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(54) Valve assembly for a rotary filing machine

(57) Valve assembly (3) for a rotary filling machine (1) of the rotating carousel type with a plurality of valve assemblies (3) arranged peripherally and each provided with a support structure (5) containing a tubular duct (4) able to convey a liquid from a tank to a container (B) through an opening (9) with which occlusion means (10) are associated, said means being able to be moved between at least one filling position, where they allow the liquid to pass through the opening during predefined operating steps, and a closing position, where they intercept the opening, preventing the flow of the liquid. Adjustment means (11) are envisaged, said means mechanically operating the occlusion means in order to vary the aperture of the opening and consequently the form and the trajectory of the jet of liquid leaving the said opening.

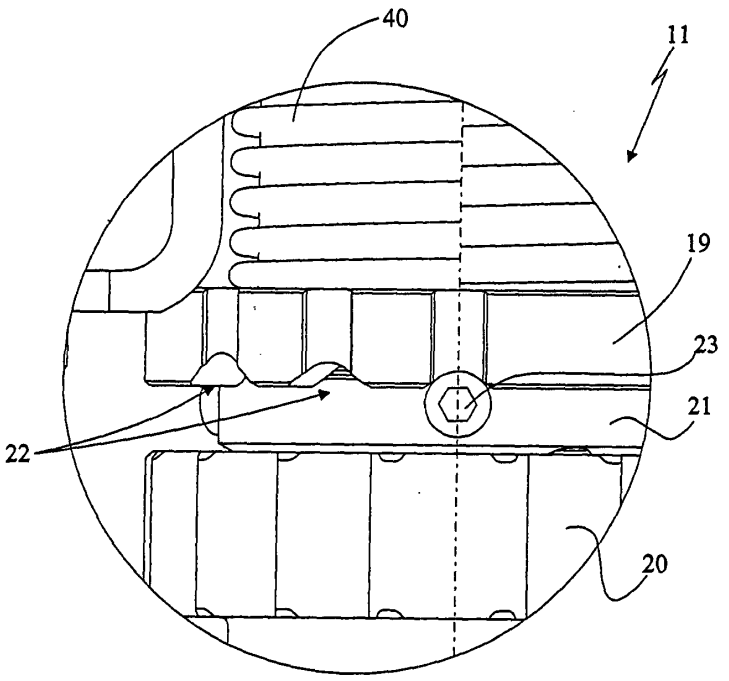

Fig. 6

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Description

[0001] The present invention relates to a valve assembly for a rotary machine for filling containers with liquids.

[0002] The assembly in question is intended to be used in the sector of industrial bottling plants, in particular for the bottling of alimentary liquids and beverages such as wine, mineral water, etc., where traditionally a plurality of valve assemblies of this type is arranged peripherally on a rotating carousel of a rotary filling machine.

[0003] In greater detail, according to a conventional technique, each filling valve assembly has a tubular duct with mounted therein an obturator which regulates the flow of liquid, for example wine, from a tank to a container, usually a bottle, arranged coaxially underneath the valve assembly.

[0004] In operational terms, during the filling cycle steps, the liquid falls by means of gravity from the tank into each bottle until the predetermined height is reached. In other words, until the liquid does not reach a hole provided in the air return pipe, the liquid continues to descend into the bottle.

[0005] For this purpose, an air return pipe is mounted inside the duct, said pipe hydraulically closing off the flow of liquid once the maximum desired level inside the bottle is reached.

[0006] The bottom part of the duct consists of a tube (or "feeder tube" more specifically) with inside it the air return pipe, which can be inserted during the programmed filling cycle with at least its terminal portion inside the neck of the bottle. In the region of the abovementioned terminal portion the feeder tube therefore has at least one opening for allowing the liquid to flow into the bottle.

[0007] At present, in accordance with the technology known hitherto, the jet of the flow leaving this opening cannot be substantially adjusted in terms of its orientation and its trajectory, with the result that the jet is optimized only in relation to a single type of bottle even when the plant is intended to operate with several types of bottles. It may happen that, when using bottles with a somewhat narrow profile, the fluid leaving the opening is directed directly against or so as to flow over the side surface of the bottle, while with bottles having a widened form the jet of fluid is directed directly against the free surface of the liquid contained inside the bottle.

[0008] In this latter case, there is the production of a considerable quantity of froth which must be sucked back up by the air return pipe in order to allow complete filling of the bottle and therefore consequent stoppage in the downflow of the liquid into said bottle.

[0009] In practice, when the froth reaches the abovementioned pipe, it obstructs the air flow and the descent of the wine slows down considerably, penalising the bottle filling time and therefore ultimately the production efficiency of the bottling plant.

[0010] A further disadvantage of the valve assemblies of the known type consists in the fact that the bubbling of the liquid caused by the jet against the free surface inside the bottle causes, in some alimentary liquids, and in particular in wine, the undesirable release of aromatic substances, fragrances, perfumes or gases (for example CO_2) which are present, being dissolved inside it, and which are thus freed and dispersed in the atmosphere.

[0011] This situation results in an impoverishment of the alimentary liquid. Moreover, the same bubbling action exposes the liquid to greater contact with the atmosphere and therefore greater oxidation or incorporation of air inside it.

[0012] In order to limit these drawbacks the valve assemblies are provided with openings which have average dimensions in order to allow them to operate with the main types of bottles envisaged for that plant or factory, without however, as mentioned, being able to operate in an optimum manner with any of these types of bottles. Alternatively, the assemblies may be optimized in a precise manner according to a prechosen type of bottle, thus reducing, however, their versatility and therefore ultimately penalising once again the production performance.

[0013] In this situation, the problem underlying the present invention is that of overcoming the drawbacks associated with the art known hitherto by providing a valve assembly for a rotary filling machine which allows the filling of containers also of a different shape and type in a shorter time compared to the solutions of the known art.

[0014] A further object of the present invention is to provide a valve assembly which allows the filling of different types of containers without producing bubbling of the liquid inside them during the programmed filling cycles.

[0015] A further object of the present invention is that of providing a valve assembly which is constructionally simple and operationally entirely reliable.

[0016] These objects, together with others, are all achieved by a valve assembly for a rotary filling machine, which comprises a support structure able to support the said valve assembly on a rotating carousel of the rotary filling machine; a tubular duct provided on the support structure, able to convey a liquid from a tank to a container and having at least one opening formed in its bottom portion intended to be inserted inside the container; and means for occluding the opening, which can be moved between at least a filling position, where the liquid is allowed to pass through the opening during predefined operating steps, and a closing position, where they intercept the opening, preventing the flow of the liquid.

[0017] This assembly is characterized in particular in that it also comprises adjustment means which mechanically operate the occlusion means in order to vary the aperture of the opening and consequently the form and the trajectory of the jet of liquid leaving the said opening.

[0018] The technical features of the invention, in accordance with the abovementioned objects, may be clearly determined from the contents of the claims indi-

cated below and the advantages thereof will emerge more clearly from the detailed description which follows, provided with reference to the accompanying drawings which show a purely exemplary and non-limiting embodiment thereof in which:

- Figure 1 shows a schematic view of a bottling plant in which a filling machine with the valve assemblies according to the present invention is incorporated;
- Figure 2 shows a schematic sectioned side view of an example of embodiment of a valve assembly according to the invention;
- Figure 3 shows an enlarged view of a detail of Fig. 3;
- Figure 4 shows a side view of the valve assembly according to the present invention having a bottle associated therewith and with adjustment means arranged in a first operating position;
- Figure 5 shows an enlarged detail of Figure 4 relating to the adjustment means;
- Figure 6 shows a cross-sectional view of Figure 4;
- Figure 7 shows an enlarged detail of Figure 6 relating to the opening aperture of the valve feeder tube;
- Figure 8 shows a side view of the valve assembly according to the present invention having a bottle associated therewith and with adjustment means arranged in a second operating position with the opening aperture of feeder tube more open than in the first operating position;
- Figure 9 shows an enlarged detail of Figure 8 relating to the adjustment means;
- Figure 10 shows a cross-sectional view of Figure 8;
- Figure 11 shows an enlarged detail of Figure 10 relating to the opening aperture of the valve feeder tube.

[0019] In accordance with the figures of the accompanying drawings, 1 denotes in its entirety a rotary filling machine carrying, mounted on a carousel or rotating platform 2, a plurality of valve assemblies 3 forming the subject of the present invention.

[0020] The machine 1 (see Fig. 1) may be arranged inside a bottling plant, downstream of a rinsing machine 90 and upstream of corking machines 70 to which it is operationally connected by means of conveyors 80.

[0021] Each valve assembly 3 has a support structure 5 for connection to the carousel 2, inside which the abovementioned tubular duct 4 is formed and on which all the devices and mechanisms necessary for operation thereof are arranged.

[0022] In greater detail, the duct 4 has a vertical axis Y, is connected at the top to the bottom of the tank by means of a seal 6 and terminates with a mechanical filter 50 having holes 7 through which the liquid can pass.

[0023] The bottom portion 8 of the duct consists of a feeder tube which is intended to be inserted with at least its bottom portion into the bottle B. The terminal part of this feeder tube 8 has an opening 9 with an aperture or flow cross-section which can be opened or closed by means of suitable occlusion means 10 which will be described more fully below.

[0024] The duct 4 has, coaxially mounted inside it, an air return pipe 15 having a terminal section able to adjust hydraulically the maximum level of the liquid inside the container via a lateral hole 15' in particular.

[0025] According to the invention, each valve assembly 3 comprises adjustment means 11 which mechanically operate the occlusion means 10 so as to vary the aperture of the opening 9 and consequently the form and trajectory of the jet of liquid emerging from it.

[0026] Usually the aforementioned means 10 may be operationally moved between at least one filling position, where the liquid is allowed to pass through the opening 9 during predefined filling steps, and a closed position, where they obstruct the opening 9, intercepting the flow of liquid.

[0027] Therefore, the idea forming the basis of the present envisages varying the filling position of the means 10 by means of the abovementioned adjustment means 11 so as to modify consequently the cross-section of the opening 9 of the feeder tube 8 and therefore also the form and trajectory of the liquid jet.

[0028] More particularly, the occlusion means 10 comprise a movable sleeve 12 which is mounted coaxially with the duct 4 and the bottom part of which is formed by the feeder tube 8.

[0029] The sleeve 12 is actuated so as to move vertically as a result of raising or lowering of the bottle which comes into contact, by means of its mouth, against the lips-shaped, bottom, terminal part 13 of the said sleeve 12.

[0030] Each bottle B is raised and lowered along the carousel 2 by actuator means of the type which are conventional per se and well-known to a person skilled in the art.

[0031] The occlusion means 10 also comprise an obturator 14 situated inside the duct 4 and consisting of a tapered body provided peripherally with an O-ring 16 able to provide a sealed closure against an annular projection 17 provided on the internal surface of the said duct 4.

[0032] In operational terms, when the bottle B raises the bottom terminal part 13 of the sleeve 12, the passage defined between the obturator 14 and the annular projection 17 of the internal surface of the duct 4 is opened and consequently the liquid is able to flow down. In this situation the occlusion means 10 are therefore in the filling position.

[0033] As soon as the bottle B moves downwards, the annular projection 17 of the sleeve 12 forms a seal again against the obturator 14 and in this case the occlusion means 10 are therefore in the closed position.

[0034] The maximum travel C of the sleeve 12 is defined on the one hand by the contact of the obturator 14 with the annular projection 17 inside the duct 4 and on the other hand by the contact of the sleeve 12 with a stop surface 18 provided on the support structure 5. The stop surface 18 therefore delimits the maximum opening of

the passage of the obturator 14 as well as the maximum aperture of the opening 9 of the feeder tube 8.

[0035] In accordance with a preferred embodiment of the present invention, the adjustment means 11 consist of a ring 19 mounted around the duct 4 on a shoulder 21 of the sleeve 12 formed substantially above an adjustment body 20, movable rotatably so as to allow a variation in the height of the feeder tube 8 in order to obtain different levels of liquid inside the bottle B.

[0036] The ring 19 comes into contact with the stop surface 18 when the sleeve 12 is raised, as explained above, owing to the action of the bottle B on the terminal part 13.

[0037] The ring 19 may be positioned at different axial heights with respect to the shoulder 21 of the sleeve 12 so as to vary the travel C thereof with respect to the stop surface 18 and allow consequently modification of the opening 9 of the feeder tube 8.

[0038] In greater detail, the ring 19 may be rotated about the axis Y of the duct 4 and has on its bottom side a plurality of recesses 22 with different depths. In the example of embodiment shown in Figures 6 and 10, 4 denotes a series of three different recesses 22 which are arranged in sequence and have different depths. The same series is repeated three times with the recesses arranged at a distance of 120° from each other along the bottom side of the ring 19.

[0039] Each of the three recesses 22 is formed so as to receive inside it to a different degree the head of a screw 23 fixed onto the upper surface of the shoulder 21. The latter has, mounted thereon, a sliding annular element 31 arranged facing and underneath the bottom surface of the ring 19 as well as fixed onto the top of the shoulder 21 of the movable sleeve 12.

[0040] Fastening means, consisting for example of a screw 30, are envisaged, said means fixing the annular element 24 of the sleeve 12 to the annular element 31. The same means, by means of a washer 81 inserted inside an annular cavity of the annular element 31 and inside a niche of the sleeve 12, rigidly connect the shoulder 21 to the upper part of the movable sleeve comprising the annular projection 17.

[0041] Obviously, the number of recesses provided, as well as the form of the latter, may be different from that shown in the example considered, without thereby departing from the scope of protection of the present invention.

[0042] A spring 40 is envisaged, said spring acting between the upper surface of the ring 19 and a seat of the support structure 5 of the valve assembly 1 so as to keep the head of the screws 23 constantly engaged inside the recesses 22 provided on the ring 19.

[0043] The spring 40, moreover, causes the return movement of the movable sleeve 12 from the filling position into the closing position.

[0044] Moreover, it is possible to provide adjustment systems equivalent to that considered as an example above, said systems also being equivalent to the same proposed solution forming the basis of the present invention.

[0045] The form, orientation and speed of the jet with which the liquid is emitted from the opening 9 are mainly determined by the form of the opening 9 itself, in addition obviously to the kinetic height of the liquid inside the tank.

[0046] By varying the aperture of the opening 9, the trajectory of the flow lines is modified (see Figs. 7 and 11) since the geometry of the control surfaces arranged in the vicinity of the opening and formed by the inner side of the feeder tube and the outer side of the air return pipe 15 is modified. In particular, by reducing the raising movement of the feeder tube 8 (see Fig. 7), the liquid flow is forced against the profile formed on the widened terminal portion 70 of the air return pipe 15 and the flow lines are obliged to follow, to a greater extent, than in the case where the feeder tube 8 is raised higher (see Fig. 11), the angle which is constructionally imposed on them by this profile of the terminal portion 70.

[0047] The widened terminal portion 70 of the pipe 15 has a bottom surface 71 in which the hole of the pipe 15 is formed and two side surfaces 72 which are connected to the upper cylindrical section 150 of the pipe 15 by means of an inclined section 73. The latter convey the liquid flow leaving the feeder tube 8 and define, together with the said feeder tube 8, the aperture of the opening 9.

[0048] Owing to the adjustment envisaged by the present invention it is possible to modify the trajectory of the jet, optimizing it depending on the type of bottle B which is intended to be filled. In particular, it will be possible to ensure that the flow of liquid leaving the opening 9 always flows over the side surface of the bottle B, limiting considerably the formation of froth and preventing the liquid from oxidising or the fragrances and perfumes contained therein from being dispersed into the surrounding environment.

[0049] The invention thus conceived therefore achieves the predefined objects.

[0050] Obviously, it may also assume, in its practical embodiment forms and configurations different from that illustrated above without thereby departing from the present scope of protection.

[0051] Moreover, all the details may be replaced by technically equivalent elements and the dimensions, forms and materials used may be of any nature according to requirements.

Claims

1. Valve assembly for a rotary filling machine, which comprises:

   - a support structure able to support said valve assembly on a carousel of said rotary filling machine;
   - a tubular duct provided on said support structure, able to convey a liquid from a tank to a

container and having at least one opening formed in its bottom portion intended to be inserted inside said container;
- means for occluding said opening, which can be moved between at least one filling position, where the liquid is allowed to pass through said opening during predefined operating steps, and a closing position, where they intercept said opening, preventing the flow of the liquid;

characterized in that it comprises adjustment means which mechanically operate said occlusion means in order to vary the aperture of said opening and consequently the form and the trajectory of the jet of liquid leaving the said opening.

2. Valve assembly according to Claim 1, **characterized in that** said occlusion means comprise a sleeve movable coaxially with respect to said duct with a maximum travel delimited by a stop surface provided on the support structure, said adjustment means comprising a ring mounted on said sleeve movable around said duct and able to interfere with said stop surface in order to define the maximum travel of said movable sleeve, said ring being able to assume different axial positions with respect to said movable sleeve so as to vary the travel of the latter with respect to said stop surface and consequently vary the aperture of the opening of said duct.

3. Valve assembly according to Claim 2, **characterized in that** said ring is kept elastically pressed against a shoulder of said movable sleeve by the action of a spring mounted coaxially with said duct on said support structure.

4. Valve assembly according to Claim 2, **characterized in that** said ring is rotatably mounted on said movable sleeve and is provided with at least two recesses with different depths able to receive inside them the head of at least one screw provided on said movable sleeve, in order to vary the axial position of the ring following an angular rotation thereof.

5. Valve assembly according to Claim 4, **characterized in that** said screw is fixed onto the upper surface of an annular element arranged underneath said ring and fixed to said movable sleeve by fastening means.

6. Valve assembly according to Claim 1, **characterized in that** said occlusion means comprise an obturator arranged inside said tubular duct for intercepting said liquid so as to open or close the flow of liquid from said tank to the bottom portion of said duct following the axial movement of said movable sleeve between said filling position and said closing position.

7. Valve assembly according to Claim 4, **characterized in that** said recesses are organized in two or more series which are arranged so as to ensure stable support of the ring 19 on the head of the screws 23.

8. Valve assembly according to Claim 1, **characterized in that**, in the vicinity of said opening 9 of the feeder tube 8, the liquid is forced against a widened terminal portion of the air return pipe 15.

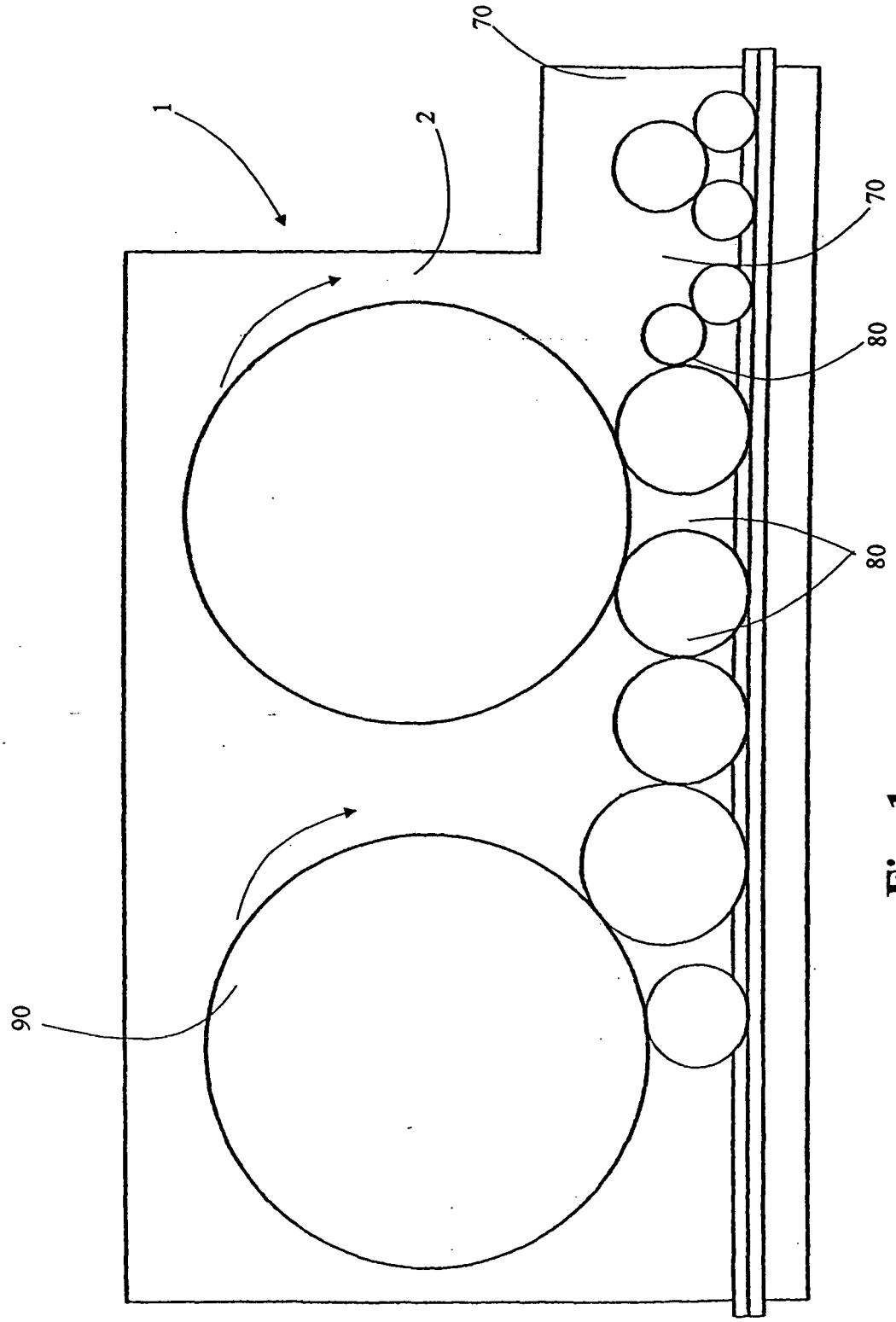

Fig. 1

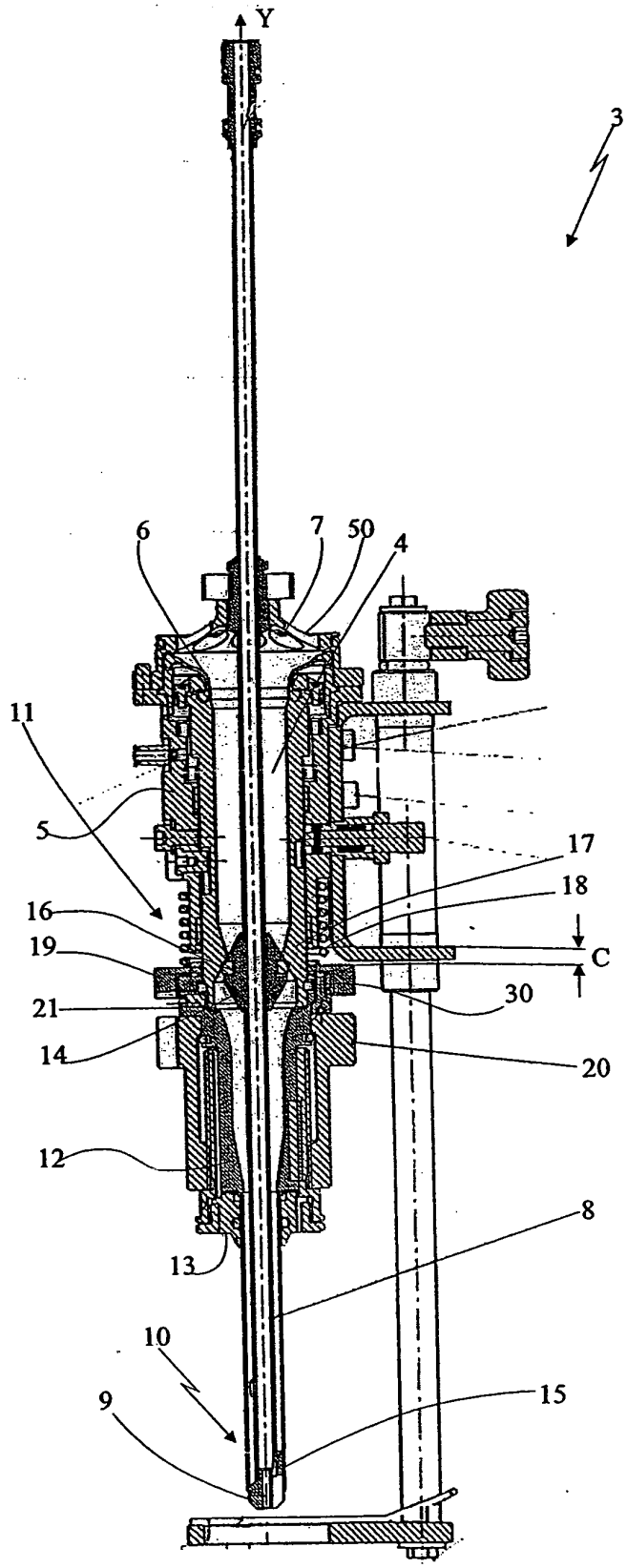

Fig. 2

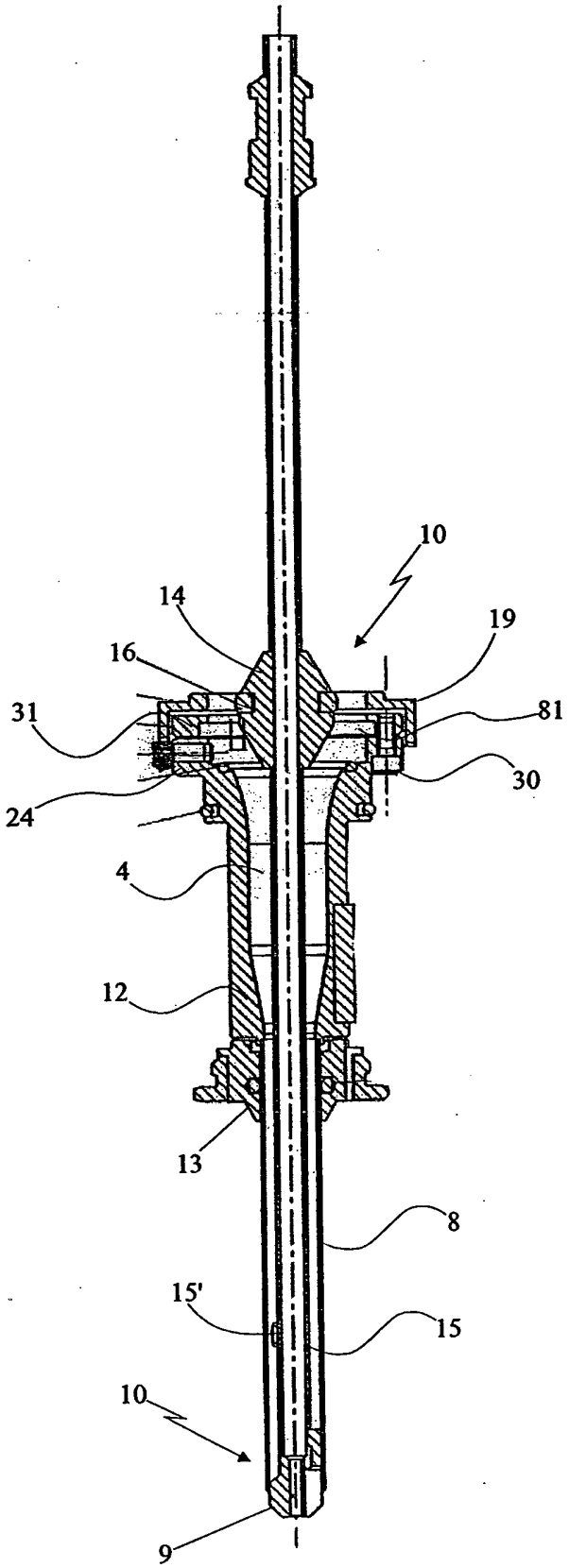

Fig. 3

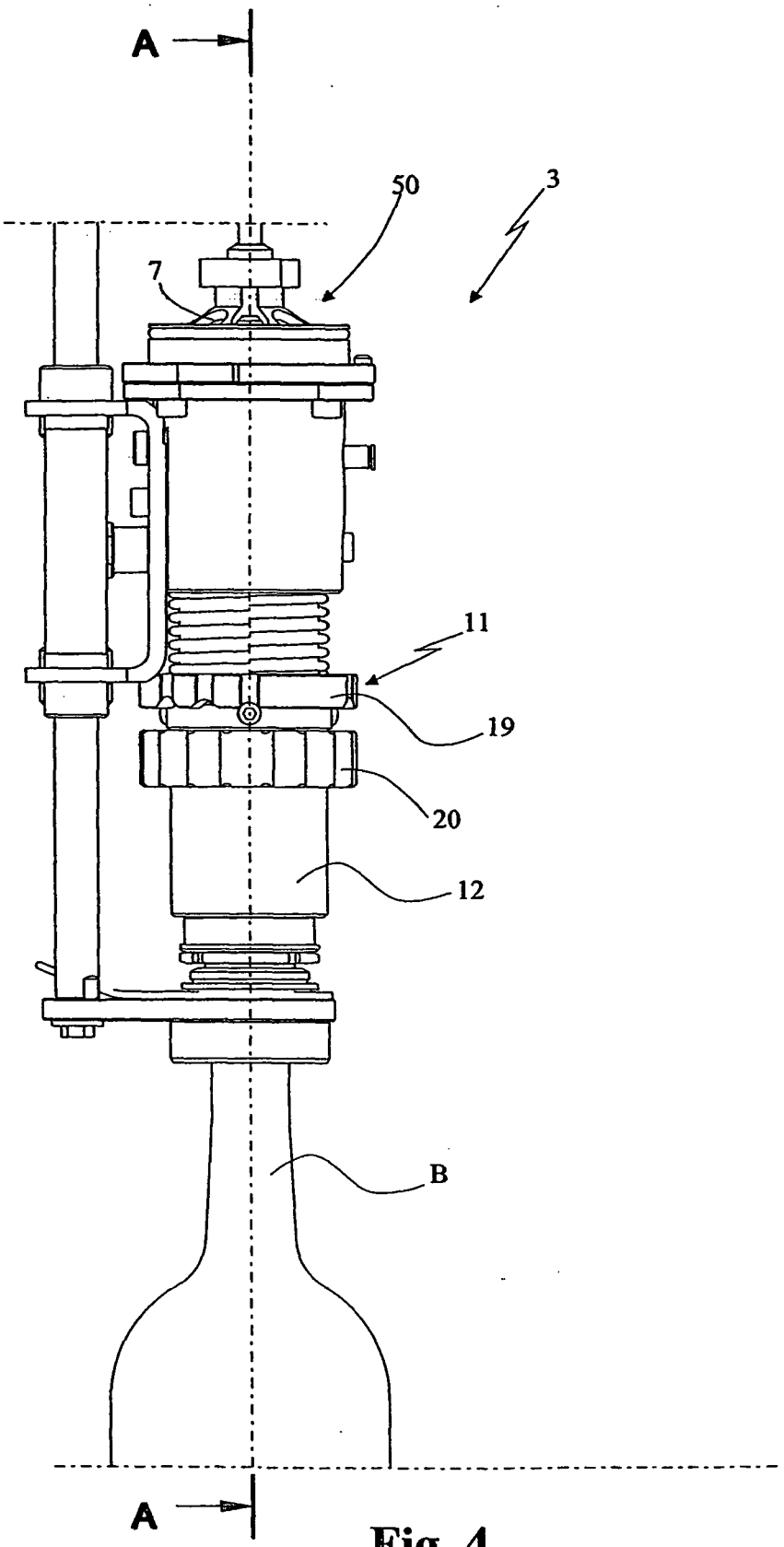

Fig. 4

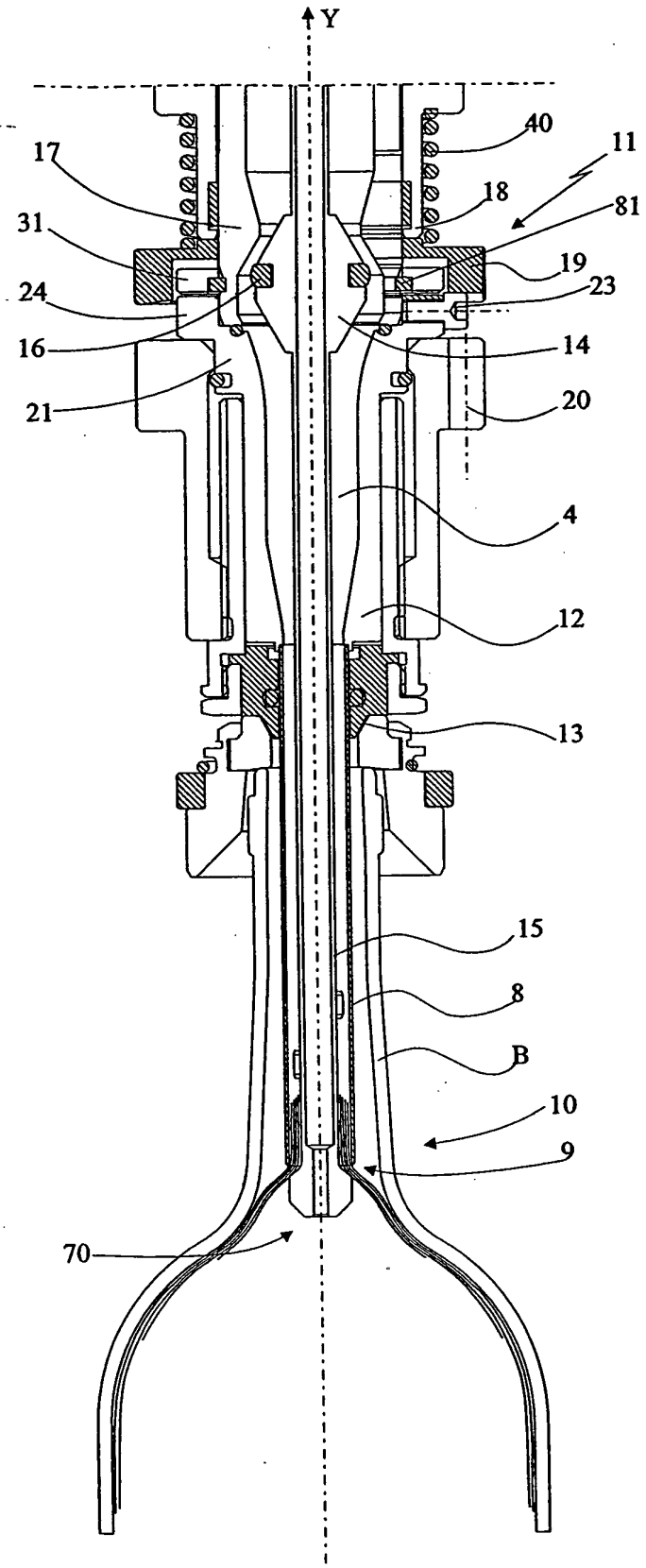

Fig. 5

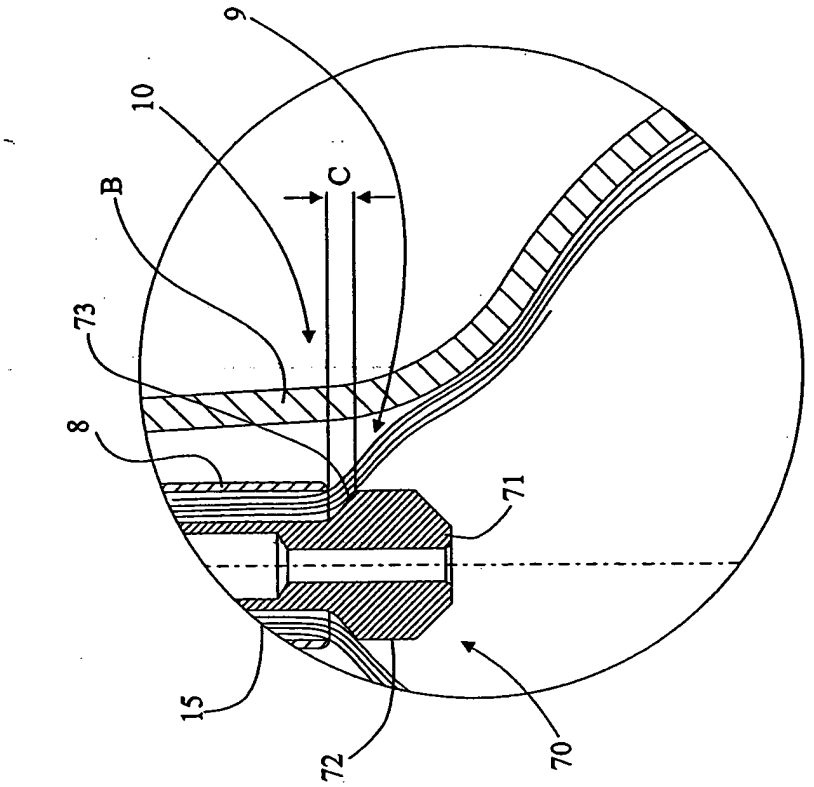

Fig. 7

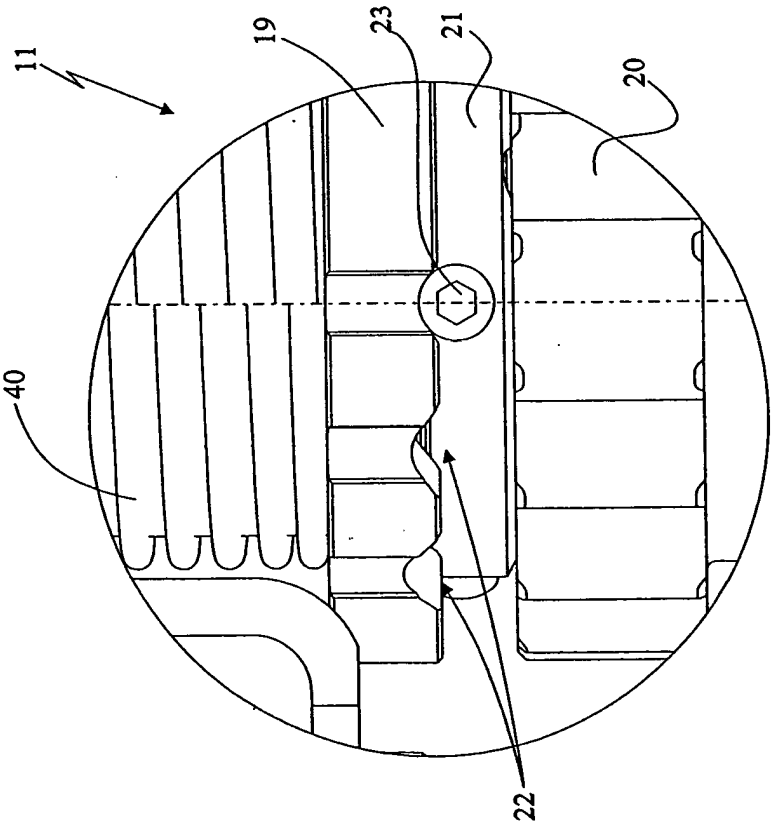

Fig. 6

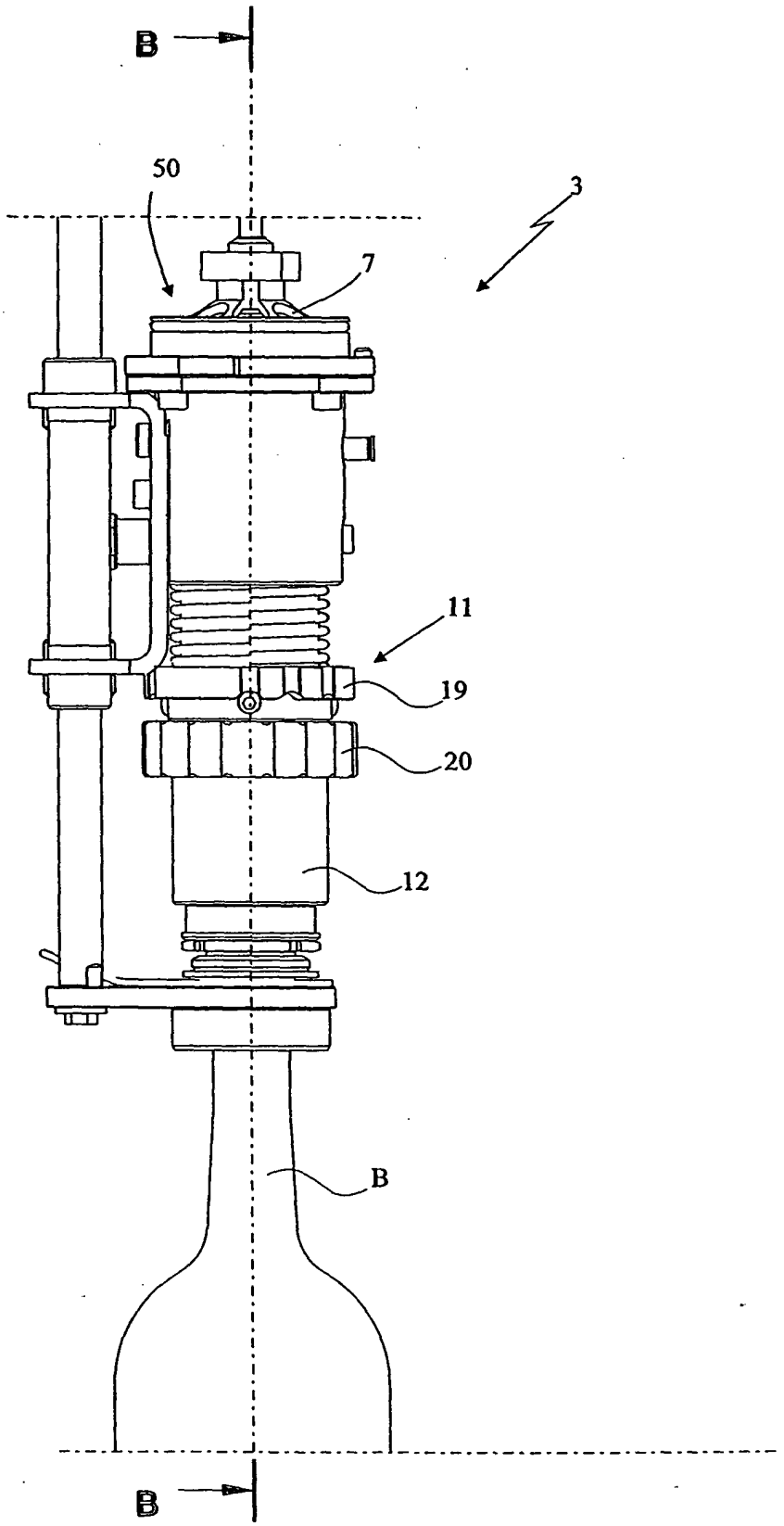

Fig. 8

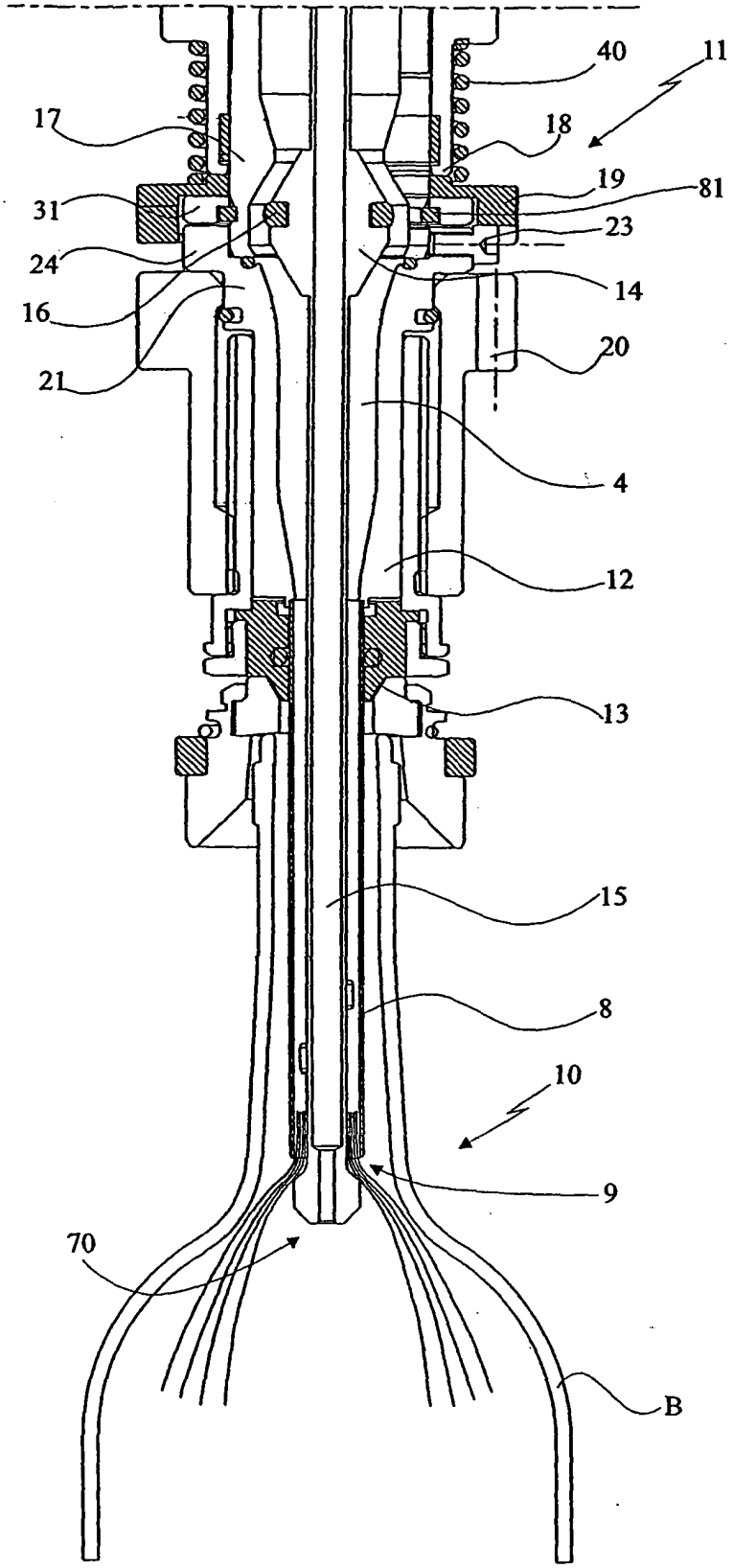

Fig. 9

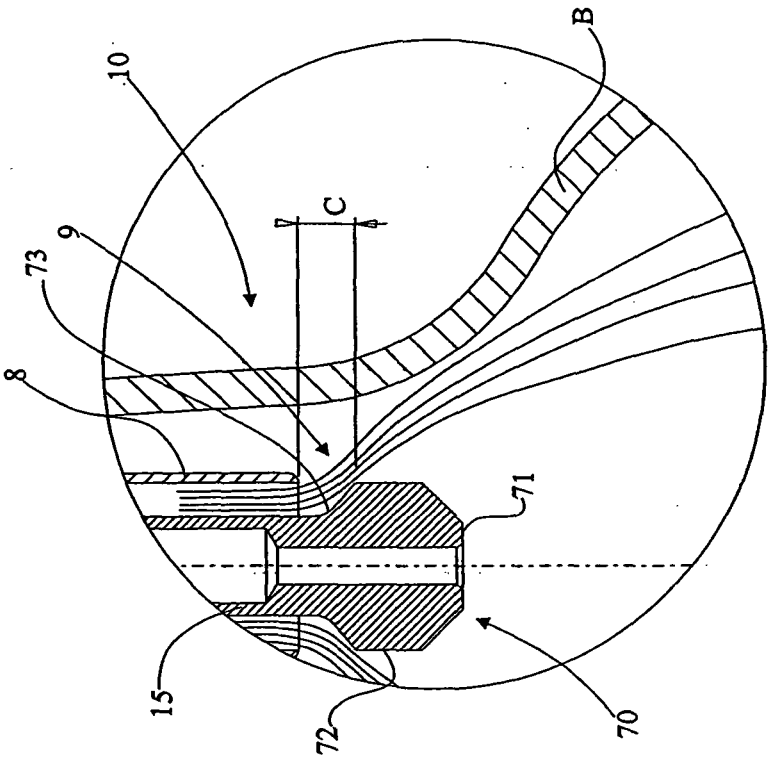

Fig. 11

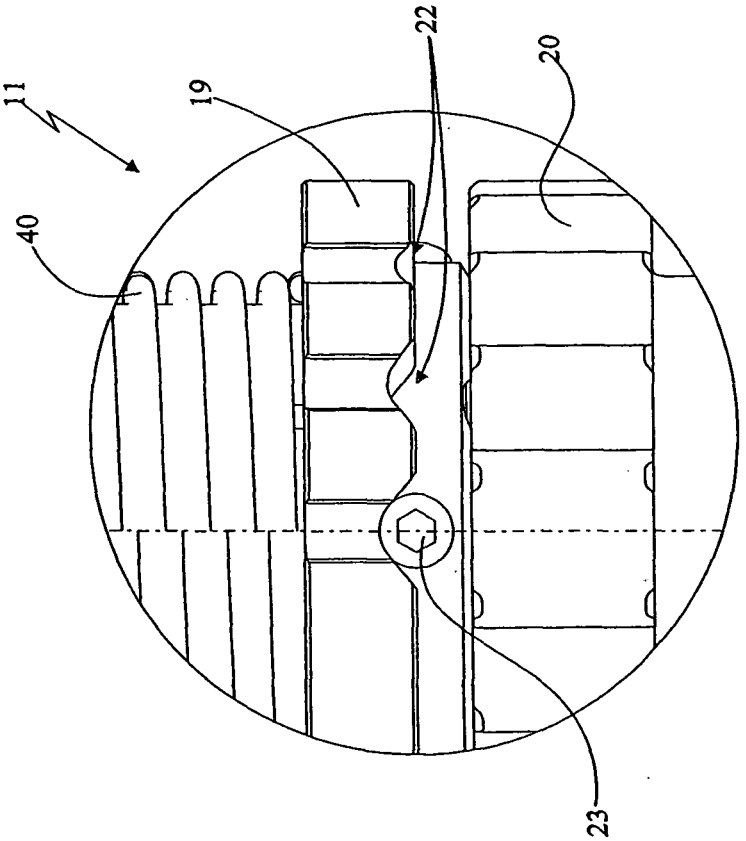

Fig. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 07 6262

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 November 2005	Desittere, M

CATEGORY OF CITED DOCUMENTS

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