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(54) **Water-jet washing valve**

(57) A valve for water-jet washing comprises:

- an adjustable body (5),
- a mobile shutter (2) that deflects the jet of water coming from the outlet (30) in directions that are transversal to the outflow direction (A).

This valve is characterised by further comprising:

- an external adaptor support (19), suitable for being fastened to a wall (20) and provided with a sliding seat (33) that can house the adjustable body (5) and allows sliding along a predetermined adjustment direction (S),
- one or more adjustment spacer elements (22, 23), for setting the relative position (H) of the adjustable body (5) with respect to the external adaptor support (19), at least along a direction not orthogonal to the mentioned predetermined adjustment direction (S),.

Furthermore, a method for fixing this valve to the wall (20) is described.

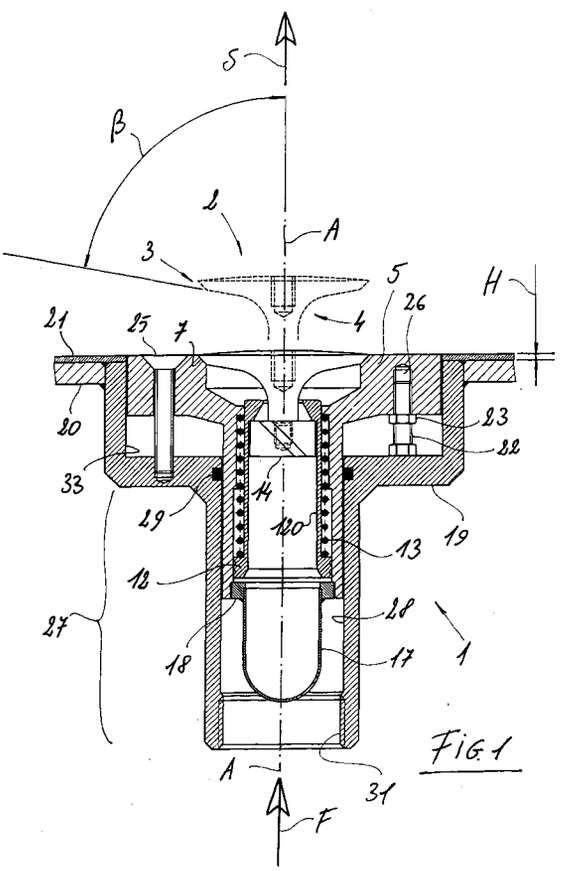

FIG.1

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Description

Field of the invention

[0001] This invention regards a valve for washing ships with water-jets, in particular for protecting war ships against fire, and chemical and nuclear attacks.

Background Art

[0002] In order to protect aircraft carriers or other war ships from chemical or nuclear attacks or fire, a known technique involves the installation of nozzles which, in case of alarm, eject liquid jets which cover the whole ship - or as much as its exposed surface as possible - with a film of water that washes away into the sea the chemical or biological agents or the radioactive particles, avoiding that they penetrate inside the ship.

[0003] Different types of nozzles or washing valves are used depending on the inclination of the walls to be sprinkled -e.g. vertical walls or however substantially inclined walls, horizontal walls or walls with a substantially little slope.

[0004] Horizontal or slightly inclined surfaces, such as aircraft carrier runways or landing strips, are generally sprinkled with valves called «deck washing valves», which usually emit a jet of water under the form of a relatively thin membrane that spreads in a practically horizontal direction with an opening angle equal to or minor than 360°.

[0005] Known deck washing valves include a mush-room-shaped shutter that lifts vertically, due to water pressure or when an opening command is given, producing a jet of water of the shape described above.

[0006] The aircraft carrier runway or landing strip is generally covered with numerous valves of this type - even hundreds - so that it may be completely washed by the protective film of water.

[0007] The runway is composed of several layers of different materials. The last layer is made of synthetic material and presents a thickness that may vary even millimetres from zone to zone due to reasons such as dimensional imprecision when laying the asphalt itself, deformation and wear from usage, poorly done maintenance operations such as local repairs and patching .

[0008] Today, different types of deck washing valves are known in the art.

[0009] For example, in one type the body, in which the seat of the mush-room shaped valve is made, is threaded externally and is screwed inside an internally threaded sleeve or annular seat; the sleeve or annular seat is welded to the steel plate of the ship's deck underneath the layer of asphalt; the vertical position of the body holding the valve seat with respect to the ship's deck is determined by a mechanical stop or abutting end present on the body itself.

[0010] In another type, the height of the body holding the valve seat is also determined by an abutting end or a mechanical stop present on the body itself; but instead of the body being screwed inside an internally threaded body, it's fixed with nut + bolt fastenings to the outer-most plate of the deck.

[0011] For the deck washing valve's correct operation, extremely important is the height of the mobile shutter and its seat, in the closed position, with respect to the external surface of the ship's deck or to the external wall on which they are installed. In fact the mobile shutter, when it is in the low position and the valve is closed, it must present as less edges and vertical protrusions as possible, so that walking on the deck, or the takeoff and landing of aircrafts, is obstructed as less as possible. In particular, it should not be positioned too high above the deck's surface, but at the same time it must not be positioned too low underneath the deck's surface, since in this case the raised edges of the opening in the deck that holds the valve would deviate the jet of water, thus not allowing it to propagate with a slight inclination with respect to a horizontal plane, or in any case in the directions required.

[0012] For various reasons, during the life of a ship it may be necessary to modify the height of the washing valves with respect to the deck's external surface or to any other external surface on which the valve is installed. For example, after localized repair operations of the deck that modify the level of the deck's surface; or during the construction of the deck itself, which is carried out by laying and levelling the outer-most layer of synthetic material - which must be as flat as possible - onto the underlying steel layers which, due to the ship's large dimensions and the inevitable building tolerances, may present errors in planarity of up to 20-30 mm from one zone to another. In both types of valves described above, the height of the valve was determined by means of a fixed mechanical stop between the valve seat and a steel wall of the deck, and - after laying the deck's outer-most layer of synthetic material - it's necessary to realign the position of each washing valve with respect to the external surface.

[0013] In both of the above described solutions, the valve's height adjustment was very difficult and sometimes impossible. It was also quite imprecise, and usually was done with improvised methods: if the sleeve or the annular seat of the valve is welded to a metal wall of the deck, valve height adjustment sometimes required to un-weld the supporting annular body.

[0014] What's more, both height adjustment solutions require the possibility of reaching the valve from under the deck, which is sometimes impossible or hindered due to numerous pipes, electric cables and other mechanical devices installed under the deck itself after the valves are mounted.

[0015] One of the problems faced by the present invention is that of supplying a deck washing valve that allows a more rapid and precise height adjustment with respect to the deck's surface, even if the valve cannot be reached from underneath the deck.

[0016] This problem, according to a first aspect of the present invention, is solved with a water-jet washing valve that includes:

- an adjustable body in which an outlet of a washing nozzle is made for ejecting a jet of liquid along a predetermined outflow direction;
- a mobile shutter comprising a plate part suitable for deflecting the jet of liquid coming from the washing nozzle outlet in directions that are transversal to the above mentioned predetermined outflow direction; the mentioned shutter is movably connected to the adjustable body and is suitable for opening, by rising the outlet, and/or for closing it by descending.

[0017] Furthermore the water-jet washing valve is characterised by:

- an external adaptor support, suitable for being fixed to the wall on which the aforesaid valve is installed; the external adaptor support is equipped with a sliding seat whose open side faces the outer surface of the wall when the valve is installed on the wall itself; the sliding seat is suitable for housing the adjustable body, and allows it to slide, with respect to the aforesaid external adaptor support, at least according to a predetermined adjustment direction;
- fastening means, suitable for fastening the adjustable body to the external adaptor support;
- one or more adjustment spacer elements, set between the adjustable body and the external adaptor support so that they lean against both, therefore determining the position of the adjustable body with respect to the external adaptor support, at least along a direction not orthogonal to the predetermined adjustment direction.

[0018] According to a second aspect of the invention, the problem is solved with a method for setting a valve as defined above, said method being characterised by comprising the step of permanently fastening the external adaptor support to the wall to which the valve is to be installed, for example by welding it.

[0019] The external adaptor support can be fastened permanently to the wall on which the valve is to be installed for example by welding it to the deck or other surface of the ship. Since the open side of the external adaptor support's sliding seat faces the outer side of the wall, the adjustable body - which holds the spraying nozzle and the mobile shutter seat within the sliding seat - can be inserted or removed from this seat from the upper side of the deck, or in any case from the outside of the ship's wall on which the valve is installed, and therefore even if access from inside the deck or the wall is obstructed by pipes, electric cables and other devices. The spacer elements allow a rapid and precise regulation of the adjustable body's height with respect to the valve's surface

List of figures

[0020] Further advantages of the present invention will result more evident to a person skilled in the sector from the following detailed description of non limiting embodiments.

Figure 1 shows a schematic side view of a cross-section of a first example of a valve for generating water-jets according to the present invention;
Figure 2 shows a schematic top view of the valve of Figure 1;
Figures 3-3A respectively show a plan and schematic side view of the valve's vortex generator of Figure 1;
Figure 4 shows a schematic side cross-view of the valve's adjustable body in Figure 1;
Figure 5 schematically shows a side cross-section of the valve's cursor in Figure 1;
Figure 6 shows in prospective a schematic view of a second example of a valve for generating washing water-jets according to the present invention;
Figure 7 shows in prospective a schematic view of a third example of a valve for generating washing water-jets according to the present invention.

Detailed description

[0021] The enclosed Figures regard a preferred embodiment of a deck washing valve according to the present invention, indicated with the overall reference numeral 1.

[0022] The valve 1 comprises a body 5 - indicated in the present description as adjustable body 5 (Figures 1, 4) - in which the outlet 30 of a washing nozzle is made, that produces a liquid jet along a predetermined outflow direction A.

[0023] The deck washing valve further comprises a mobile shutter 2, also called simply shutter 2 in this description, which in turn comprises a plate part 3 for deflecting the liquid jet coming from the outlet 30 in directions that are transversal to outflow direction A , and a stem 4 (Figure 1).

[0024] The outlet 30 also defines the seat 7 in which the mobile shutter 2 rests when closes the outlet 30 itself in the low position.

[0025] In the example in Figure 1, the shutter's seat 7 has a frustoconical shape, suitable for coupling with a correspondent frustumconical surface made in the outer part of the lower side of the shutter's plate 3 when the mobile shutter 2 itself is lowered in its rest position and closes the deck washing valve 1.

[0026] The adjustable body 5 has an upper side, facing the outer surface of the valve, with an appropriately flat surface and no protrusions; the plate part 3 of the mobile shutter's head and the seat 7 of the shutter 2 have such shapes and couple so that, when the shutter 2 is lowered in the rest position, the deck washing valve

1 presents an upper surface, facing outwards, that is as flat as possible. This allows to obstruct as less as possible the movement of vehicles with wheels and the walking of the crew. In the embodiment of Figure 1, the upper surface of the shutter's head 4 is not exactly flat, but has the shape of a spherical cap with a sufficiently large radius of curvature.

[0027] In the example in Figures 1, 4, the upper part of the valve seat body 5 has the shape of a flange 10 with a thickness that allows to make in it the seat 7 of the shutter; the flange 10 has a substantially cylindrical lateral surface 8 with a circular cross-section; in its lower part, the diameter of the adjustable body 5 decreases sharply, and defines a tubular stem 9 with a virtually cylindrical shape.

[0028] The inside of the tubular stem 9 presents a seat 11 for holding another substantially tubular shaped body 12 (Figures 1, 4), which itself is hollow inside and has an approximately cylindrical external shape; in the present description the tubular body 12 will be referred to as cursor 12. Inside the cursor seat 11, and around the cursor 12, in some cases there may be a spiral compression spring 13.

[0029] A vortex generator 14 is housed inside the cursor 12. In the example in Figures 3, 3A, the vortex generator 14 is made as a cylindrical body equipped with helically inclined notches that, as explained further on, confer a rotational component to the water that flows through the internal cavity 120 of the cursor 12.

[0030] The vortex generator 14 is fixed - for example, though not necessarily - by screwing to the rod 4 of the mobile shutter 2. The rod 4, when the valve is assembled, goes through the opening 15 in the upper end of the cursor 12 and with dimensions that avoid the vortex generator 14 from passing through it. On the inside of the cursor 12 an annular shoulder 16 is made against which the vortex generator 14 stops when the mobile shutter 2 if lifted. For this reason, the vortex generator 14 is positioned along the mobile shutter's stem 4 at a level which, when the plate 3 rises to let out the liquid jet, allows the vortex generator 14 to stop against the shoulder 16 of the cursor 12, pulling the cursor 12 itself upwards.

[0031] The lower end of the tubular stem 9 may be closed by a filter 17.

[0032] The operation per se known of the shutter 2 and the cursor 12 of the deck washing valve is the following.

[0033] The water to be sprayed with the valve 1 arrives under pressure from a feeding duct not shown, and advances in the direction indicated by the arrow F of Figure 1. It goes through the filter 17, the internal cavity 120 of the cursor 12 and, through the opening 15, it presses on the lower surface of the mobile shutter 2, lifting it if feeding pressure is greater than the force of the compression spring 13. This causes the outer edge of the vortex generator 14 to stop against the annular shoulder 16 of the cursor 12, and pulls the cursor 12 itself upwards.

[0034] The balance between out-flowing water pressure on the mobile shutter 2 and the force of the spring 13 determines a substantially stable open position of the deck washing valve 1.

[0035] As it flows out, the water flows through and around the vortex generator 14 and receives a rotational component around the axis of the vortex generator 14 and of the internal cavity 120 of the cursor 12; deviated by the lower surface of the shutter's plate 3, the water produces a liquid film jet, coming out from the adjustable body 5, with the shape of an umbrella, a hollow cone, or a fan. Depending on the shape of the mobile shutter 2, the liquid jet initially moves along flow lines that are transversal to outflow direction A. Approximately, the β angle that the outflow direction of the jet forms with the outflow axis A of the nozzle 30, in the embodiment shown, is of about 80°.

[0036] The height H with respect to the surface of the outermost layer of the deck 21 - or in any case to the wall to which the deck washing valve 1 is fixed - at which the adjustable body 5 must be positioned also depends on the angle β of the valve. The outermost layer of the deck 21, for example, may be made of synthetic or other appropriate material.

[0037] The liquid jet can be deviated by the mobile shutter 2 asymmetrically with respect to the outflow axis A, in order to obtain a membrane-shaped jet with an opening angle - around axis A - of 360°. It can also be deviated non asymmetrically, therefore creating a membrane-shaped jet with an opening angle - around axis A - minor than 360°, for example of 180°.

[0038] If water pressure returns below the programmed opening value, the compression spring 13 recloses the mobile shutter 2 against the seat 7 closing the outflow nozzle; without the spring, the mobile shutter 2 descends by gravity.

[0039] According to the present invention, the deck washing valve 1 includes an external adaptor support 19 (Figure 1) suitable for being fixed to the wall 20 on which the valve 1 itself must be installed. On the external adaptor support 19 a sliding seat 33 is made, the open side of which faces the outer surface of the wall 20 on which the deck washing valve 1 is installed; the sliding seat 33 is suitable for housing the adjustable body 5, and for allowing it to slide, with respect to the external adaptor support 19, at least along a predetermined adjustment direction S; in the example shown in Figures 1-5, the adjustment direction S is parallel to the outflow direction A. The steel wall 20 is the outermost layer of the ship's deck, and is covered by the lining 21.

[0040] Still with reference to the embodiment of Figures 1, 2, the external adaptor support 19 is permanently welded to the steel wall 20, but of course it can also be fastened with other methods, such as bolting, without departing from the scope of the present invention.

[0041] Furthermore, the deck washing valve 1, according to the present invention, comprises:

- fastening means 25, suitable for fastening the adjustable body 5 to the external adaptor support 19;
- one or more adjustment spacer elements 22, 23 set between the adjustable body 5 and the external adaptor support 19 so that they lean against both and determine the position of the adjustable body 5 with respect to the external adaptor support 19, at least along a direction not orthogonal to the mentioned predetermined adjustment direction S.

[0042] In the example of Figures 1-5, the fastening devices 25 consist of screws, which are inserted in the corresponding threaded seats of the adaptor support 19; they go through appropriate holes of the adjustable body 5, and close the valve 1 by pulling down the adjustable body 5 itself and fastening it firmly to the external adaptor support 19. The height H (Figure 1) of the adjustable body 5 with respect to the external adaptor support 19 - and therefore with respect to the level of the deck's walkway or the ship's runway - is adjusted using the regulation screws 22 and the locknuts 23. The adjusting screws 22 are inserted in appropriate threaded seats 26 (Figures 1, 4) of the external adaptor support 19, and for example have a thread axis that is just about parallel - or in any case not perpendicular - to the adjustment direction S. In other words, the screws 22 act as mechanical stops that lean, with the part that sticks out of the threaded seat 26, against the bottom 24 of the external adaptor support's sliding seat 33. Screwing or unscrewing the screws 22 allows to vary the length of the segment that protrudes from the adjustable body's threaded seat 26 (Figures 1, 4), and therefore the height H at which the adjustable body 5 itself is positioned with respect to the external adaptor support 19. After adjustment, the screws 22 can be locked in the desired position by means of locknuts 23.

[0043] The screws 22 allow to accurately adjust height H.

[0044] In the embodiment of Figures 1, 2 the adjusting screws 22 are screwed in the adjustable body 5 and lean against a part of the external adaptor support 19. As an alternative, without departing from the scope of the present invention, they can be screwed in appropriate threaded holes made in the external adaptor support 19, and lean against a part of the adjustable body 5. This alternative - not shown - offers the advantage of obtaining threaded seats for the adjustment screws 22 that are deeper than those that can be sometimes obtained in the adjustable body 5. In many cases in fact, for various reasons - for example the ease of maintenance or for saving storage space - it is desired to limit weight and dimensions of the adjustable body 5 . Advantageously the external adaptor support 19 also encloses - in part or for its entire length - the tubular stem 9 of the adjustable body 5, and the external adaptor support 19 itself extends downwards with the tubular stem 27 (Figure 1) at the end of which a seat or fastening area 31 is made, to which the valve's feeding duct (not shown) can be fastened. In the embodiment shown, the fastening area 31 consists of a threaded seat inside the tubular stem 27. As an alternative, the threaded seat may be outside of the tubular stem 27, or may also be a non threaded seat of another type.

[0045] This allows the adjustable body 5 to be easily extracted from the external adaptor support 19, or adjusted in height, without the need of disconnecting or varying the height of the water's feeding duct.

[0046] In the internal cavity 28 of the external adaptor support's tubular stem 27, a sealing element 29 - an O-ring in the example in Figure 1 - can be optionally mounted with the following functions:

a) it avoids that the filth present on the ship's deck, but mainly the radio-active dusts or toxic substances that may be present on the outside of the ship during a nuclear, chemical or biological attack, penetrate inside the ship itself through the perimeter clearance between the adjustable body's flange 10 and the external adaptor support 19;
b) it avoids water leakage between the tubular stem 9 of the adjustable body 5 and the tubular stem 27 of the external adaptor support during water pumping.

[0047] To adjust the height of the adjustable body 5, the closing screws 25 are unscrewed, the adjustable body 5 is removed from the external adaptor support 19, and the length of screws 22 protruding from the adjustable body 5 is adjusted; the deck washing valve 1 is then reassembled by reinserting the adjustable body 5 into the external adaptor support 19 and fastening it with the screws 25.

[0048] Using the screws 25 for fastening the adjustable body 5 allows to quickly carry out disassembly and reassembly of the adjustable body 5 - for example for deck washing valve maintenance or cleaning. In fact, the socket screws 25 can be screwed and unscrewed not only using a hand wrench, but also with electrical or even pneumatic screwdrivers.

[0049] Adjusting the screws 22 is also very quick: in this way it's possible to easily and quickly align the body 5 with the level of the outermost layer 21 of the ship's deck when the latter is redone or in any case when its thickness varies.

[0050] The above mentioned advantages are even more interesting if you consider the large number - even hundreds - of deck washing valves usually installed on a war ship, in particular on an aircraft carrier.

[0051] The embodiments described above may be subject to several modifications and variations without departing from the scope of the present invention. For example, the fastening means suitable for fastening the adjustable body 5 on the external adaptor support 19, instead of being screws 25 in the external adaptor support 19, can comprise

- a male thread 34, provided for example on the lateral surface 8 (Figure 6) of the adjustable body 5, and
- a corresponding female threaded seat 35 obtained inside the sliding seat 33 of the external adaptor support 19.

[0052] This allows to screw the adjustable body 5 directly into the external adaptor support 19. The adjustment screws 22 can be screwed into the adjustable body 5 with axes that are unparallel to the direction S along which the height H of the adjustable body 5 itself is adjusted. In general, the adjustment spacer elements 22, 23, instead of adjustment screws 22 + locknuts 23, can also consist of or comprise other threaded elements inserted in appropriate threaded seats 26 obtained in the adjustable body 5 or in the external adaptor support 19. Instead of using screws 22 and locknuts 23, the height H of the adjustable body 5 with respect to the external adaptor support 19 can be set with other spacer elements such as, for example, one or more annular shaped elements 32 (Figure 6) - preferably but not necessarily - that are positioned inside the sliding seat 33 of the external adaptor support 19, and upon which adjustable body 5 is laid. The mobile shutter 2 may be shaped so as to produce washing jets that proceed not only with an opening angle of 360°, as in the example in Figure 1, but also with different opening angle values, such as 180° or still others.

[0053] Figure 7 schematically shows a further embodiment of a deck washing valve built according to the present invention, where the height of the adjustable body 5 with respect to the external adaptor support 19 is determined by means of spacer discs 32', placed between the adjustable body 5 and the external adaptor support 19, similarly to the previously described example shown in Figure 6. Differently from the example in Figure 6, the adjustable body 5 is fastened to the external adaptor support 19 by means of fastening screws 25, which are inserted in the through holes 36 obtained in the flange 10 of the adjustable body 5; they go through the holes 320 obtained in the spacer discs 32', and are screwed in apposite threaded holes of the external adaptor support 19.

[0054] Any other modification and variation that falls within the context of the claims is to be considered included.

Claims

1. Valve for generating washing water-jets, comprising:

   - an adjustable body (5) in which an outlet (30) of a washing nozzle is made for ejecting a liquid jet along a predetermined outflow direction (A),
   - a mobile shutter (2) comprising a plate part (3) suitable for deflecting the liquid jet coming from said outlet (30) in directions that are transversal to said predetermined outflow direction (A), said shutter (2) being movably connected to said adjustable body (5) and suitable for opening by rising, said outlet (30), and/or for closing it by descending;
   - an external adaptor support (19), suitable for being fixed to a wall (20) on which said valve is to be set, said external adaptor support (19) holding a sliding seat (33) the open side of which faces the outer surface of said wall (20) when said valve is set on said wall, said sliding seat (33) being suitable for housing said adjustable body (5) and allowing it to slide with respect to said external adaptor support (19) at least along a predetermined adjustment direction (S),
   - fastening means (25, 34, 35), suitable for fastening said adjustable body (5) to said external adaptor support (19)
   - one or more adjustment spacer elements (22, 23, 32) set between said adjustable body (5) and said external adaptor support (19) so that it resp. they lean against both and determine the relative position (H) of said adjustable body (5) with respect to said external adaptor support (19) at least along a direction not orthogonal to said predetermined adjustment direction (S).

2. Valve according to claim 1, **characterised in that** each of said spacer elements (22, 23) comprises an annular body (32).

3. Valve according to the claim 1, **characterised in that** inside said adjustable body (5) or said external adaptor support (19) one or more threaded seats (26) are provided, and each of said spacer elements includes a threaded body (22) suitable for being screwed and unscrewed into one of said threaded seats (26) that leans, with its part that sticks out of said threaded seat (26), respectively against said external adaptor support (19) or against said adjustable body (5), the thread axis of said threaded seat (26) being not orthogonal to said predetermined adjustment direction (S).

4. Valve according to claim 3, **characterised in that** said one or more threaded seats (26) are made within said adjustable body (5), and said one or more threaded bodies (22) lean against said external adaptor support (19) with their part that sticks out of said threaded seat (26).

5. Valve according to one or more of the previous claims, **characterised in that** said external adaptor support (19) comprises a tubular stem (27) with a seat for fastening a duct (1) for feeding said valve.

6. Valve according to one or more of the claims from 3 to 5, **characterised in that** a locknut (23) is screwed to each of said threaded bodies (22) for locking the position of said threaded bodies along the screwing axis.

7. Valve according to one or more of the previous claims, **characterised in that** said fastening means (25) comprise one or more screws (25) that can be screwed into a threaded seat of said external adaptor support (19) so as to lock together said external adaptor support and the adjustable body (5).

8. Valve according to one or more claims from 1 to 6, **characterised in that** said fastening means (25) comprise a male thread (34) made on said adjustable body (5), and a threaded female seat (35) made on the inside of said external adaptor support (19).

9. Valve according to one or more of the previous claims, **characterised in that** said external adaptor support (19) is welded to said wall (20) on which the valve (1) is to be installed.

10. Method for setting a valve according to one or more of the previous claims, **characterised by** comprising the step of permanently fastening said external adaptor support (19) to said wall (20) on which said valve (1) is to be fixed.

11. Method according to claim 10, **characterised in that** said external adaptor support (19) is fastened by welding to said wall (20) on which said valve (1) is to be installed.

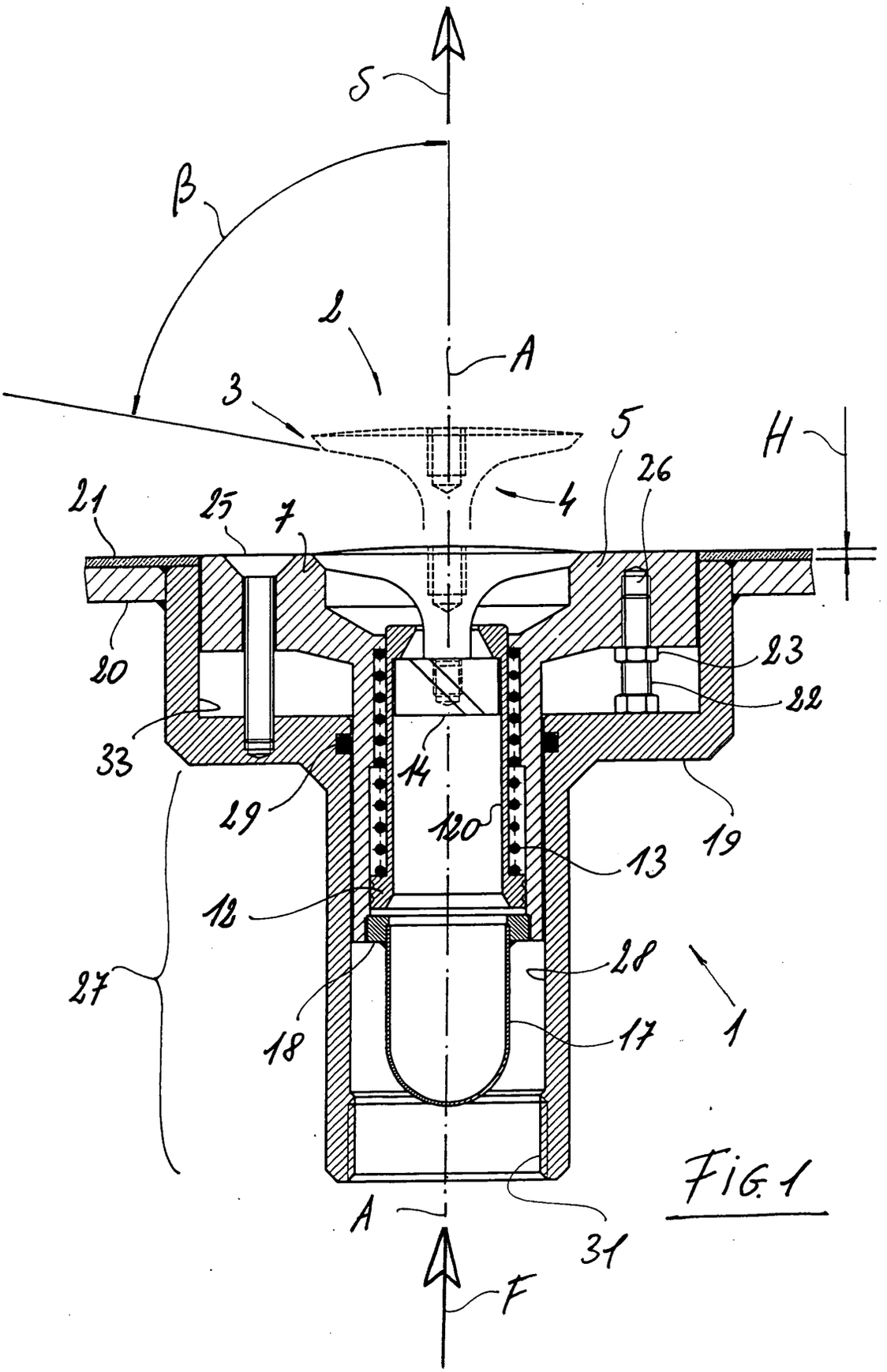

FIG 1

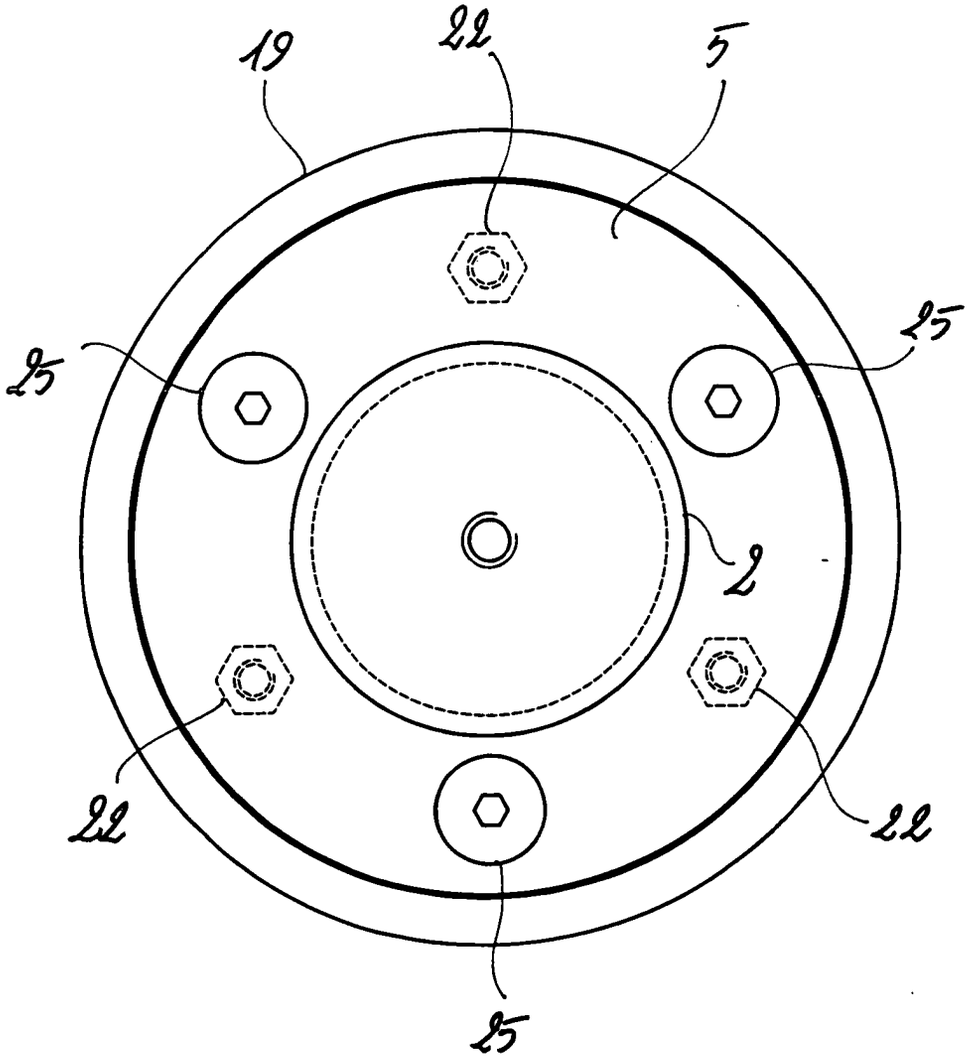

FIG. 2

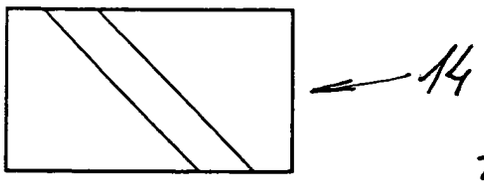

FIG.3A

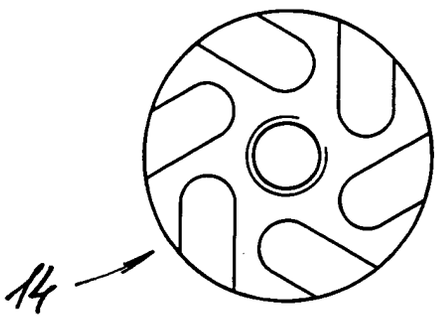

FIG.3

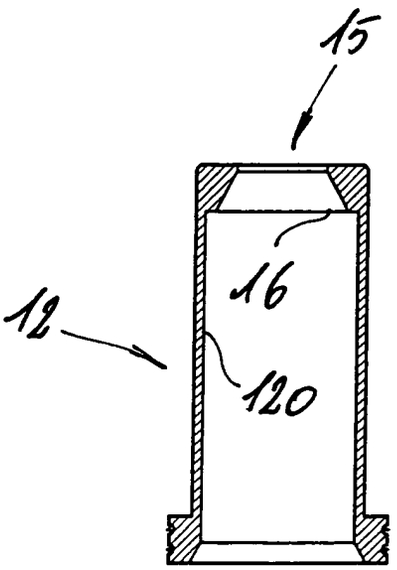

FIG.5

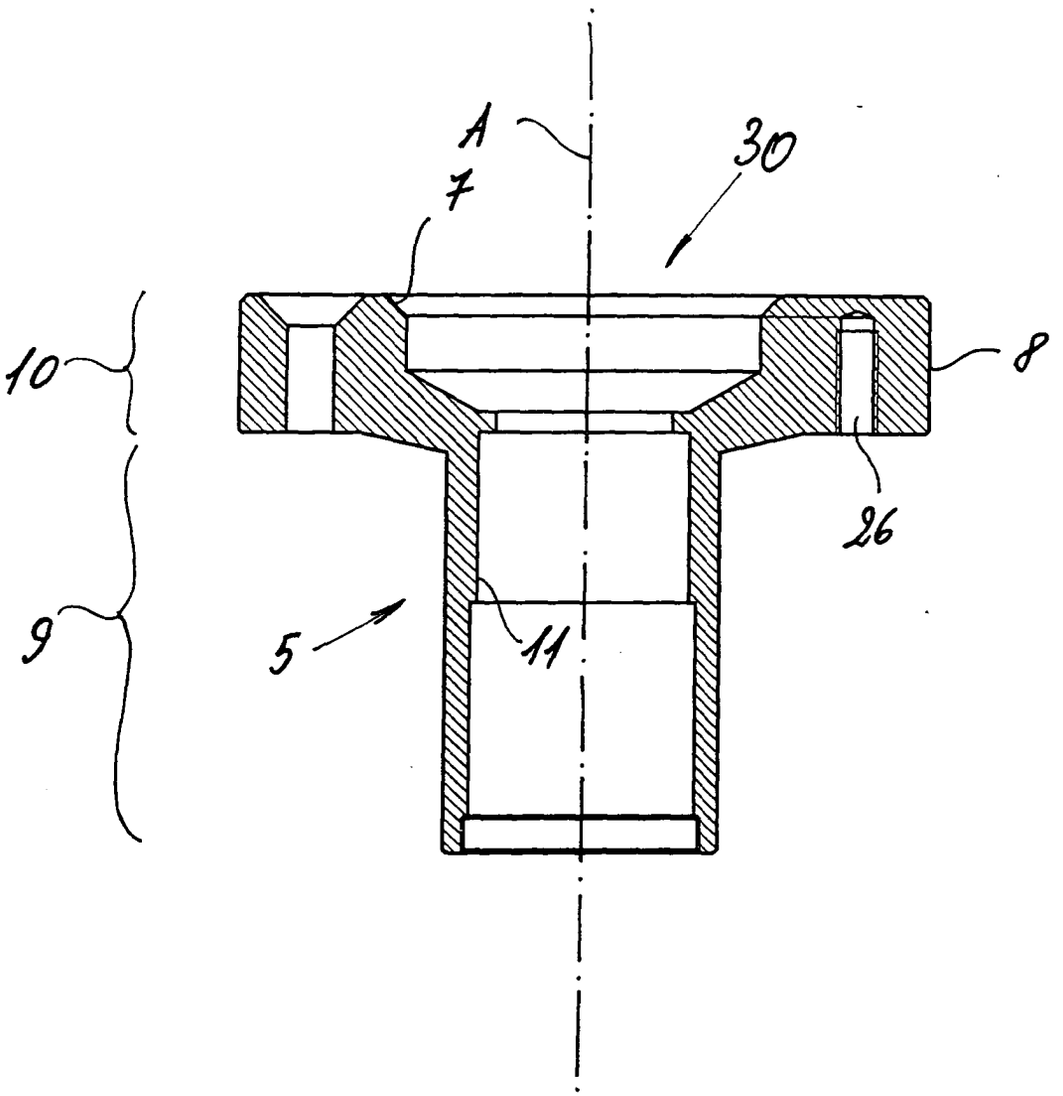

FIG. 4

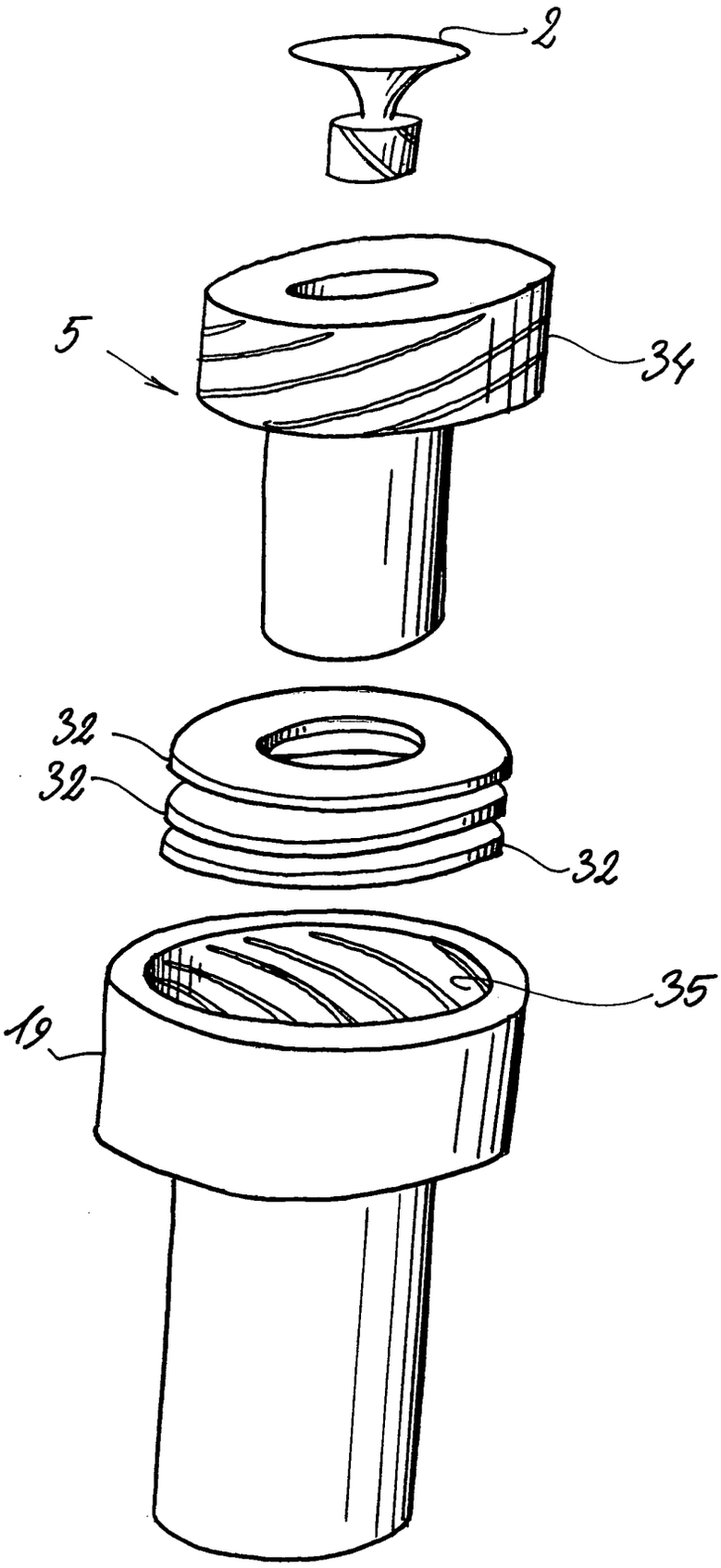

FIG. 6

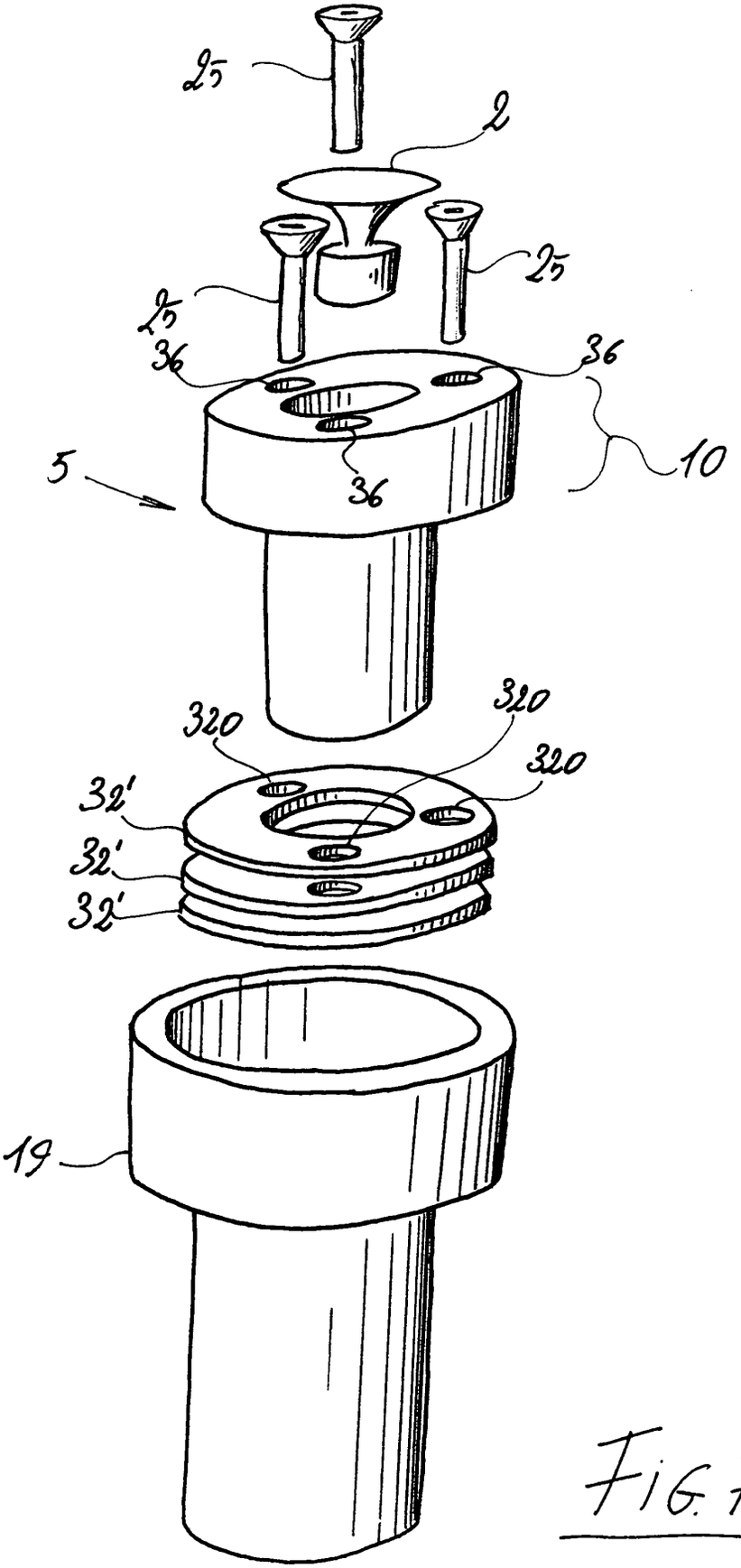

FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 02 7547

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 100 57 429 A (LECHLER GMBH & CO KG) 24 January 2002 (2002-01-24) * paragraph [0009] * * paragraph [0014] - paragraph [0015] * * paragraph [0018] * * claims 9,10 * * figure 1 *	1,2,7-11	B05B15/10 B05B1/30 B05B1/26 A62C37/09 A62C3/10
A	---	3-6	
A	FR 1 277 114 A (H C STUELCKEN SOHN) 24 November 1961 (1961-11-24) * the whole document *	1-11	

X	US 5 137 307 A (KINSEY WALTER J) 11 August 1992 (1992-08-11) * column 13 - column 15 * * figures 13-15 *	1	

A	US 3 633 676 A (GLOECKLER FRED A) 11 January 1972 (1972-01-11) * the whole document *	1	
	---		TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	US 3 404 840 A (TRICKEY WILLIAM J) 8 October 1968 (1968-10-08) * the whole document *	1	B05B A62C B63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 May 2004	Barré, V

CATEGORY OF CITED DOCUMENTS

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1

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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25-05-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10057429 A	24-01-2002	DE 10057429 A1	24-01-2002
		DE 10057426 A1	17-01-2002
		DE 10057427 A1	17-01-2002
		EP 1170059 A2	09-01-2002
		EP 1170058 A2	09-01-2002
		US 2002020764 A1	21-02-2002
		US 2002023975 A1	28-02-2002
FR 1277114 A	24-11-1961	NONE	
US 5137307 A	11-08-1992	NONE	
US 3633676 A	11-01-1972	NONE	
US 3404840 A	08-10-1968	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82