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(54) **SHUTTER FOR A SINK DRAIN PLUG AND DRAIN ASSEMBLY PROVIDED WITH SAID SHUTTER**

(57) Shutter for a plug of a drain of a sink, which comprises a pin (2) slidably inserted into an insertion hole (722) of a bush (72) of a plug (7), a basket (4) fixed to the pin (2) and an interference element (3) connected to the pin (2) and susceptible to interfere with the bush (72) to keep the shutter (1) in position. In greater detail, the pin (2) and the interference element (3) are made of polymeric material. Furthermore, the interference element (3) comprises at least one projecting portion (31), which is elastically deformable in the radial direction and it is designed to be elastically bent towards the latter when it is inserted into the insertion hole (722) of the bush (72).

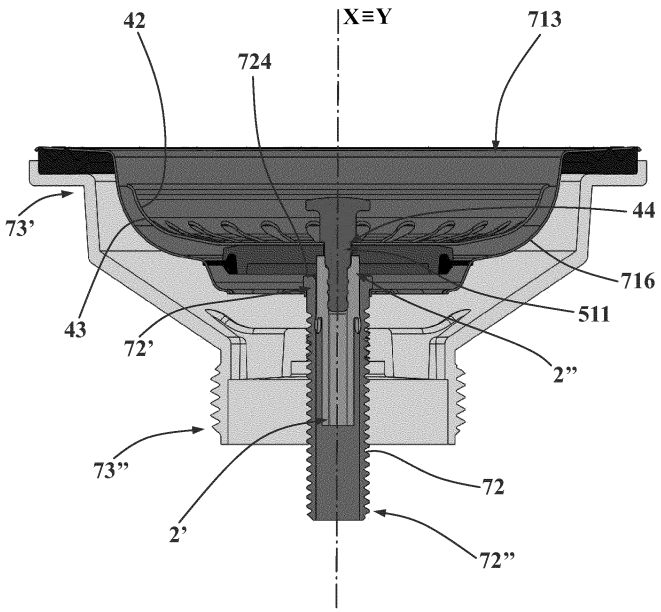

Fig. 3

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Description

Field of the invention

[0001] The present invention relates to a shutter for a sink drain plug and according to the preamble of the independent claim 1.

[0002] The shutter in question is designed to be used to open and close a sink drain plug, so as to allow or prevent the outflow of the water from the sink through the drain hole of the latter.

[0003] The shutter subject of the present invention therefore relates to the industrial field of production of accessories for plumbing fixtures and in particular in the field of producing accessories for kitchen sinks.

[0004] The invention also relates to a drain assembly comprising the shutter mentioned above.

State of the art

[0005] As known, sinks (in particular kitchen sinks) are provided, on the bottom wall thereof, with at least one drain hole to allow the discharge of the water contained therein through a drain pipe arranged under the sink in question. In particular, the sink comprises a drain plug which is placed in the drain hole and hydraulically connects the sink to the underlying drain pipe. A shutter is applied to the plug to close or open the plug in question (and therefore the drain hole) so as to prevent or allow the discharge of the water.

[0006] In detail, the drain plugs of the known type are provided with a conveyance body (known in the technical jargon with the expression "waste trap"), which is designed to be fixed to the containment basin of the sink at the drain hole, and it is susceptible to convey the water from the basin towards the drain pipe. To this end, the conveyance body is substantially funnel-shaped and it extends between an upper opening, which is arranged at the drain hole of the sink basin, and a lower wall, which is provided with one or more passage openings which are placed in communication with the drain pipe. Furthermore, the drain plugs of the known type comprise a bush, which is fixed to the lower wall of the conveyance body, extends below the latter and it is adapted to support the shutter, as explained in detail below.

[0007] The shutter (known in the technical jargon with the expression "basket plug") is designed to be slidably engaged with the bush between an opening position, in which it allows the liquid to flow through the conveyance body towards the drain pipe, and a closing position, in which it prevents the liquid from flowing through passage opening of the conveyance body, therefore allowing water to accumulate in the sink.

[0008] The shutter generally comprises a basket, which is concave-shaped facing upwards, is arranged in the conveyance body of the plug, is provided with multiple through openings to allow the water to flow through, and it is susceptible to collect solid residues possibly present in the water, preventing them from dropping drain pipe. Furthermore, the shutter comprises a pin fixed below the basket and designed to be slidably inserted into the bush for moving the shutter between the opening position and the closing position. The pin is generally made of brass, so as to exploit the great ductility of the latter so as to simplify the processing obtaining a low-cost pin. Generally, the shutters further comprise a sealing body (referred to as "cap" in the technical jargon), which is fixed beneath the basket and, with the shutter in the closing position, is susceptible to provide sealing on the conveyance body above the passage openings of the latter, to prevent water from reaching such openings.

[0009] In order to prevent the unwanted movement of the shutter between the opening position and the closing position for example due to gravity and water in the sink, the shutter further comprises an interference element susceptible to prevent the unwanted sliding of the pin along the bush.

[0010] In greater detail, the interference element comprises a ball pressing device housed in the pin, which acts transversely to the pin exerting a thrust force on the inner wall of the bushing which induces a friction between the pin and the bush therefore preventing the unwanted movement of the shutter.

[0011] A further example of shutters of the known type is disclosed in document CN 2603123, wherein the interference element is obtained through a projecting spring.

[0012] The shutters for drain plugs of the known type revealed some drawbacks in application. A first drawback lies in the fact that, as reported above, the pin of the shutter is made of brass, which may entail a strong environmental impact for the disposal of the product. As a matter of fact, the brass used at industrial level contains therein a percentage of lead, which, as known, can cause even serious unwanted effects if dispersed into the environment for example during disposal at the end of the service life of the products made therewith.

[0013] In this respect, increasingly strict regulations aimed at reducing and possibly eliminating the presence of lead in plumbing installations have entered into force in recent years.

[0014] Furthermore, the process for disposing shutters of the known type is not particularly easy, especially to allow the recycling of the material with which the various components with which they are formed are made.

[0015] The documents CA 1197653, US 4,706,306, US 5,592,701, US 4,232,407 and US 5,165,118 disclose shutters of the known type in which the pin is made of plastic material. However, also the latter solutions of the known type are not capable of entirely overcoming the problems mentioned above. Furthermore, such solutions of the known type reveal drawbacks relating to the reliability of the shutter and to the ease of use, as well as difficulty relating to manufacturing processes.

Summary of the invention

[0016] In this situation, the technical problem underlying the present invention is to overcome the drawbacks revealed by the prior art known to date, by providing a shutter for a drain plug and a drain assembly, which do not cause significant disposal problems, in particular in terms of recycling and eco-sustainability.

[0017] A further object of the present invention is to provide a shutter for a drain plug and a drain assembly, which are entirely compliant with the laws regulating plumbing installations, in particular in relation to the allowed maximum percentages of lead.

[0018] A further object of the present invention is to provide a shutter for a drain plug and a drain assembly, which do not cause a particular environmental impact.

[0019] A further object of the present invention is to provide a shutter for a drain plug, which is operatively entirely reliable.

[0020] A further object of the present invention is to provide a shutter for a drain plug, that is simple and cost-effective to manufacture and that is easy to use for the end user.

Brief description of the drawings

[0021] The technical characteristics of the invention, according to the objects mentioned above, are clearly observable from the content of the claims outlined below and the advantages thereof will be more apparent from the detailed description that follows, provided with reference to the attached drawings, which represent an embodiment thereof provided purely by way of non-limiting example, wherein:

- figure 1 shows a perspective view of an exploded component of a drain assembly with a shutter subject of the present invention;
- figure 2 shows a cross-sectional view of the drain assembly 1 with the shutter in an opening position;
- figure 3 shows a cross-sectional view of the drain assembly 1 with the shutter in a closing position;
- figure 4a shows a perspective view of a first embodiment of a pin of the shutter subject of the present invention;
- figure 4b shows a perspective view of a second embodiment of a pin of the shutter subject of the present invention;
- figure 5 shows a cross-sectional view of the pin of figure 4a;
- figure 6 shows a cross-sectional view of a detail of the pin of figure 5 with a fin of the pin in an inoperative configuration (shown with a bold line) and in compressed configuration (shown with a dashed line).

Detailed description of a preferred embodiment

[0022] With reference to the attached drawings, an embodiment of a shutter for a drain plug 7 subject of the present invention was indicated in its entirety with 1.

[0023] As described with greater detail below, the shutter 1 in question is designed to be applied to a drain plug 7 for a sink.

[0024] As known, the sink comprises a containment basin in which a liquid, such as water coming from a tap mounted on the sink in question, is susceptible to be collected. In greater detail, the containment basin is open at the upper part and it comprises a bottom wall and a lateral wall which define a filling volume. Furthermore, the containment basin is provided with at least one drain hole, generally provided on the bottom wall, through which the liquid can be discharged from the basin to empty the sink.

[0025] In the present document, the expression sing will be used to indicate any bathroom fixture designed to contain a liquid (for example a kitchen sink, a washbasin, a handbasin, a bidet, a shower, etc.) which is provided with a containment basin provided with at least one drain hole mentioned above.

[0026] Furthermore, forming an object of the present invention is also a drain assembly 100 for a sink which comprises the shutter 1 mentioned above and the plug 7 mentioned above. The plug 7 is designed to be applied to the sink drain hole, and in particular it is inserted inside such drain hole.

[0027] In a per se known manner, the plug 7 is designed to be fixed to the bottom wall of the sink basin and to hydraulically connect the containment volume of the basin with one or more drain pipes of a hydraulic system to allow the liquid to flow out from the sink. Advantageously, for example with reference to figures 2 and 3, the plug 7 comprises a conveyance body 71 (known in the technical jargon with the expression "waste trap"), which defines a housing seat 711 open at the upper part and it is provided with at least one passage opening 712 (and preferably more than one) through which it is susceptible to make the liquid contained in the sink to flow through to reach the drain pipe. Preferably, the conveyance body 71 extends, in particular tapered-shaped, from an upper opening 713, which is arranged at the sink drain hole, and a lower wall 714, on which there is provided the passage opening 712 mentioned above. The conveyance body 71 advantageously comprises a lateral wall 716 which connects the lower wall 714 to the upper opening 713 and laterally closes the housing seat 711 of the conveyance body 71.

[0028] In this manner, in use, the liquid contained in the sink basin is susceptible to enter into the housing seat 711 of the conveyance body 71 and be conveyed in the drain pipe through the passage opening 712 (when the shutter 1 is in the opening position, as outlined below).

[0029] Preferably, the plug 7 comprises a bush 72, which is fixed to the conveyance body 71 and it is provided with an inner wall 721 defining an insertion hole 722, which extends along a movement direction Y advantageously substantially orthogonal to the lower wall

714 of the conveyance body 71 and, in particular, substantially vertical. Preferably, the bush 72 is substantially tubular-shaped and it predominantly extends (in particular with extended shape) along the movement direction Y mentioned above. Advantageously, the bush 72 is fixed to the lower wall 714 of the conveyance body 71 and preferably it extends along the movement axis Y outside the housing seat 711 below the conveyance body 71.

[0030] As will be readdressed in greater detail below, the shutter 1 subject of the present invention is preferably designed to be movably applied to the plug 7 of the drain assembly 100 so as to allow or prevent the liquid from flowing through the plug 7.

[0031] The shutter 1 comprises a pin 2, which is intended to be at least partially inserted into the insertion hole 722 of the bush 72 of the plug 7. The pin 2 mentioned above extends, along an extension axis X (preferably with extended shape), between a first end 2', which is intended to be arranged in the insertion hole 722 of the bush 72, and an opposite second end 2", which is intended to be arranged outside the insertion hole 722 mentioned above.

[0032] Preferably, the pin 2 of the shutter 1 is at least partially slidably inserted into the into the insertion hole 722 with the extension axis X substantially parallel (and particularly aligned) to the movement direction Y. In this manner, the pin 2 of the shutter 1 is movable along the movement direction Y.

[0033] Furthermore, the shutter 1 comprises an interference element 3, which is connected to the pin 2, is arranged between the first end 2' and the second end 2" of the pin 2, advantageously spaced apart from both, and it is susceptible to interfere with the bush 7 so as to keep the shutter 1 in position, therefore preventing the unwanted movement of the pin 2 along the bush 72 parallel to the movement direction Y.

[0034] The shutter 1 further comprises a basket 4, which is fixed to the pin 2 at the second end 2" and it is designed to be arranged in the housing seat 711 defined by the conveyance body 71 of the plug 7, in particular interposed between the upper opening 713 and the passage opening 712 of the conveyance body 71.

[0035] Advantageously, the basket 4 is concave-shaped with concavity facing upwards and it is provided with a plurality of through openings 41 susceptible to allow the liquid to flow through retaining any solid agglomerates with larger dimensions with respect to the dimensions of the through openings 41.

[0036] Furthermore, the shutter 4 comprises sealing means 5 arranged under the basket 2, rigidly connected to the pin 2, and designed to provide sealing on the plug 7 to close it so as to prevent the liquid from flowing through the plug 7.

[0037] According to the idea underlying the present invention, the pin 2 and the interference element 3 of the shutter 1 are made of polymeric material.

[0038] In this manner, the shutter 1 subject of the present invention does not comprise any component made of brass and, therefore, it does not comprise any amount of lead that is potentially harmful for the environment if dispersed inappropriately. As a result, the shutter 1 subject of the present invention is lead-free and complies with the strictest environmental protection regulations.

[0039] In particular, the shutter 1 according to the invention allows an easy disposal at the end of its service life, in particular facilitating the recovery of the materials for recycling and, therefore, offering greater environmental sustainability.

[0040] For example, the pin 2 and/or the interference element 3 can be made of polypropylene (PP).

[0041] In particular, the pin 2 and/or the interference element 3 are entirely made of polymeric material.

[0042] Furthermore, the interference element 3 comprises at least one projecting portion 31, which is elastically deformable at least in radial direction with respect to the extension axis X and it is designed to be elastically bent towards the extension axis X when it is inserted into the insertion hole 722 of the bush 72 (for example as shown in figure 3).

[0043] In this manner, the projecting portion 31 of the shutter 1 subject of the present invention, through elastic return due to the bending thereof, is susceptible to exert a thrust force on the inner wall 721 of the bush 72, therefore inducing a friction between the pin 2 and the inner wall 721, the friction opposing the movement of the shutter 1 keeping it stationary, in particular in the absence of external forces (like the action of a user) capable of overcoming the friction mentioned above, with respect to the bush 72. Preferably, with the interference element 3 arranged outside the insertion hole 722 of the bush 72, the projecting portion 31 has a maximum width LM (measured orthogonally to the extension axis X) larger than the diameter of the insertion hole 722. In this manner, when the interference element 3 is inserted into the insertion hole 722, it mechanically interferes with the inner wall 721 of the bush 72 which, therefore, is susceptible to deform the projecting portion 31 of the interference element 3 determining the downtime due to friction mentioned above.

[0044] Advantageously, the interference element 3 is made of a single body with the pin 2, preferably by means of injection molding, in particular made of the same material and by means of two-component molding (should the interference element 3 and the pin 2 be made of other polymeric materials).

[0045] In this manner, with the shutter 1 subject of the present invention, the complexity of the interference element 3 and the time required to assemble the latter with the pin 2 are significantly lower than the prior art shutters.

[0046] According to a different embodiment, the interference element 3 and the pin 2 may be made of distinct components that are mechanically fixed to each other, for example by gluing or shape coupling.

[0047] Advantageously, with the pin 2 of the shutter 1

slidably inserted into the insertion hole 722 of the bush 72, the shutter 1 can be moved, along the movement direction Y, between an opening position (shown in the example of figure 2), in which it allows the liquid to flow through the plug 7, and a closing position (shown in the example of figure 3), in which it prevents the liquid from flowing through the plug 7. In particular, in the opening position, the sealing means 5 are spaced apart from the conveyance body 71 so as to allow the liquid to flow out of the sink through the passage opening 712. Preferably, in the opening position, the shutter 1 is in a raised position so as to keep the sealing means 5 spaced apart from the conveyance body 71 at the upper part, and in the closing position, the shutter 1 is in a lowered position to press the sealing means 5 against the conveyance body 71.

[0048] Advantageously, the bush 72 extends, along the movement direction Y (in particular with extended shape), between an upper head 72', fixed to the lower wall 714 of the conveyance body 71 of the plug 7, and a lower head 72" facing downwards. Preferably, the bush 72 is provided with an inlet mouth 724, which, in particular, is arranged on the upper head 72' of the bush 72, and it is traversed by the pin 2 when the latter is inserted into the bush 72.

[0049] Preferably, when the shutter 1 is in the opening position, the interference element 3 is arranged restingly on the inlet mouth 724.

[0050] In this manner, the resting of the projecting portion 31 of the interference element 3 on the inlet mouth 724 of the bush 72 allows the shutter 1 to remain in the opening position, in particular maintaining the sealing means 5 spaced apart from the conveyance body 71 of the plug 7.

[0051] Advantageously, as shown in figure 3, in the closing position, the sealing means 5 are in contact with the conveyance body 71 occluding the housing seat 711 above the passage opening 712.

[0052] In such closing position, the interference element 3 is at least partially inserted into the insertion hole 722 of the bush 72 with the projecting portion 31 elastically bent by the inner wall 721 of the bushing 72 towards the extension axis X. In this manner, the shutter 1 is kept in the closing position due to the friction force induced by the elastic return thrust exerted by the projecting portion 31 of the interference element 3 on the inner wall 721 of the bush 72.

[0053] Advantageously, with reference to examples of figures 4a-6, the projecting portion 31 of the interference element 3 comprises at least one fin 32, which extends projecting from the pin 2 and it extends, along the extension axis X mentioned above, between a constrained end 32', which is joined to pin 2, and a (terminal) free end 32", which is separated from the pin 2.

[0054] In particular, the pin 2 is provided with a lateral surface 27, which extends around the extension axis X. Advantageously, the fin 32 mentioned above extends projectingly from such lateral surface 27 of the pin 2.

[0055] Preferably, the fin 32 is susceptible to elastically bend between an inoperative configuration, in which the free end 32" is spaced apart from the pin 2, and a compressed configuration, in which the pin 32 is bent towards the pin 2 with the free end 32" closer to the pin 2 with respect to the inoperative configuration.

[0056] Preferably, when the fin 32 is in the inoperative configuration, the interference element 3 is, in at least one portion thereof, wider than the diameter of the insertion hole 722 of the bush 72.

[0057] Preferably, in the inoperative configuration, the fin 32 defines the maximum width LM (measured orthogonally with respect to the extension axis X) mentioned above, of the projecting portion 31 of the interference element 3, the maximum width LM, as mentioned above, is larger than the diameter of the insertion hole 722 of the bush 72.

[0058] In this manner, when the fin 32 is inserted into the insertion hole 722 (in particular when the shutter 1 is brought to the closing position), it interferes with the inner wall 721 of the bush 72 which elastically bends the fin 32 from the inoperative configuration to the compressed configuration.

[0059] Advantageously, when the shutter 1 is in the opening position, the interference element 3 is at least partially arranged outside the insertion hole 722 of the bush 72 and the fin 32 is in the inoperative position. When the shutter 1 is in the closing position, the interference element 3 is arranged in the insertion hole 722 and the fin 32 is bent by the inner wall 721 of the bush 72 in the compressed configuration mentioned above. Preferably, when the shutter 1 is in the opening position, the fin 32 is arranged restingly on the inlet mouth 724 of the insertion hole 722 of the bush 72 (as shown in the example of figure 2).

[0060] According to a variant embodiment not shown in the attached figures, the fin 32 is at least partially inserted into the insertion hole 722 even when the shutter 1 is in the opening position. According to this variant embodiment, in such opening position, the fin 32 is in a compressed configuration, returning to the inoperative configuration only when the shutter 1 is removed from the plug 7. In particular, the opening position of the shutter 1 is defined by another abutment element of the plug 7 or of the shutter 1. Advantageously, the interference element 3 comprises multiple fins 32 (in particular more than two, for example four) arranged around the extension axis X and separated from each other (preferably along a circumferential direction around the extension axis X) through separation slits 33 interposed between the fins 32. In particular, the fins 32 are arranged around the pin 2, for example with a crown-like configuration.

[0061] Preferably, with reference to figures 4a and 4b, each fin 32 extends along the circumferential direction mentioned above, between the two lateral edges 325. Advantageously, each separation slit 33 is defined by two lateral edges 325 of two mutually adjacent fins 32.

[0062] The separation slits 33 mentioned above have the function of facilitating the deformation of the fins 32

between the inoperative configuration and the compressed configuration. As a matter of fact, as reported above, when switching from the inoperative configuration to the compressed configuration, the free end 32" of each fin 32 approaches the fin 2, and the separation slit 33 allows two lateral edges 325 of two adjacent fins 32 to approach each other, therefore reducing resistance to deformation and possible mechanical stresses (both on the fins 32 and on the bush 72) which would instead occur in the case of a fin 32 which extends around the extension axis X without interruption.

[0063] Advantageously, the fin 32 has a thinned shape (in particular sheet-like), for example substantially petal-shaped.

[0064] Preferably, the fin 32 extends, from its constrained end 32' to its free end 32", approaching the first end 2' of the pin 2.

[0065] Advantageously, the fin 32 is provided with an inner surface 321, facing towards the pin 2, and with an opposite outer surface 322.

[0066] Preferably, with the fin 32 at least in the inoperative configuration, the inner surface 321 is at least partially spaced apart and counter-faced to the pin 2. In this manner, the distance between the inner surface 321 and the pin 2 allows to bend the fin 32 from the inoperative configuration to the compressed configuration approaching the pin 2.

[0067] In particular, as shown in the example of figure 6, the inner surface 321 of the fin 32 delimits with the lateral surface 27 of the pin 2 a spacing interspace 326, which is closed at the upper part by the joining of the constrained end 32' of the fin 32 with the fin 2, and it is open at the lower part, at the free end 32" of the fin 32.

[0068] Preferably, when the fin 32 is in the inoperative position, the interference element 3 has an end width LE (measured orthogonally to the extension axis X), at the free end 32" of the fin 32, smaller than the diameter of the insertion hole 722 of the bush 72.

[0069] In this manner, when the pin 2 of the shutter 1 is inserted into the insertion hole 722 of the bush 72 and the projecting portion 31 of the pin reaches the inlet mouth 724 of the bush 72, the free end 32" of the fin 32 easily enters into the inlet mouth 724 without having to elastically deform the fin 32 approaching the extension axis X. As a result, the insertion of the pin 2 into the insertion hole 722 of the bush 72 is facilitated, preventing the free end 32" of the fin 32 from abutting against the inlet mouth 724 of the bush 72 being trapped or damaged.

[0070] Advantageously, the fin 32, at the free end 32", comprises a tapered pilot portion 323 on the outer surface 322. Preferably, at the pilot portion 323 the outer surface 322 of the fin 32 extends approaching the extension axis X towards the free end 32" of the fin 32. Advantageously, when the shutter 1 is in the opening position and the interference element 3 is arranged restingly on the inlet mouth 724 of the bush 72, the free end 32" of the fin 32 is arranged in the insertion hole 722 of the bush 72 (in particular in the inlet mouth 724 of the latter).

[0071] In this manner, when moving the shutter 1 from the opening position to the closing position, the fin 32 slides on the inlet mouth 724 of the bush 72, in particular exploiting the pilot portion 323, elastically deforming progressively without the movement being blocked due to an interference between the free end 32" of the fin and the inlet mouth 724 of the bush 72.

[0072] Advantageously, the inlet mouth 724 of the bush 72 comprises a flared shape for further facilitating the insertion of the free end 32" of the fin and the movement of the shutter 1 from the opening position to the closing position.

[0073] Advantageously, the pin 2 extends (along the extension axis X) for at least half of its length (and preferably in large part of the length) from the interference element 3 to the first end 2' of the pin 2.

[0074] Preferably, the pin 2 is provided, along the extension axis X, with a first section 21 and with a second section 22.

[0075] Advantageously, the first section L1 extends from the second end 2" of the pin 2 to the interference element 3, and the second section 22 extends from the interference element 3 to the first end 2' of the pin 2.

[0076] Advantageously, the second section 22 has a length that is greater than or equal to the length of the first section 21, preferably with a ratio between the length of the second section 22 and the length of the first section 21 that is greater than or equal to 1.5 and even more preferably comprised between 1.5 and 3.

[0077] Advantageously, the second section 22 of the pin 2 is adapted to be inserted into the insertion hole 722 of the bush 72 even when the shutter 1 is in the opening position (besides when the shutter 1 is in the closing position). In this manner, in particular, the pin 2 keeps the shutter 1 stable even in the opening position and it can guide the movement of the shutter 1 along the extension axis X between the opening position and the closing position.

[0078] Preferably, with reference to figure 5, the pin 2 is provided, along the extension axis X, with the first section 21 having a first width L1 (in particular measured orthogonally to the extension axis X), and with the second section 22, which extends from the first section 21 towards the first end 2' of the pin 2 and it has a second width L2 (in particular measured orthogonally to the extension axis X) smaller than the first width L1.

[0079] Advantageously, the first width L1 of the first section 21 of the pin 2 is smaller than the diameter of the insertion hole 722 of the bush 72, in particular with a minimum clearance such to allow the substantially fitting insertion and, at the same time, with the sliding of the first section 21 in the insertion hole 722. In this manner, the first section 21 of the pin 2 is susceptible to be arranged in the insertion hole 722 of the bush 72 centering the pin 2 with respect to such insertion hole 722.

[0080] Advantageously, the first section 21 is connected to the second section 22 by means of a radial shoulder 23.

[0081] Preferably, the fin 32 extends protruding from the radial shoulder 23 towards the first end 2' of the pin 2 facing, in particular with the inner surface 321 thereof, on the second section 22 of the latter.

[0082] In this manner, in particular, such configuration of the fin 32 entails that, during the movement of the shutter 1 from the closing position to the opening position, the friction between the inner wall 721 of the bush 2 and the fin 32 generates shear stresses which tend to detach the fin 32 from the pin 2, therefore ensuring a good duration of the service life of the shutter 1.

[0083] Advantageously, the constrained end 32' of the fin 32 is arranged at the radial shoulder 23.

[0084] Preferably, the projecting portion 31 of the interference element 3 has a width (in particular measured orthogonally to the extension axis X) at the constrained end 32' of the fin 32 greater than or equal to the first width L1 of the first section 21 of the pin 2. Advantageously, with reference to figure 6, the fin 32 is provided with a widening portion 324 which is arranged between the pilot portion 323 and the constrained end 32' and it defines the maximum width LM mentioned above of the interference element 3, the maximum width LM being greater than the first width L1 of the first section 21 of the pin 2.

[0085] Preferably, the outer surface 322 of the fin 32 is convex-shaped and, at least partially, arc-shaped.

[0086] Advantageously, the outer surface 322 of the fin 32 extends, along the extension axis X, moving away from the latter from the constrained end 32' to the widening portion 324, and it extends, along the extension axis X, approaching the latter from the widening portion 324 to the free end 32".

[0087] In this manner, in particular, such configuration of the outer surface 322 of the fin 32 further reduces, during the movement of the shutter from the closing position to the opening position, shear stresses acting on the fin 32 which can weaken and reduce their service life.

[0088] Advantageously, the pin 2 is provided with guide ribs 24 arranged along the second section 22.

[0089] Preferably, the guide ribs 24 extend radially from the second section (in particular from the portion of the lateral surface 27 of the pin 2 defined by such second section 22). Preferably, the guide ribs 24 extend parallel to the extension axis X over the entire length of the second section 22 of the pin.

[0090] The guide ribs 24 have the function of guiding, in particular keeping it centered with respect to the extension axis X, the second section 22 of the pin 2 along the insertion hole 722 of the bush 72 when inserting the shutter 1 into the plug 7, so that the free end 32" of the fin 32 does not abut against the inlet mouth 724 of the bush 72 being trapped or damaged.

[0091] Advantageously, each rib 24 radially extends protruding from the second section 22 of the pin 2 up to its outer edge 24', so that the enveloping of the outer edges 24' around the extension axis X defines a centering width LC substantially equal to the first width L1 of the first section 21 of the pin 2.

[0092] Preferably, each guide rib 24 is arranged aligned to a corresponding separation slit 33, in particular so as not to interfere with the fins 32.

[0093] Advantageously, with reference to figures 2 and 3, the sealing means 5 of the shutter 1 comprise a locking body 51, preferably disc-shaped, which is rigidly connected to the pin 2 and it is arranged below the basket 4 coaxially to the extension axis X. Furthermore, the sealing means 5 comprise an annular seal 52 arranged perimetrically on the locking body 51.

[0094] Preferably, the locking body 51 and the annular seal 52 are made of a single body, advantageously of two materials different from each other by means of two-component molding.

[0095] Advantageously, as observable from figure 2, with the shutter 1 in the opening position, the annular seal 52 is arranged spaced apart from the conveyance body 71, therefore allowing the liquid to flow through the plug 7. Preferably, as observable in figure 3, with the shutter 1 in the closing position, the annular seal 52 is arranged restingly on the conveyance body 71, therefore ensuring the hydraulic sealing between the locking body 51 and the conveyance body 71 preventing the liquid from flowing through the plug 7. In particular, the lower wall 714 of the conveyance body 71 of the plug 7 is provided with a lowering cavity 717, at which there is obtained the passage opening 712 for the outlet of the liquid. In the closing position of the shutter 1, the sealing means 5 sealingly close such lowering cavity 717 at the upper part, therefore separating the passage opening 712 preventing the flow of the liquid towards the latter.

[0096] Preferably, the basket 4 of the shutter 1 is provided with an upper concave surface 42 designed to be faced towards the containment basin of the sink, and with an opposite lower convex surface 43. Advantageously, the locking body 51 is arranged abutting against the lower surface 43 of the basket 4.

[0097] Advantageously, the shutter 1 comprises a gripping element 6 arranged on the upper surface 42 of the basket 4, preferably aligned to the extension axis X, and fixed to the second end 2" of the pin 2.

[0098] Preferably, the gripping element 6 is fixed to the second end 2" of the pin 2 by means of a fitting coupling.

[0099] Advantageously, the basket 4 is provided with a first through hole 44 aligned with respect to the extension axis X of the pin 2, and the locking body 51 comprises a second through hole 511 arranged aligned to the first through hole 44 of the basket 4. According to a first embodiment shown in figure 4a, the pin 2 comprises a coupling hole 25 extending starting from the second end 2" along the extension axis X. The coupling hole 25 is preferably a through hole, but without departing from the scope of protection of the present invention, it can be a blind hole.

[0100] Preferably, the gripping element 6 extends, along the extension axis X, protruding from the upper surface 42 of the basket 4 up to an enlarged head 61

thereof, which is arranged above the basket 4 and it is susceptible to be grasped by an operator to move the shutter 1.

[0101] Advantageously, with reference to the embodiment of figures 2 and 3, the gripping element 6 comprises an engagement portion 62, which is arranged beneath the basket 4, in particular passes through the first through hole 44 of the basket 4 and the second through hole 511 of the locking body 51, and it is fixed, for example by fitting coupling, in the coupling hole 25 of the pin 2.

[0102] According to a second embodiment shown in figure 4b, the pin 2 comprises a coupling appendage 26 extending starting from the second end 2" along the extension axis X. Preferably, according to such second embodiment, the gripping element 6 comprises an engagement hole (not shown) obtained at an opposite end of the enlarged head 61. Advantageously, the coupling appendage 26 of the pin 2 is arranged to pass through the first through hole 44 of the basket 4 and of the second through hole 511 of the locking body 51 and it is fixed, in particular by fitting coupling, in the engagement hole of the gripping element 6.

[0103] In this manner, the basket 4 and the locking body 51 are retained between the second end 2" of the pin 2 and the gripping portion 61 of the gripping element 6. Advantageously, with reference to figures 2 and 3, the conveyance body 71 comprises an annular upper flange 715 which extends around the extension axis X transversely to the latter and delimits an upper opening 713 therein.

[0104] Preferably, the plug 7 comprises a substantially tubular support body 73, extending, along the movement axis Y mentioned above, preferably substantially funnel-shaped, from an upper annular edge 73', designed to be fixed to the bottom wall of the sink basin, around the drain hole of the latter, to a lower coupling portion 73" intended to be fixed to the drain pipe, for example by means of a coupling ring nut. In particular, the support body 73 substantially contains the conveyance body 71 therein.

[0105] Preferably, the support body 73 is preferably provided, at the upper annular edge 73' thereof, with a coupling flange 732 arranged below the annular upper flange 715 of the conveyance body 71, in particular with a sealing gasket 74 arranged between them.

[0106] In use, when the plug 7 is fixed to the sink, the annular upper flange 715 and the coupling flange 732 retain between them a portion of the bottom wall of the sink basin extending around the drain hole.

[0107] Advantageously, the support body 73 comprises, in a per se conventional manner, a fixing portion (not shown in the attached figures) which is arranged at the lower coupling portion 73" and it is provided with a threaded hole extending along the extension axis X within which there is fixed the bush 72, which therefore fixes the conveyance body 71 and the support body 73 to each other.

[0108] Therefore, the invention thus conceived attains the pre-established objects.

Claims

1. Shutter (1) for a plug (7) of a drain of a sink, which comprises:

   - a pin (2), which is intended to be at least partially slidably inserted into an insertion hole (722) of a bush (72) of a plug (7) and it extends, along an extension axis (X), between a first end (2'), which is intended to be arranged in the insertion hole (722) of said bush (72), and an opposite second end (2"), which is intended to be arranged outside said insertion hole (722);
   - an interference element (3), which is connected to said pin (2), is arranged between the first end (2') and the second end (2") of said pin (2), is spaced apart from both said first end (2') and second end (2"), and it is susceptible to interfere with said bush (7) in order to maintain said shutter (1) in position;
   - a basket (4), which is fixed to said pin (2) at said second end (2");
   - sealing means (5) arranged below said basket (2) rigidly connected to said pin (2) and intended to provide a sealing on said plug (7) in order to close it;

   wherein said pin (2) is made of polymer material, and
   wherein said interference element (3) is made of polymer material and it comprises at least one projecting portion (31), which is elastically deformable at least in radial direction with respect to said extension axis (X) and it is provided in order to be elastically bent towards said extension axis (X) when it is inserted into the insertion hole (722) of said bush (72).

2. Shutter (1) according to claim 1, **characterized in that** the projecting portion (31) of said interference element (3) comprises at least one fin (32), which is extended projectingly from said pin (2) and it extends, along said extension axis (X), between a constrained end (32'), which is joined to said pin (2), and a free end (32"), which is separated from said pin (2);
   wherein said fin (32) is susceptible to elastically bend between an inoperative configuration, in which said free end (32") is spaced from said pin (2), and a compressed configuration, in which said fin (32) is bent towards said pin (2) with said free end (32") closer to said pin (2) with respect to said inoperative configuration.

3. Shutter (1) according to claim 2, **characterized in that** said interference element (3) comprises multiple said fins (32) arranged around said extension

axis (X) and separated from each other by separation slits (33) interposed between said fins (32).

4. Shutter (1) according to claim 2 or 3, **characterized in that** said fin (32) extends, from said constrained end (32') to said free end (32"), approaching the first end (2') of said pin (2).

5. Shutter (1) according to any one of claims 2 to 4, **characterized in that** said fin (32) is provided with an inner surface (321), directed towards said pin (2), and with an opposite outer surface (322);
wherein said fin (32), at said free end (32"), comprises a pilot portion (323) tapered on said outer surface (322).

6. Shutter (1) according to any one of claims 2 to 5, **characterized in that** said pin (2) is provided, along said extension axis (X), with a first section (21) having a first width (L1), and with a second section (22), which extends from said first section (21) towards the first end (2') of said pin (2) and it has a second width (L2) smaller than said first width (L1);

wherein said first section (21) is connected to said second section (22) by means of a radial shoulder (23);
wherein said fin (32) projectingly extends from said radial shoulder (23) towards the first end (2') of said pin (2) facing said second section (22).

7. Shutter (1) according to claims 5 and 6, **characterized in that** said fin (32) is provided with a widening portion (324) which is arranged between said pilot portion (323) and said constrained end (32') and defines a maximum width (LM) of said interference element (3) greater than the first width (L1) of the first section (21) of said pin (2).

8. Shutter (1) according to any one of the preceding claims 2 to 7, **characterized in that** said pin (2) is provided with a lateral surface (27), which extends around said extension axis (X); wherein said at least one fin (32) extends projectingly from the lateral surface (27) of said pin (2).

9. Shutter (1) according to claims 5 and 8, **characterized in that** the inner surface (321) of said fin (32) delimits with the lateral surface (27) of said pin (2) a spacing interspace (326), which is closed at the upper part by the configuration of the constrained end (32') of said fin (32) with said pin (2), and it is open at the lower part, at the free end (32") of said fin (32).

10. Shutter (1) according to any one of the preceding claims, **characterized in that** said interference element (3) is made of a single body with said pin (2).

11. Shutter (1) according to any one of the preceding claims, **characterized in that** said pin (2) extends for at least half of its length, defined along said extension axis (X), from said interference element (3) to said first end (2').

12. Drain assembly (100) for a sink, said assembly (100) comprising:

- a plug (7), which is intended to be applied to a drain hole of said sink and comprises:

  - a conveyance body (71), which defines a housing seat (711) open at the upper part and is provided with at least one passage opening (712) through which a liquid contained in said sink is susceptible to flow through;
  - a bush (72), which is fixed to said conveyance body (71) and is provided with an inner wall (721) defining an insertion hole (722);

- a shutter (1) according to any one of the preceding claims,

  wherein the pin (2) of said shutter (1) is inserted into the insertion hole (722) of said bush (72) and the basket (4) of said shutter (1) is arranged within the housing seat (711) defined by the conveyance body (71) of said plug (7);
  wherein said shutter (1) can be moved, along a movement direction (Y) parallel to said extension axis (X), between an opening position, in which said sealing means (5) are spaced from said conveyance body (71) in order to allow the outflow of said liquid from said sink through said passage opening (712), and a closed position, in which said sealing means (5) are in contact with said conveyance body (71), occluding said housing seat (711) above said passage opening (712) and said interference element (3) is at least partially inserted into the insertion hole (722) of said bush (72) with said projecting portion (31) elastically bent from the inner wall (721) of said bush (72) towards said extension axis (X).

13. Drain assembly (100) according to claim 12, comprising a shutter (1) according to any one of claims 2 to 9, **characterized in that**, when said shutter (1) is in said opening position, said interference element (3) is at least partially arranged outside the insertion hole (722) of said bush (72) and said fin (32) is in said inoperative position, and when said shutter (1) is in said closing position, said interference element (3) is

arranged within said insertion hole (722) and said fin (32) is bent from the inner wall (721) of said bush (72) in said compressed configuration.

14. Drain assembly (100) according to claim 13, **characterized in that**, when said fin (32) is in said inoperative configuration, said interference element (3) is, in at least one portion thereof, wider than the diameter of said insertion hole (722).

15. Drain assembly according to claim 14, **characterized in that** said bush (72) is provided with an inlet mouth (724) traversed by said pin (2) and on which there is restingly arranged said interference element (3) when said shutter (1) is in said opening position; wherein, when said fin (32) is in said inoperative position, said interference element (3) has a width, at the free end (32") of said fin (32), smaller than the diameter of the insertion hole (722) of said bush (72).

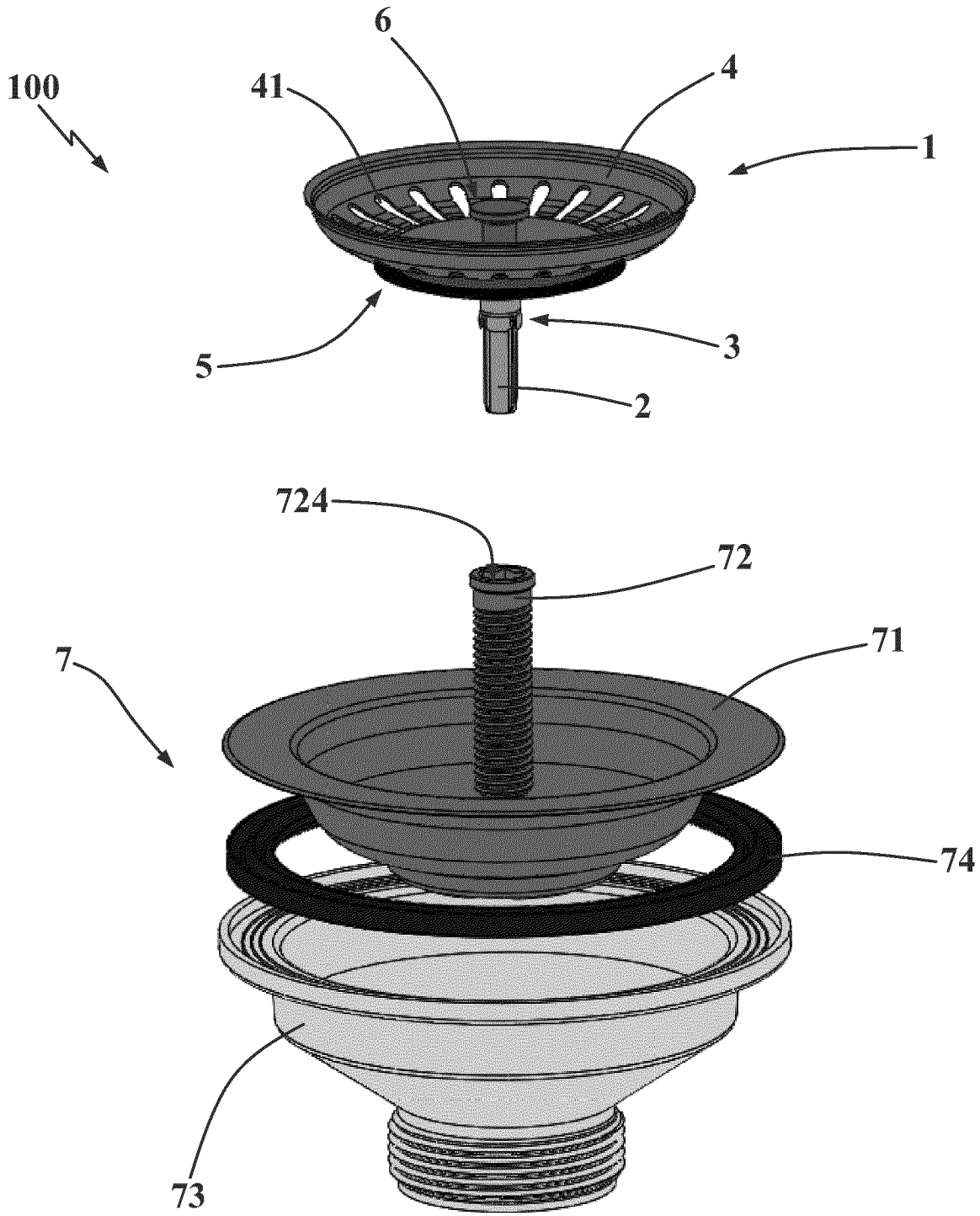

Fig. 1

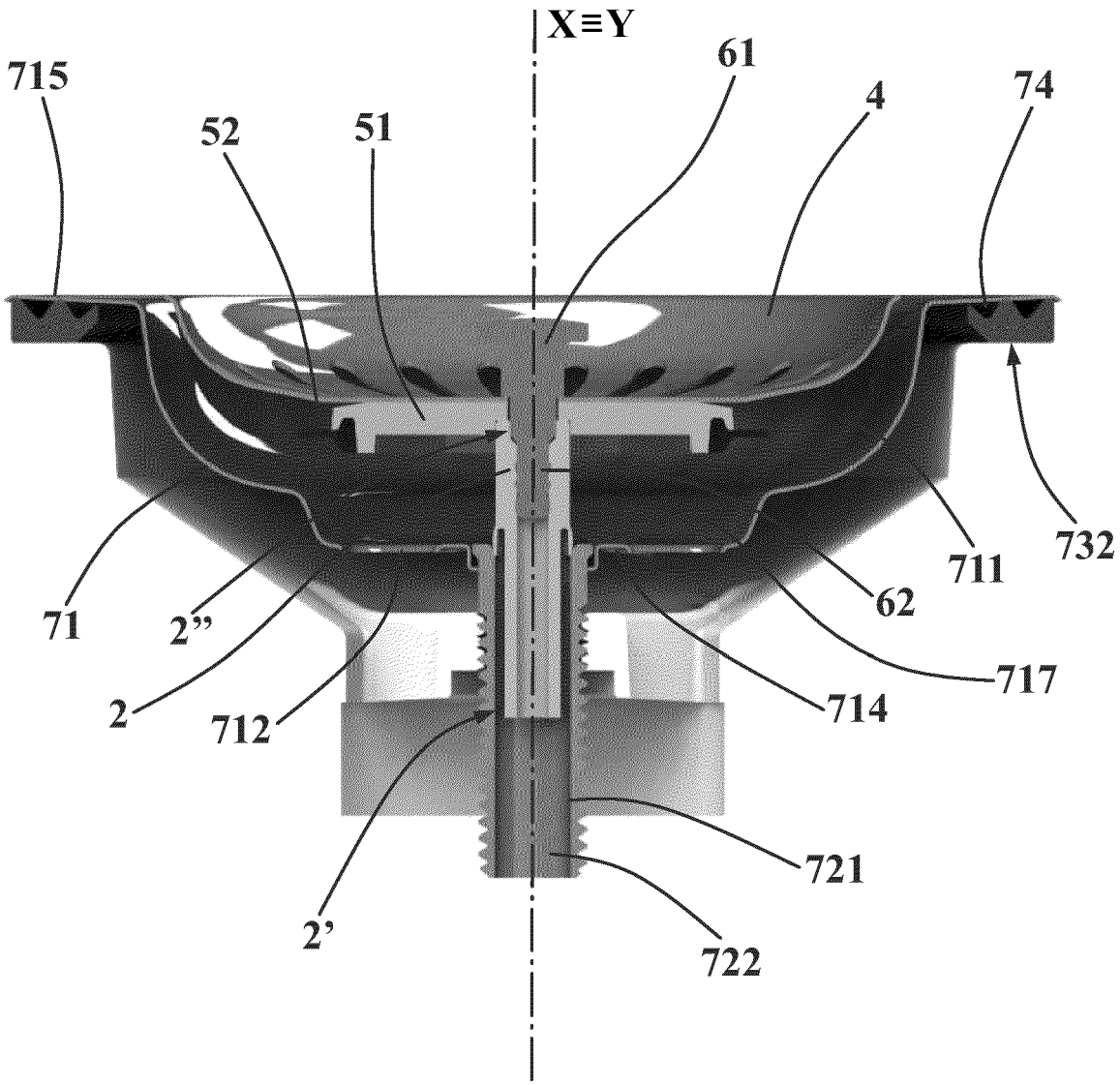

Fig. 2

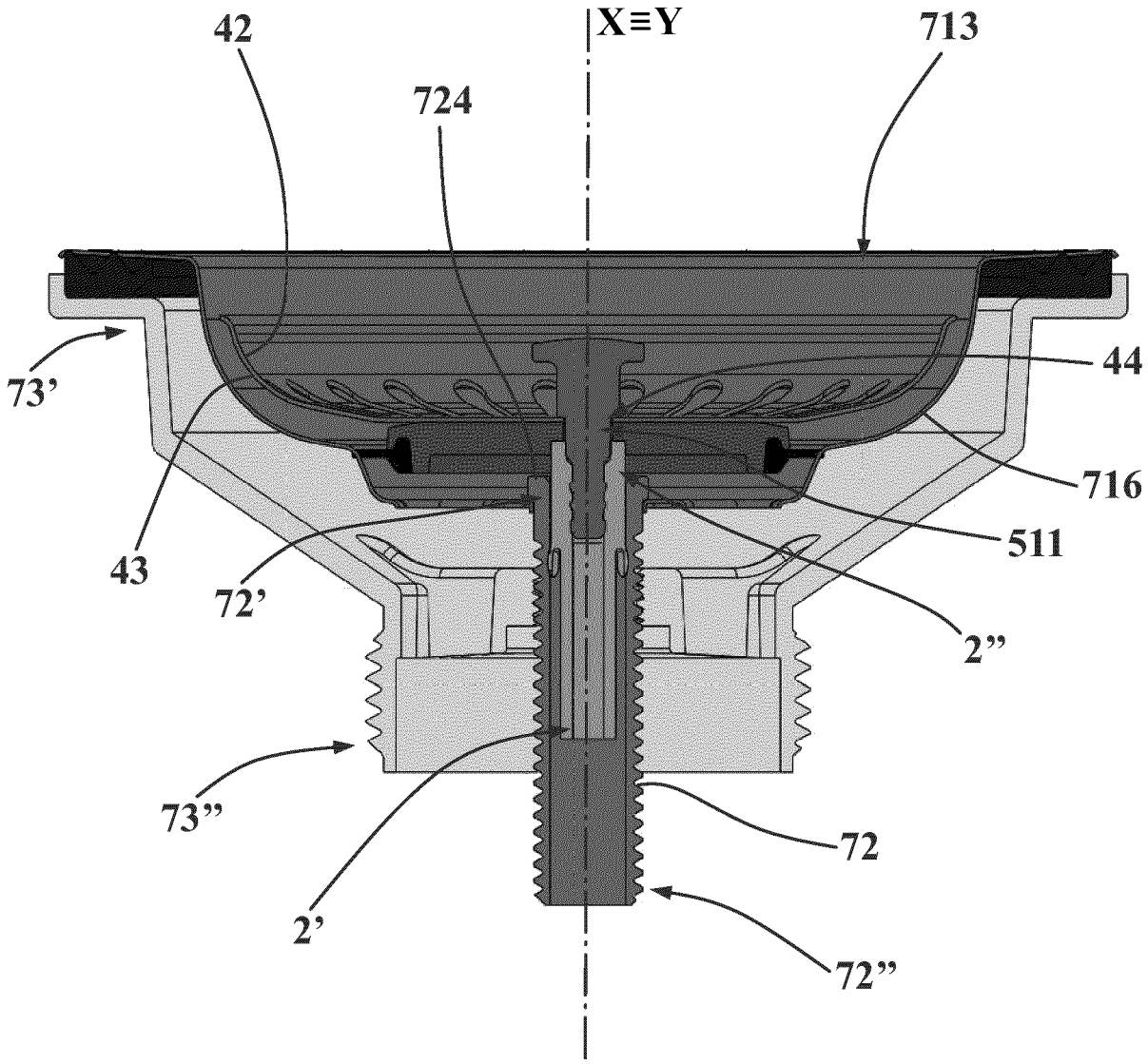

Fig. 3

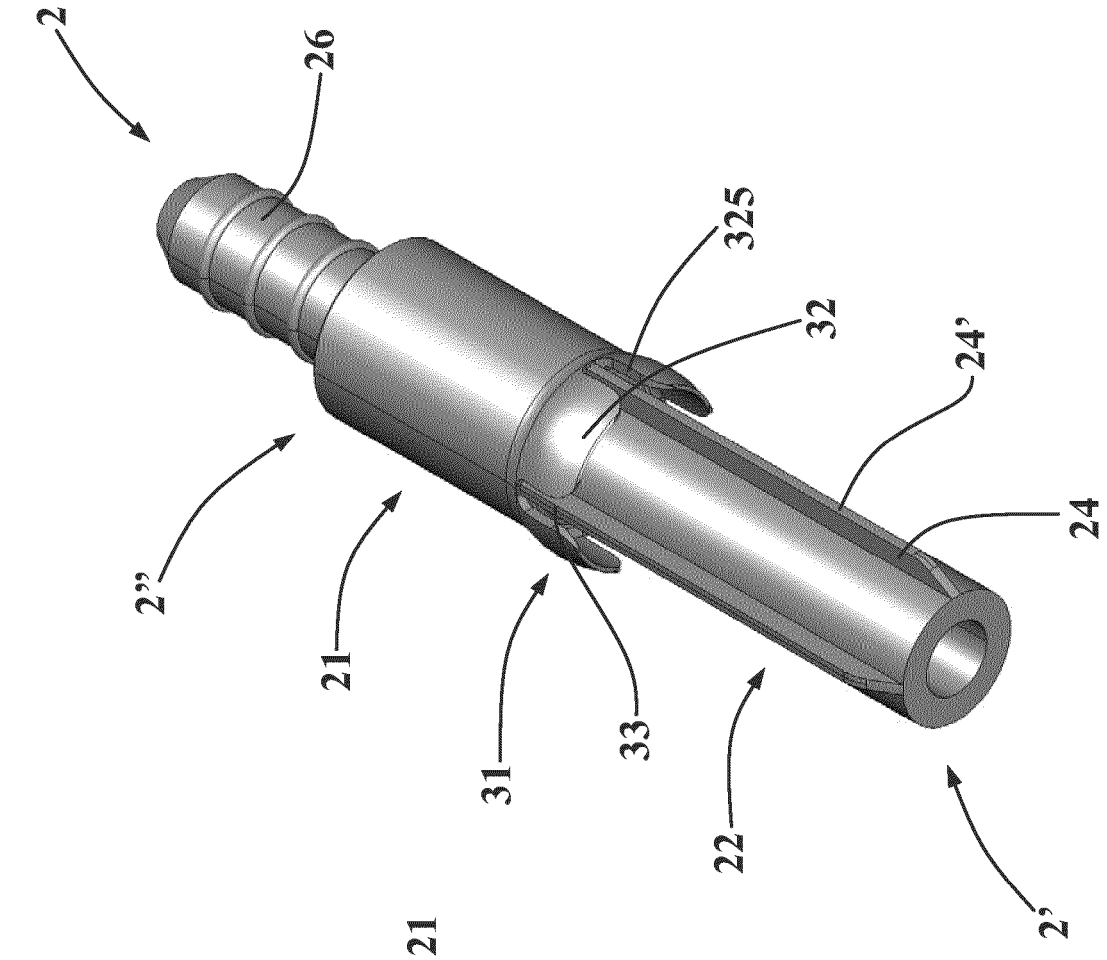

Fig. 4b

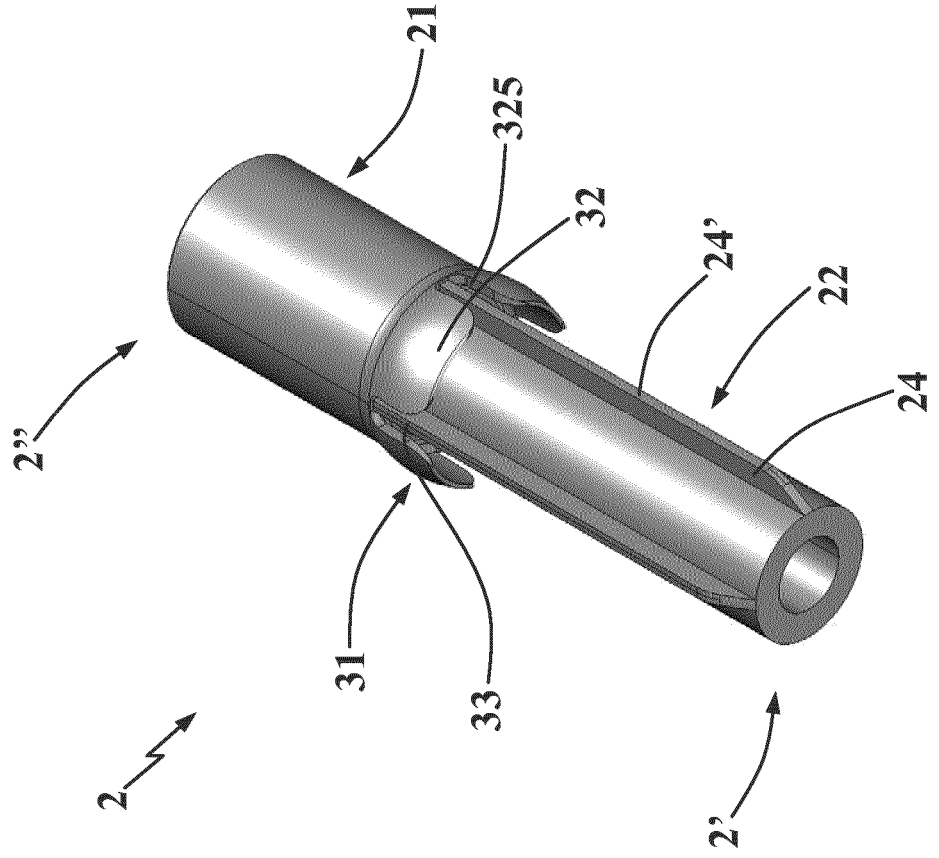

Fig. 4a

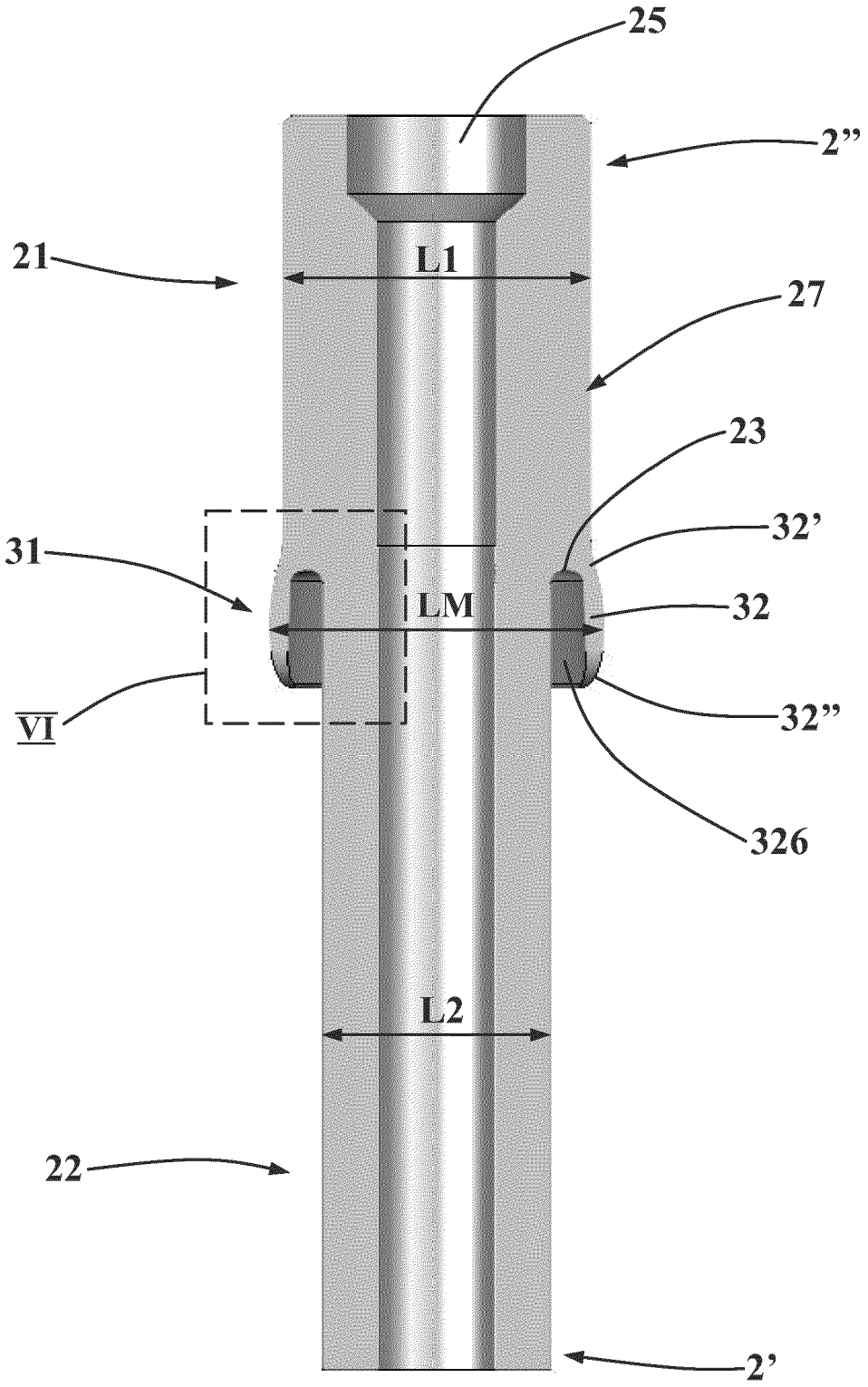

Fig. 5

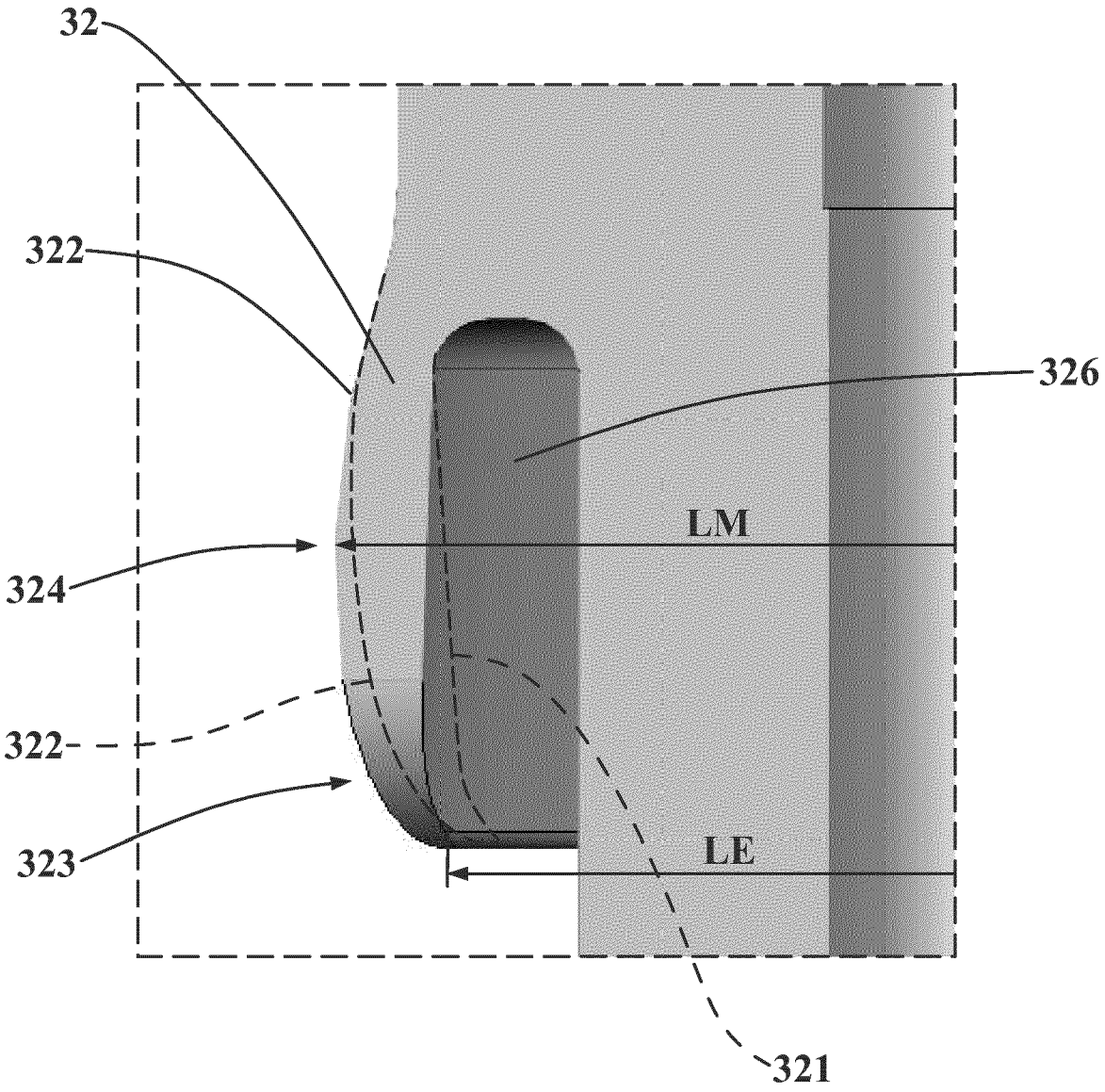

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 2727

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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	28 November 2024	Posavec, Daniel

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