrial dishwasher according to claim 1, **characterized in that** to each telescopic guide (3) there is associated a moving device comprising a cable (4), secured between a first attachment (4') arranged on the sliding part (2) of said telescopic guide (3) and a second attachment (4'') fixed on the dishwasher structure, at least an idler wheel (5) fixed on the dishwasher structure, a pulley (6) arranged on a plate (7) that is mounted in a rotatable way on the dishwasher structure through a fulcrum (A), and a balancing spring (8) pivoted between a first attachment (8') fixed on the dishwasher structure and a second attachment (8'') fixed on said plate (7) at a position intermediate between said fulcrum (A) and said pulley (6).
 3. Hood-type industrial dishwasher according to claim 1 or 2, **characterized in that** the hood (1) moving mechanism includes two identical moving devices arranged mirror-like with respect to the vertical mid-plane of the dishwasher and the actuator (10) is arranged at a central position such that it can drive both moving devices.
 4. Hood-type industrial dishwasher according to claim 3, **characterized in that** the actuator (10) is a piston whose stem is connected to each moving device through a rod (11) pivoted between said stem and a pin (B) located at the end of the relevant moving device.
 5. Hood-type industrial dishwasher according to claim 3 or 4, **characterized in that** each moving device further includes a second rotatable plate (9) pivoted on the same fulcrum (A) of the first rotatable plate (7), the connection between said plates (7, 9) being achieved through a pin (P) fixed on the first plate (7) which slidably engages a slot (S) formed in the second plate (9), said slot (S) being shaped like an arc of circle centered on the fulcrum (A) and said pin (P) being located on the first plate (7) so as to abut on the internal end of the slot (S) when the hood (1) is closed.
 6. Hood-type industrial dishwasher according to the preceding claim, **characterized in that** it further includes means for achieving a bidirectional restraint between the two plates (7, 9).
 7. Hood-type industrial dishwasher according to any of claims 1 to 5, **characterized in that** it further includes a release mechanism for the actuator (10) suitable to drive the movement of a mobile support device (12) acting as a base for the actuator (10), between a supporting position and releasing position in which the actuator (10) can descend by gravity through a distance at least equal to the extension of its stem.
 8. Hood-type industrial dishwasher according to the preceding claim, **characterized in that** the mobile support device (12) is driven by a cable (13) that slides on wheels (14) secured on the dishwasher structure and ends with a handle (15).
 9. Hood-type industrial dishwasher according to the preceding claim, **characterized in that** the mobile support device (12) includes a spring (16) that keeps taut the cable (13) on which a mobile plate (17) is secured that has a hole (17a) sized so as to allow the passage of the actuator (10), said mobile plate (17) sliding within a double fixed plate (18) provided with a hole (18a) having the same size of said hole (17a) of the mobile plate (17).
 10. Hood-type industrial dishwasher according to any of the preceding claims, **characterized in that** it further includes a control system suitable to stop the drive of the actuator (10) in case the hood (1) finds an obstacle during its descent.
 11. Hood-type industrial dishwasher according to any of the preceding claims, **characterized in that** it further includes means for adjusting the length of the cables (4) and/or of the springs (8) and/or of the rods (11) suitable to achieve an alignment of the devices making up the moving mechanism.
- Amended claims in accordance with Rule 137(2) EPC.**
1. Hood-type industrial dishwasher including a hood (1) mounted on at least two vertical guides arranged on the rear wall of the stationary lower part of said dishwasher, said hood (1) sliding vertically along said guides with the help of balancing springs (8) suitable to limit the hood (1) opening/closing effort, the at least two guides being telescopic guides (3)

including sliding parts (2) on which the hood (1) is secured, the movement of said sliding parts (2) being driven by cables (4) on which said balancing springs (8) act through mobile pulleys (6) arranged on plates (7) that are mounted in a rotatable way on the dishwasher structure, as well as by at least one actuator (10) suitable to drive the rotation of said rotatable plates (7), said elements (2, 3, 4, 6, 7, 10) making part of the hood (1) moving mechanism being arranged on the back of the dishwasher, **characterized in that** it further includes a release mechanism for the actuator (10) suitable to drive the movement of a mobile support device (12) acting as a base for the actuator (10), between a supporting position and releasing position in which the actuator (10) can descend by gravity through a distance at least equal to the extension of its stem.

2. Hood-type industrial dishwasher according to the preceding claim, **characterized in that** the mobile support device (12) is driven by a cable (13) that slides on wheels (14) secured on the dishwasher structure and ends with a handle (15).

3. Hood-type industrial dishwasher according to the preceding claim, **characterized in that** the mobile support device (12) includes a spring (16) that keeps taut the cable (13) on which a mobile plate (17) is secured that has a hole (17a) sized so as to allow the passage of the actuator (10), said mobile plate (17) sliding within a double fixed plate (18) provided with a hole (18a) having the same size of said hole (17a) of the mobile plate (17).

4. Hood-type industrial dishwasher according to any of the preceding claims, **characterized in that** to each telescopic guide (3) there is associated a moving device comprising a cable (4), secured between a first attachment (4') arranged on the sliding part (2) of said telescopic guide (3) and a second attachment (4'') fixed on the dishwasher structure, at least an idler wheel (5) fixed on the dishwasher structure, a pulley (6) arranged on a plate (7) that is mounted in a rotatable way on the dishwasher structure through a fulcrum (A), and a balancing spring (8) pivoted between a first attachment (8') fixed on the dishwasher structure and a second attachment (8'') fixed on said plate (7) at a position intermediate between said fulcrum (A) and said pulley (6).

5. Hood-type industrial dishwasher according to any of the preceding claims, **characterized in that** the hood (1) moving mechanism includes two identical moving devices arranged mirror-like with respect to the vertical midplane of the dishwasher and the actuator (10) is arranged at a central position such that it can drive both moving devices.

6. Hood-type industrial dishwasher according to claim 5, **characterized in that** the actuator (10) is a piston whose stem is connected to each moving device through a rod (11) pivoted between said stem and a pin (B) located at the end of the relevant moving device.

7. Hood-type industrial dishwasher according to claim 5 or 6, **characterized in that** each moving device further includes a second rotatable plate (9) pivoted on the same fulcrum (A) of the first rotatable plate (7), the connection between said plates (7, 9) being achieved through a pin (P) fixed on the first plate (7) which slidably engages a slot (S) formed in the second plate (9), said slot (S) being shaped like an arc of circle centered on the fulcrum (A) and said pin (P) being located on the first plate (7) so as to abut on the internal end of the slot (S) when the hood (1) is closed.

8. Hood-type industrial dishwasher according to the preceding claim, **characterized in that** it further includes means for achieving a bidirectional restraint between the two plates (7, 9).

9. Hood-type industrial dishwasher according to any of the preceding claims, **characterized in that** it further includes a control system suitable to stop the drive of the actuator (10) in case the hood (1) finds an obstacle during its descent.

10. Hood-type industrial dishwasher according to any of the preceding claims, **characterized in that** it further includes means for adjusting the length of the cables (4) and/or of the springs (8) and/or of the rods (11) suitable to achieve an alignment of the devices making up the moving mechanism.

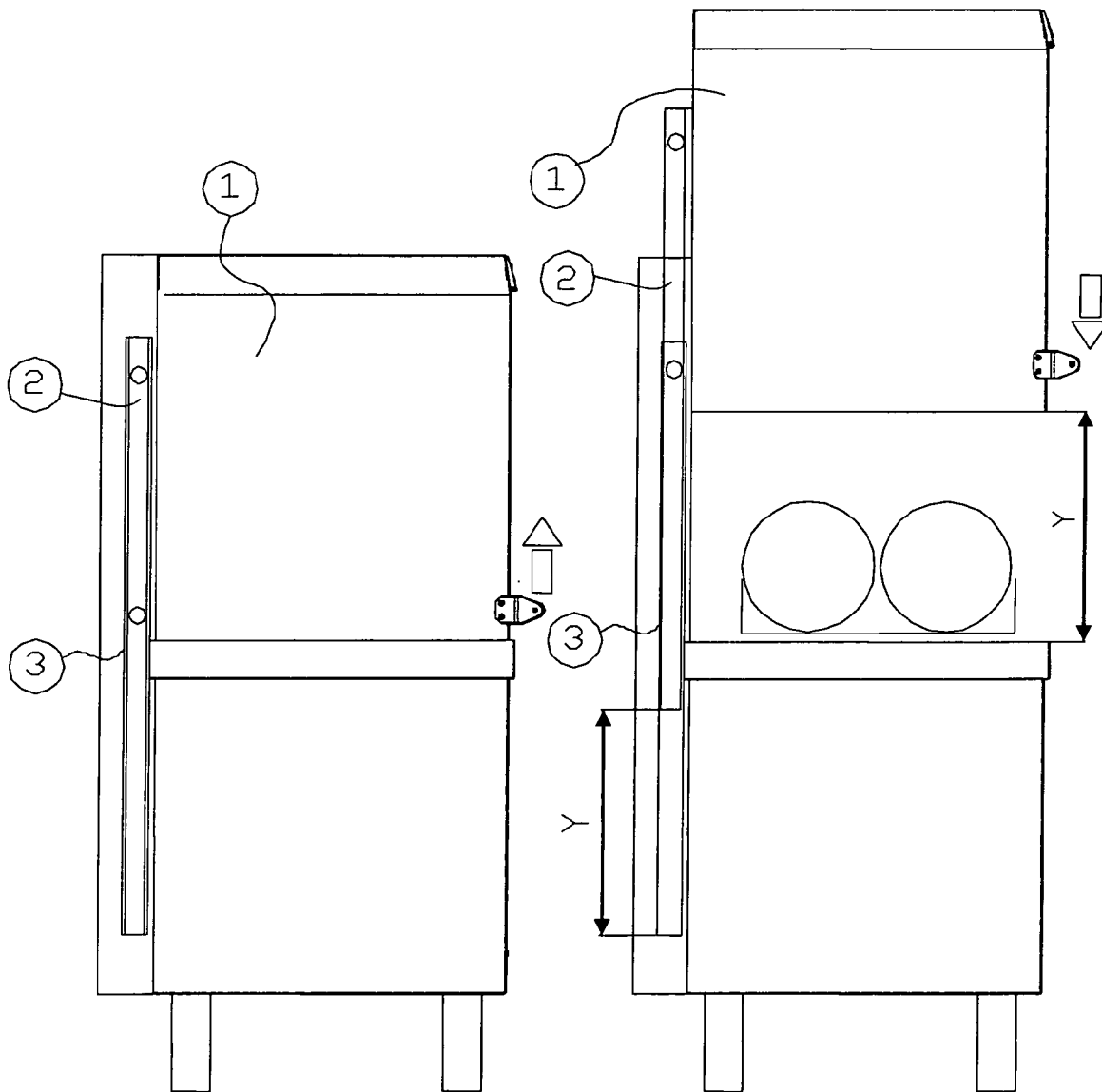


Fig.1

Fig.2

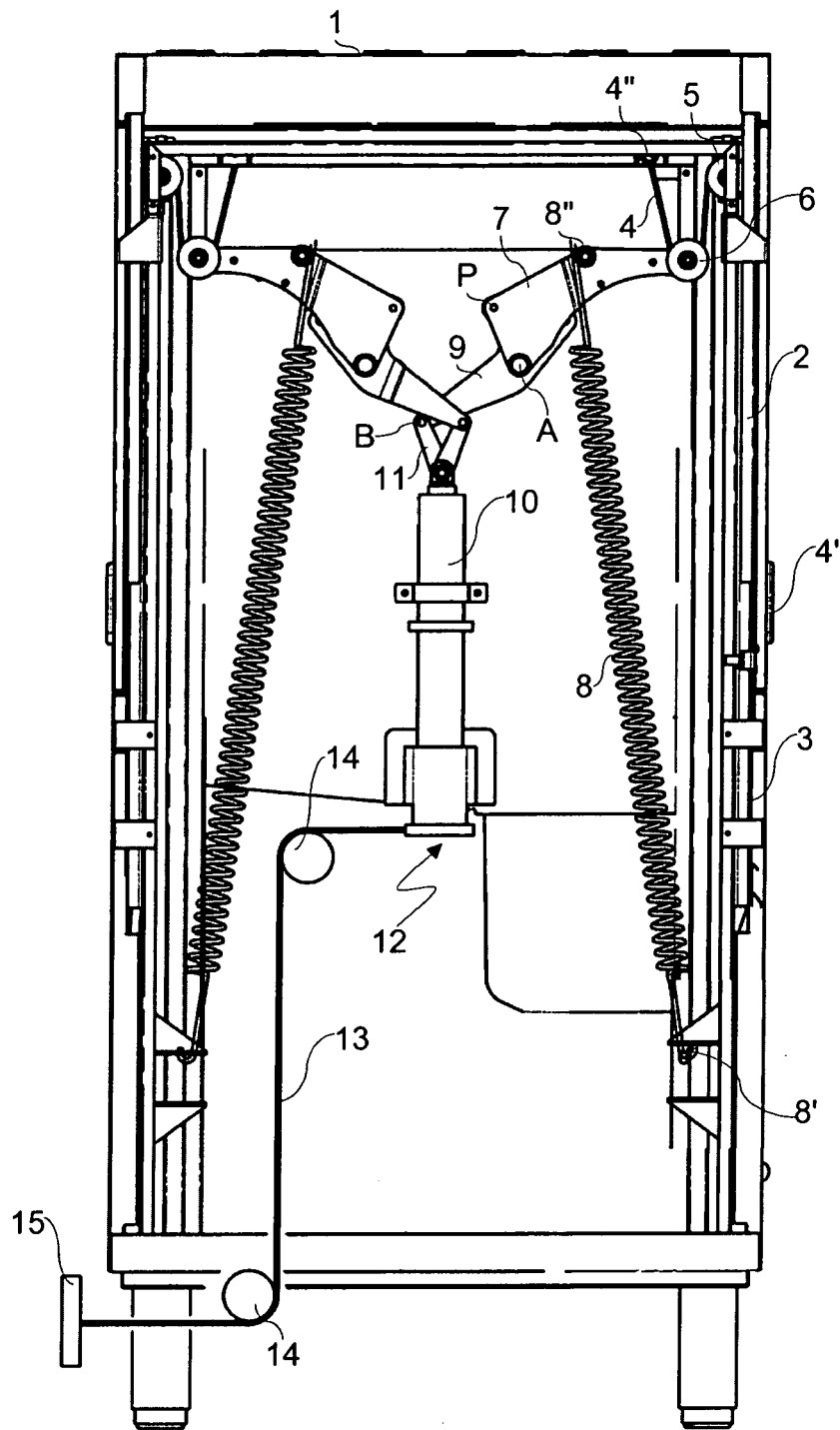


Fig.3

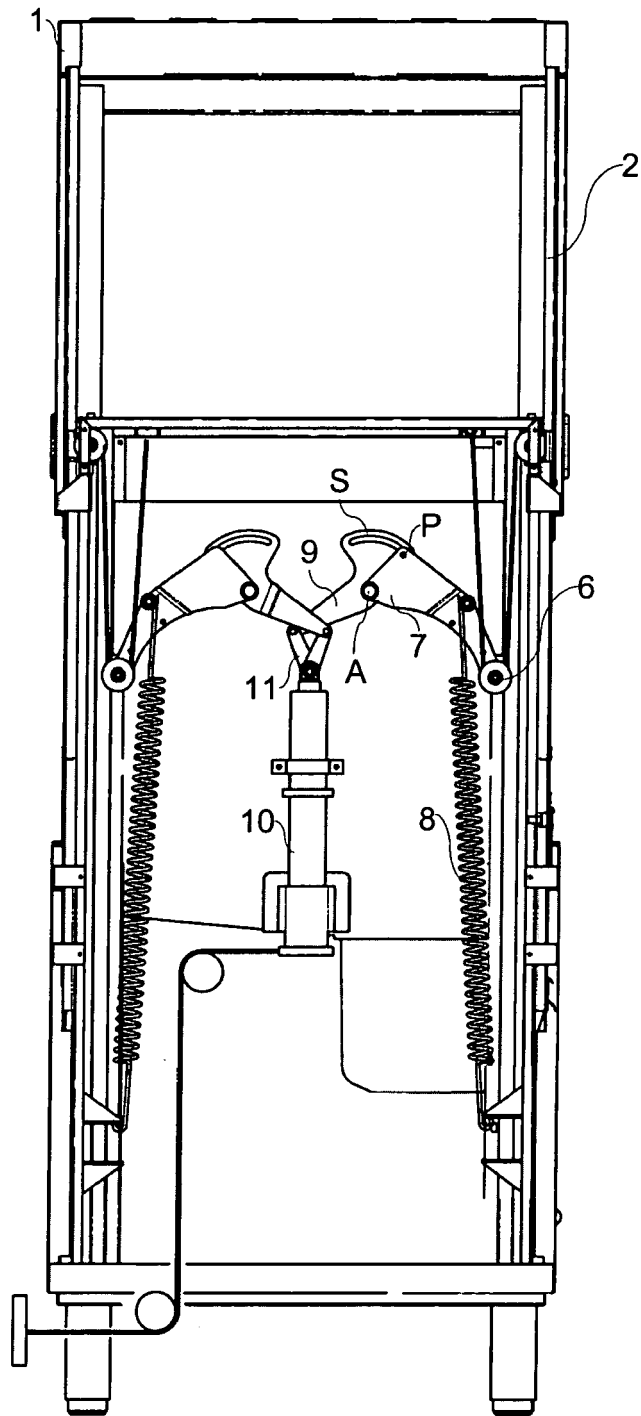


Fig.4

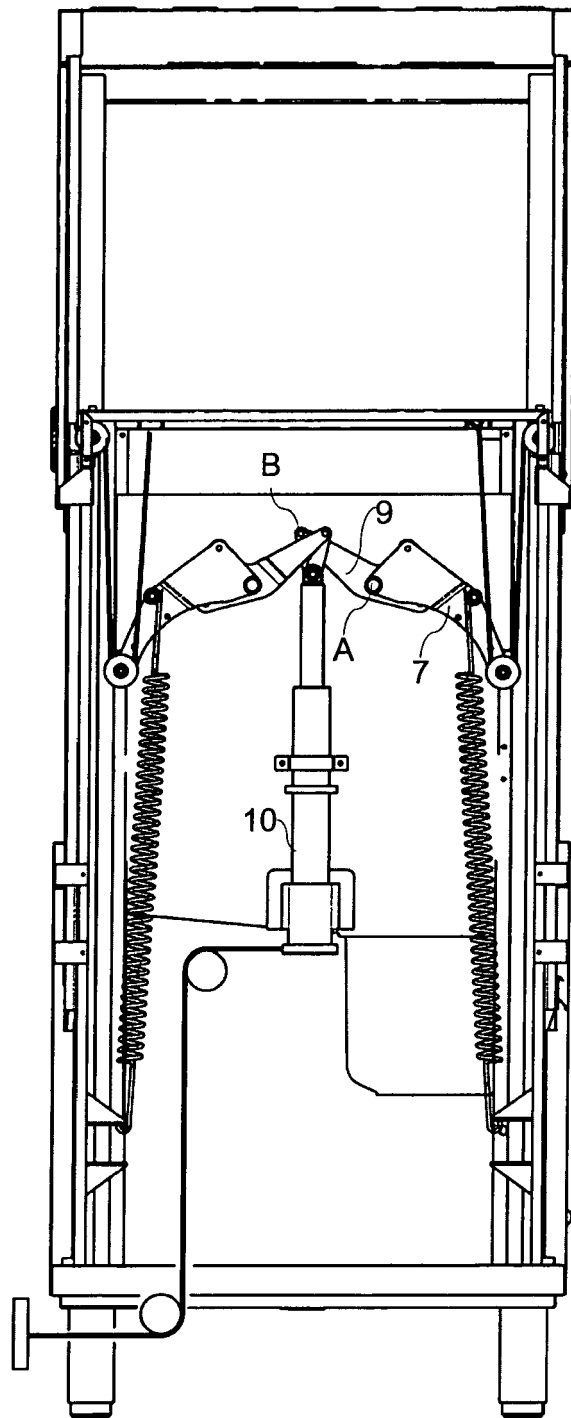


Fig.5

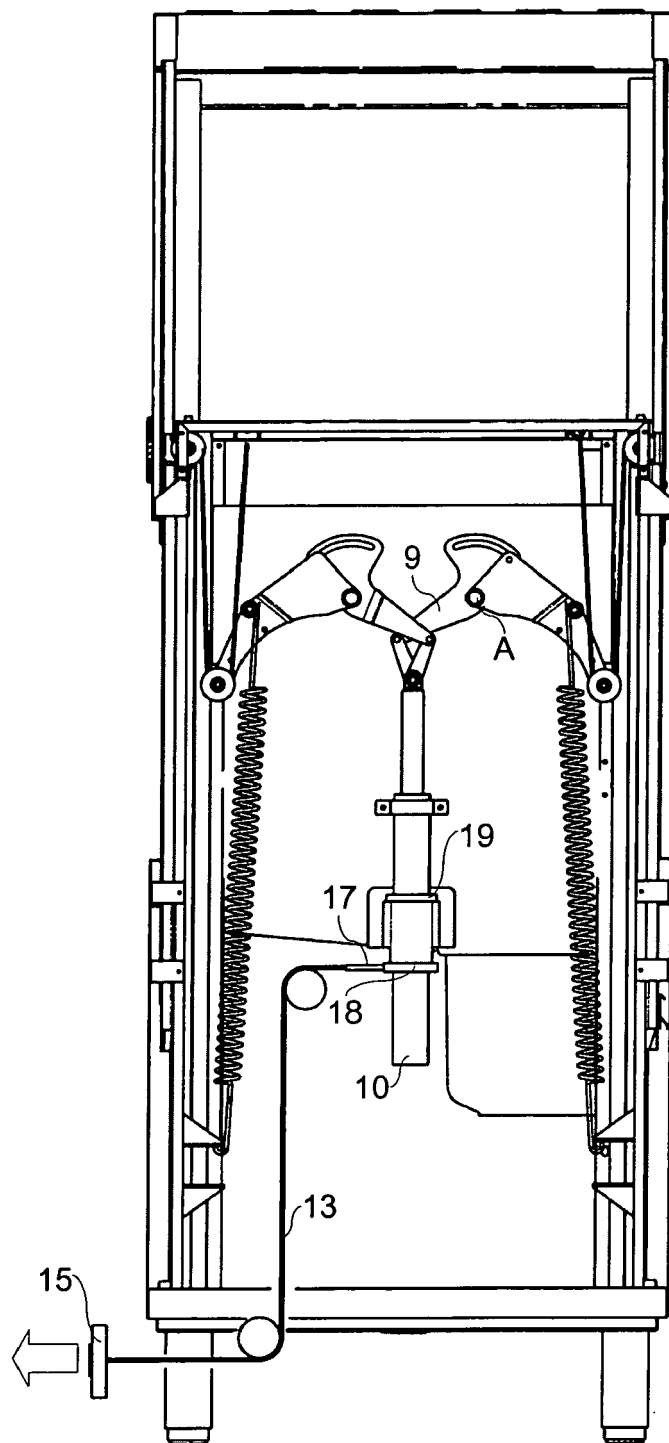


Fig.6

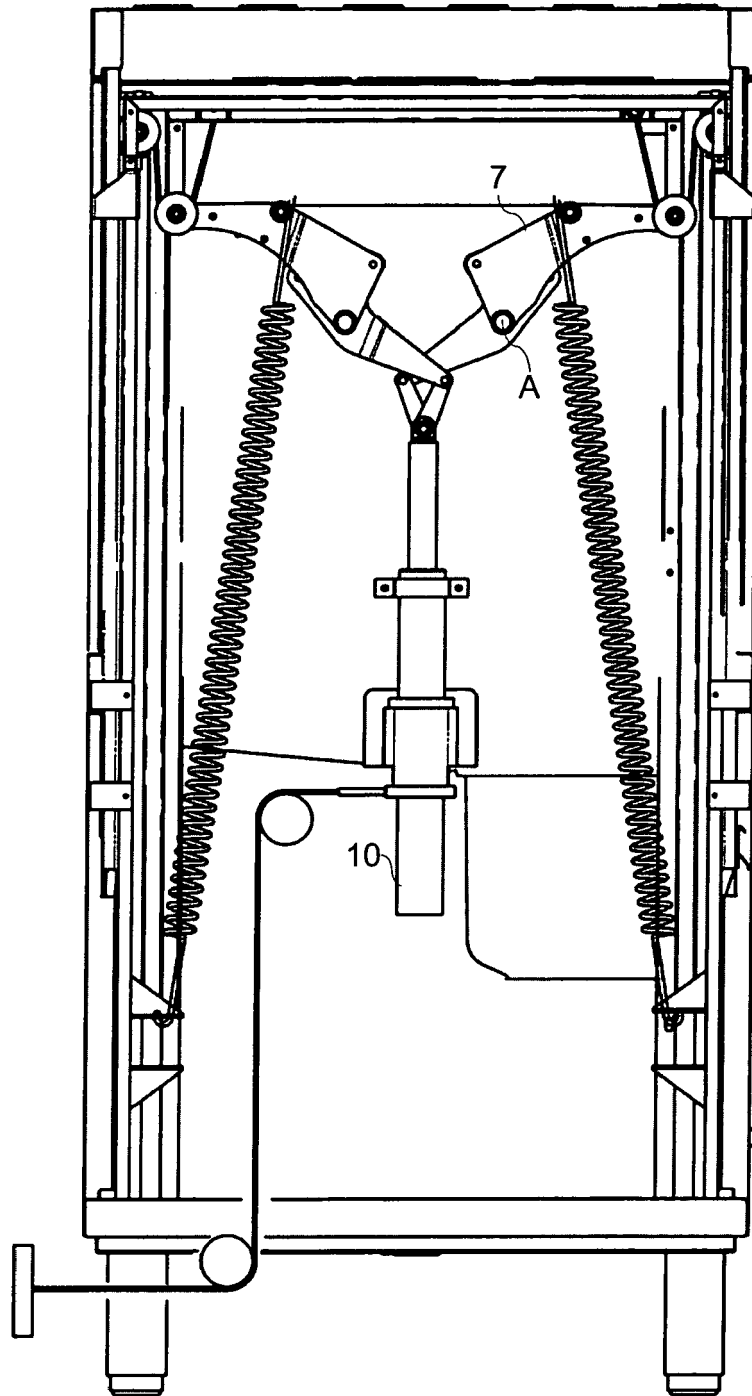


Fig.7

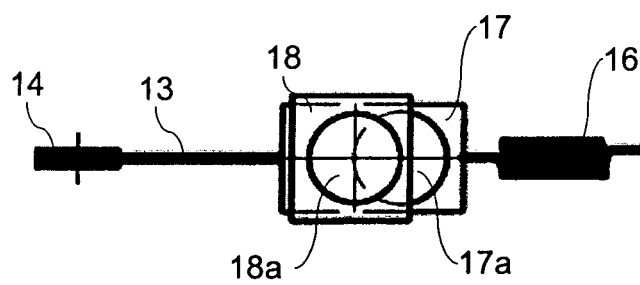
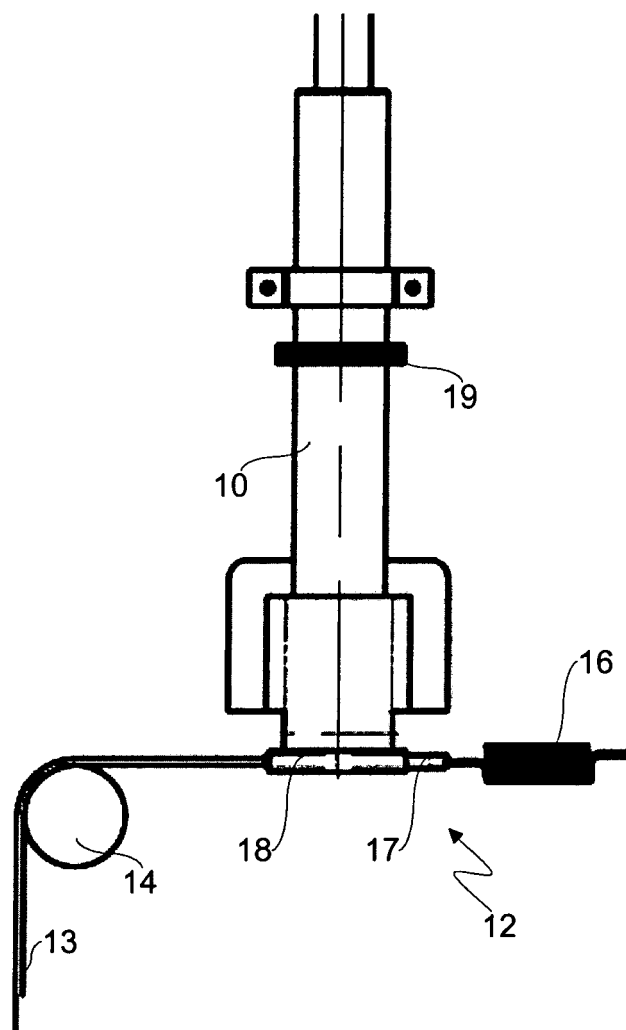


Fig.8

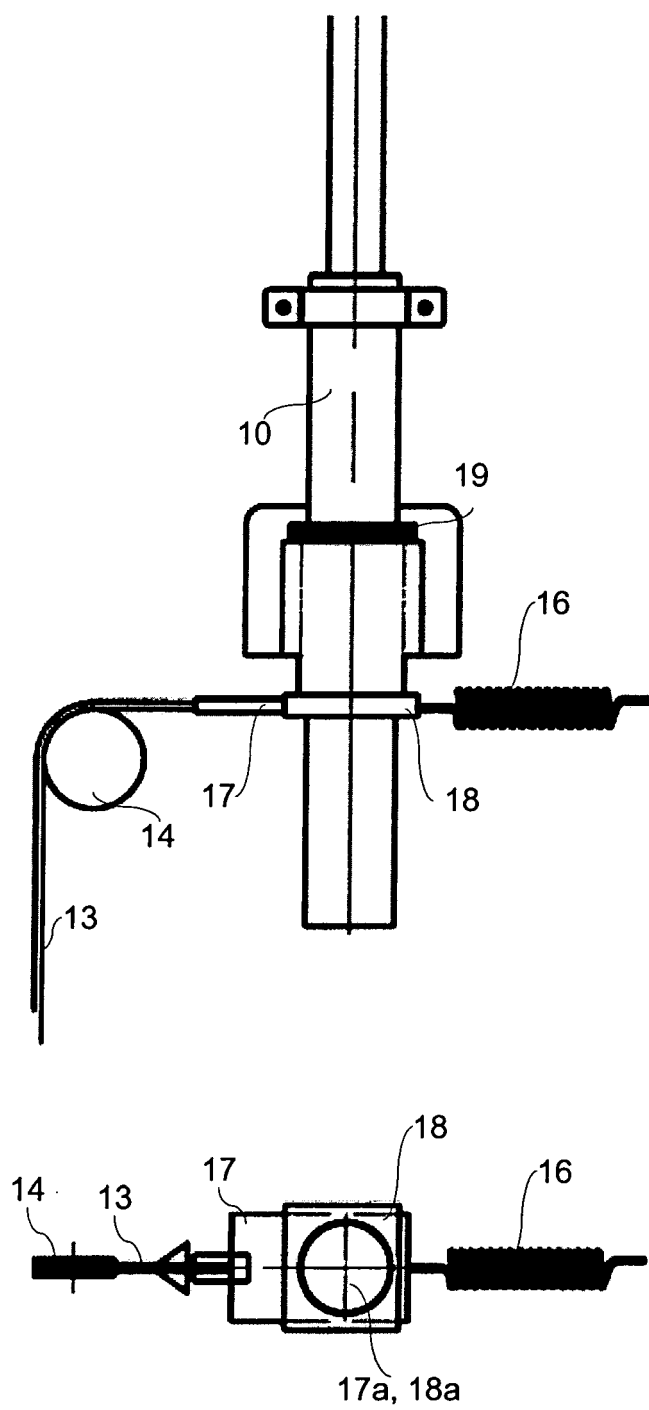


Fig.9



EUROPEAN SEARCH REPORT

Application Number
EP 09 42 5425

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
E	EP 2 165 636 A1 (BONFERRARO SPA [IT]) 24 March 2010 (2010-03-24) * column 5, paragraph 26 - column 6, paragraph 35; claims 1-10; figures 5-9 *	1-6,10, 11	INV. A47L15/42
A	EP 1 203 864 A2 (WINTERHALTER GASTRONOM GMBH [DE]) 8 May 2002 (2002-05-08) * the whole document *	1-11	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A47L
Place of search		Date of completion of the search	Examiner
Munich		14 April 2010	Lodato, Alessandra
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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14-04-2010

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