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(54) **A PUMP MANIFOLD**

(57) A manifold (70,150) for a multi-stage pump (10) equipped with a plurality of pumping chambers, wherein the manifold (70,150) comprises a body (75,155) shaped to define a duct (80,160) having an access mouth (125,240) and a plurality of distribution mouths (85,165), wherein each distribution mouth (85,165) is adapted to be connected to a respective pumping chamber (15) of the pump (10), and wherein the body (75,155) consists of a monoblock made of plastic material.

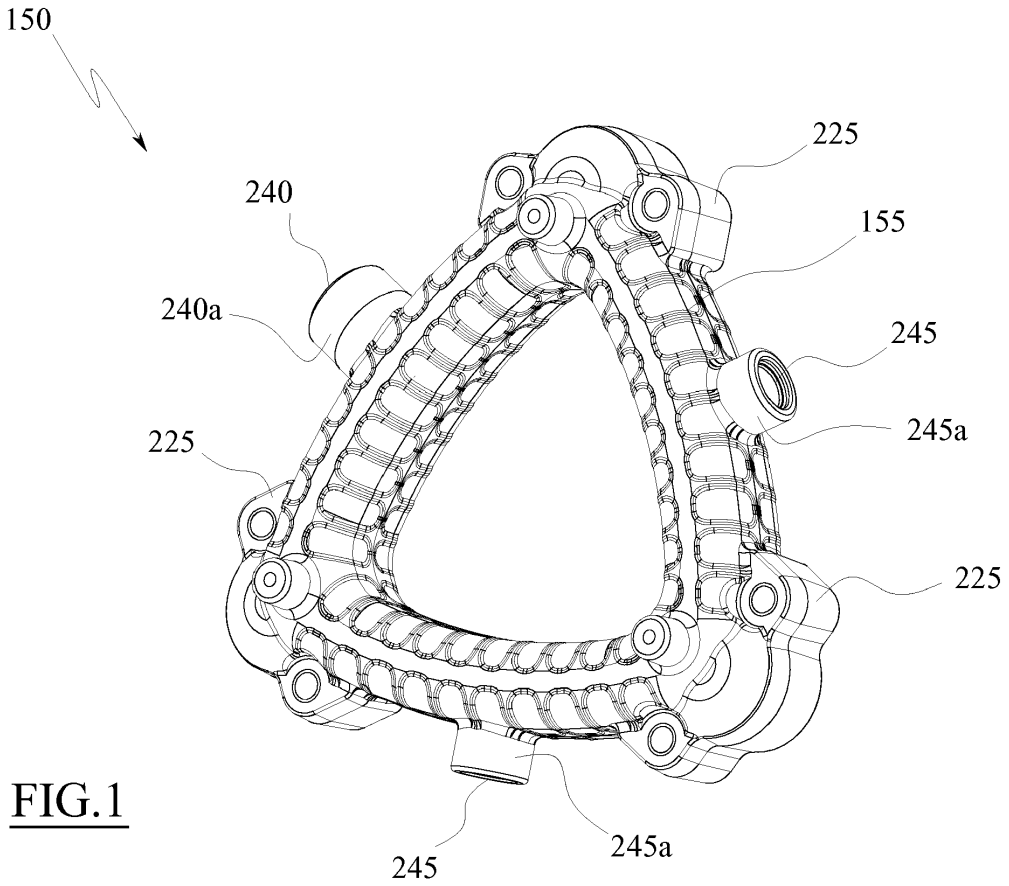

FIG.1

EP 3 372 836 A1

Description

TECHNICAL FIELD

[0001] The present invention concerns a manifold for a multi-stage pump equipped with a plurality of pumping chambers, in particular a manifold for a multi-stage membrane pump.

PRIOR ART

[0002] Pumps generally comprise a casing, a head fixed to the casing and a pumping chamber formed in the head and equipped with a suction duct and a delivery duct that open into the pumping chamber.

[0003] Multi-stage pumps are equipped with a plurality of pumping chambers arranged parallel to one another and are usually equipped with a suction manifold, which takes the work fluid coming from a tank to the suction duct of each pumping chamber, and a delivery manifold, which collects the pressurised fluid coming out from the delivery ducts and sends it towards a single outlet, connected in various ways to a tool and/or a device for dispensing the pressurised fluid.

[0004] Such manifolds are commonly made in a single monolithic body made of aluminium in order to keep the weight of the pump down.

[0005] A problem of this solution is the relatively high cost of the material used. Alternatively, the manifolds can be made of many elements of polymeric material, for example obtained through injection moulding, which are assembled to make the manifold.

[0006] In order to assemble such elements, it is necessary to use sealing gaskets and means for fixing between one element and the other that are used to avoid losses of the work fluid, and it is thus clear that, considering the time needed for assembly as well as the cost of the gaskets and of the fixing means, this solution also has relatively high costs.

[0007] Therefore, there is a great need to reduce the production costs of such manifolds, in a simple, rational and low-cost solution.

[0008] A purpose of the present invention is therefore to satisfy such requirements. Such purposes are accomplished by the characteristics of the invention given in the independent claims.

[0009] The dependent claims outline preferred and/or particularly advantageous aspects of the invention.

SUMMARY OF THE INVENTION

[0010] The invention provides a delivery and/or suction manifold for a multi-stage pump equipped with a plurality of pumping chambers, wherein the manifold comprises: a body shaped to define a duct having an access mouth and a plurality of distribution mouths, wherein each distribution mouth is adapted to be connected to a respective pumping chamber of the pump, wherein the body consists of a monoblock made of plastic (polymeric) material.

[0011] Thanks to such a solution a manifold for a multi-stage pump is provided, i.e. equipped with a plurality of pumping chambers in parallel, the cost of which is particularly low and the manifold made of plastic material does not have joints and relative seals.

[0012] Preferably, the body can be made through rotational moulding of plastic material.

[0013] In this way, no further processing is necessary to make the duct inside the body, thus making the solution particularly cost-effective.

[0014] According to another aspect of the invention, the duct can be shaped like a path closed in a loop.

[0015] In this way, the duct does not obstruct the connection of the pump, on which the manifold is installed, to a drive shaft, for example a power take-off.

[0016] The same advantage is helped to be obtained by another aspect of the invention according to which the body has a substantially annular shape.

[0017] According to a further aspect of the invention, the duct can comprise a withdrawal mouth distinct from the access mouth and from the distribution mouths. Thanks to such a solution the manifold makes it possible to send the pressurised fluid to many devices, for example dispensers.

[0018] According to another aspect of the invention, each distribution mouth can comprise a plate for fixing to the respective pumping chamber of the pump.

[0019] In this way, an optimal seal is ensured at the distribution mouths.

[0020] The invention also provides a multi-stage pump comprising a plurality of pumping chambers and a delivery and/or suction manifold equipped with a body shaped to define a duct having an access mouth and a plurality of distribution mouths, wherein each distribution mouth is connected to a respective pumping chamber of the pump, wherein the body consists of a monoblock made of plastic material.

[0021] Thanks to such a solution a pump is provided equipped with a manifold that is cost-effective to make.

[0022] Preferably, each pumping chamber can comprise a delivery duct, each distribution mouth of the manifold being connected to a respective delivery duct, and a suction duct, each distribution mouth of the manifold being connected to a respective suction duct.

[0023] According to another aspect of the invention, between each pumping chamber and the respective distribution mouth an automatic unidirectional valve can be arranged.

[0024] In this way, refluxes of pressurised fluid are prevented.

[0025] According to a further aspect of the invention, the distribution mouth can comprise a housing seat of said unidirectional valve.

[0026] In this way, it is not necessary to work the head of the pump to obtain the housing for the valve.

[0027] The invention also provides a method for making a manifold made of plastic material for multi-stage

pumps comprising the steps of: obtaining a monoblock body equipped with an inner cavity shaped like a duct through rotational moulding and perforating a wall of the monoblock body by making at least one through opening on it along the duct defining an access mouth of a manifold for multi-stage pumps and a plurality of through holes along the duct each defining a distribution mouth of a manifold for multi-stage pumps.

[0028] Thanks to such a solution, making the manifold is particularly quick, cost-effective and rational.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Further characteristics and advantages of the invention will become clearer from reading the following description provided as an example and not for limiting purposes, with the help of the figures illustrated in the attached tables.

Figure 1 is a perspective view of a delivery manifold according to the invention.

Figure 2 is a front view of figure 1.

Figure 3 is a section view according to the plane III-III of figure 2

Figure 4 is a side view of figure 1.

Figure 5 is a section view according to the plane V-V of figure 4.

Figure 6 is a section view corresponding to that of figure 5 of a suction manifold according to the invention.

Figure 7 is a perspective view of a pump equipped with the suction manifold and the delivery manifold.

Figure 8 is a front view of figure 6.

Figure 9 is a partial section view according to the section line VIII-VIII of figure 7.

DETAILED DESCRIPTION

[0030] With particular reference to figures 7 to 9, a multi-stage pump, for example of the membrane type, equipped with a plurality of pumping chambers 15, has been globally indicated with 10.

[0031] It should be specified that in this description the term multi-stage pump is meant to indicate a pump in which the pumping chambers are parallel to one another, i.e. in which the pressure difference between upstream and downstream of every pumping chamber is the same for all of the pumping chambers. The pump 10 comprises a casing 20 and a shaft 25, which is rotatably associated with said casing 20 and at least partially contained in it.

[0032] Said shaft 25 comprises a cam (not illustrated) rotating as a unit with the shaft itself.

[0033] Moreover, the shaft 25 comprises a grooved tang 30 adapted for being coupled with a matching grooved tang of a drive shaft, for example of a power take-off of a vehicle.

[0034] For example, the shaft 25 can comprise an end projecting externally from the casing 20, equipped with said grooved tang 30.

[0035] The pump 10 can be equipped with a protective collar (not illustrated) adapted for wrapping around the grooved tang 30 in the radial direction.

[0036] For example, the pump 10 comprises a tank of lubricating fluid T fixed to the casing 20, for example outside of it.

[0037] The pump 10 comprises a foot 35, for example two feet 35, fixedly connected to the casing 20 and adapted for supporting the pump 10 resting on a flat surface so that the axis of the shaft 25 is substantially parallel to the plane on which said flat surface lies.

[0038] The feet 35 each comprise a plurality of holes adapted for allowing the pump 10 to be fixed to a vehicle or a tool through threaded connections.

[0039] The pump 10 is equipped with a plurality of cylinders 40, for example three of them, the central axes of which are perpendicular to the axis of the shaft 25. Each cylinder 40 is made inside the casing 20.

[0040] For example, the cylinders 40 are equally angularly spaced apart with respect to the axis of the shaft 25.

[0041] The pump 10 comprises a plurality of pistons (not illustrated), each slidably received in a respective cylinder 40 and associated with the shaft 25 through a connecting rod (not illustrated), which at one end is hinged to the piston and at the opposite end has a concave surface on which the cam of the shaft 25 slides.

[0042] The pump 10 is equipped with a plurality of heads 45, for example three of them, each fixed to the free end of a respective cylinder 40 and in which the respective pumping chamber 15 is formed.

[0043] Each pumping chamber 15 is partially delimited by an elastic membrane (not illustrated), which is deformable, under the thrust of the piston, between a first position in which the volume of the pumping chamber 15 is maximum and a second position in which the volume of the pumping chamber 15 is minimum. Moreover, every pumping chamber 15 comprises a delivery duct 50 and a suction duct 55 formed in the respective head 45, each of which is equipped with an inner opening communicating with the pumping chamber 15 and an opposite outer opening 65, for example having a circular shape, formed on an outer surface of the head 45.

[0044] Preferably, the outer openings 65 of the delivery ducts 50 lie on a same plane, distinct from the plane on which the outer openings 65 of the suction ducts 55 lie.

[0045] Moreover, the outer openings 65 are equally angularly space apart with respect to the axis of the shaft 25.

[0046] With particular reference to figures 6 to 9, the pump 10 comprises a suction manifold 70, adapted for placing a source of a fluid to be pressurised in communication with each pumping chamber 15.

[0047] The suction manifold 70 comprises a body 75, as will be described more clearly hereinafter, equipped with an inner cavity defining a duct 80.

[0048] The duct 80 is shaped like a longitudinal path P.

[0049] For example, the path P is closed in a loop.

[0050] In the preferred embodiment the closed path P approximates the perimeter of an equilateral triangle (see figure 5).

[0051] Specifically, said equilateral triangle has sides lying on a same plane and curved, i.e. equipped with a concavity facing towards the centre of the triangle itself.

[0052] This does not rule out the possibility that, alternatively, the path P defined by the duct 80 can approximate a circle or an ellipse or any polygon.

[0053] In the illustrated embodiment, the duct 80 comprises a plurality of longitudinal segments.

[0054] For example, the duct 80 comprises a first longitudinal segment 80a, a second longitudinal segment 80b and a third longitudinal segment 80c.

[0055] Every segment 80a,80b,80c forms a side of the triangular path P.

[0056] Preferably, the first segment 80a, the second segment 80b and the third segment 80c have a closed cross section (i.e. substantially perpendicular to a longitudinal axis of the segment itself), for example of rectangular shape (with rounded vertices).

[0057] The duct 80 can also comprise a plurality of chambers 80d, each arranged between two longitudinal segments and arranged in fluid communication with them.

[0058] For example, the duct 80 comprises a plurality of chambers 80d, for example three of them, each adapted for connecting the ends of two adjacent segments 80a,80b,80c.

[0059] Said chambers 80d are arranged at the vertices of the triangle defined by the path P of the duct 80.

[0060] The chambers 80d are shaped like cylindrical surfaces, for example equipped with a central axis perpendicular to the longitudinal axes of the adjacent longitudinal segments

[0061] For example, such cylindrical surfaces comprise joining openings adapted for placing every chamber 80d in communication with the respective adjacent segments.

[0062] The chambers 80d have a larger cross section than the cross section of the longitudinal segments.

[0063] The duct 80 of the suction manifold 70 comprises a plurality of distribution mouths 85, for example circular in shape, formed in the body 75.

[0064] Each distribution mouth 85 is connected to the suction duct 55 of a respective pumping chamber 15.

[0065] In the preferred embodiment, the duct 80 comprises three distribution mouths 85, one for every pumping chamber 15.

[0066] This does not rule out the possibility that the duct 80 can comprise more than 3 distribution mouths 85, for example one for every pumping chamber 15. The distribution mouths 85 all face in the same direction, for example said distribution mouths 85 lie on a same plane.

[0067] The distribution mouths 85 are equally spaced apart along the duct 80.

[0068] For example, every distribution mouth 85 is positioned between at least two adjacent segments 80a,80b,80c.

[0069] Specifically, every distribution mouth 85 is formed at a respective chamber 80d.

[0070] Moreover, the central axes of the distribution mouths 85 are substantially perpendicular to the longitudinal axes of the adjacent segments 80a,80b,80c. For example, the distribution mouths 85 have a central axis arranged close to, for example at, a respective vertex of the triangle identified by the path P of the duct 80.

[0071] Every distribution mouth 85 is equipped with a centring ring 90.

[0072] The centring ring 90 is equipped with an outer surface 100, for example cylindrical.

[0073] The outer surface 100 has its central axis parallel to the central axis of the respective distribution mouth 85.

[0074] Each distribution mouth 85 also comprises a fixing plate 110.

[0075] Such a plate 110 has a pair of through holes 115, for example arranged beside the respective distribution mouth 85 in diametrically opposite positions with respect to it.

[0076] The through holes 115 have central axes parallel to the central axis of the respective distribution mouth 85.

[0077] Every through hole 115 comprises a bushing 120, for example made of metallic material, inserted concentrically to it.

[0078] The duct 80 of the suction manifold 70 also comprises an access mouth 125, for example circular in shape, formed in the body 75.

[0079] Said access mouth 125 places the duct 80 in communication with the outside. In particular, the access mouth 125 of the suction manifold 70 is adapted for being connected, for example through pipes, to a container of a fluid to be pressurised.

[0080] The access mouth 125 is preferably arranged between two distribution mouths 85 and is, for example, equally spaced from them.

[0081] For example, the access mouth 125 is formed in the first segment 80a of the duct 80.

[0082] Preferably, the access mouth 125 lies on a different plane from the plane on which the distribution mouths 85 lie.

[0083] The access mouth 125 comprises a collar 125a for removably fixing a tube, for example said collar 125a projects towards the outside of the duct 80. Preferably, the collar 125a has a longitudinal axis parallel to the plane on which the distribution mouths 85 lie.

[0084] The body 75 shaped to define the duct 80 has a substantially annular shape. In practice, the body 75 is equipped with an inner surface 130, which delimits the duct 80 in the radial direction, and with an outer surface 135, opposite to the inner surface 130.

[0085] The outer surface 135 defines a central opening 140, which does not communicate with the duct 80.

[0086] The body 75 has a wall 145 (defined as the body

portion 75 comprised between the outer surface 135 and the inner surface 130) the thickness of which is practically constant along the entire path P of the duct 80.

[0087] The body 75 consists of a monoblock made of plastic material, for example through rotational moulding.

[0088] It should be specified that the term monoblock is meant to indicate an object without joining points, i.e. not made by the union of many parts and in which any sections consists of the same body.

[0089] Furthermore, the term monoblock body is meant to indicate a body consisting of the solidification of a single volume of a fluid.

[0090] The plastic material of which the body 75 consists can for example be polyethylene, polypropylene or polyamide.

[0091] The suction manifold 70 is fixed to the pump 10 through threaded members inserted, through the through holes 115 (and the bushings 120) of every fixing plate 110, in suitable threaded holes formed in the corresponding heads 45. The suction manifold 70 is fixed so that every distribution mouth 85 faces the outer opening 65 of a respective suction duct 55.

[0092] Moreover, every centring ring 90 is inserted, for example with low clearance, in a seat 95 formed in a respective opening 65 of a suction duct 55 (see figure 9).

[0093] In practice, the outer surface 100 of the centring ring 90 is inserted in contact in a matching inner surface 105, for example cylindrical, of the seat 95.

[0094] In addition, when the suction manifold 70 is fixed to the pump 10, the central opening 140 of the outer surface 135 of the body 75 wraps, with a lot of clearance, around a grooved tang of the shaft 25 and for example, a protective collar of said grooved tang (not illustrated in the figures).

[0095] Between every distribution mouth 80 and every respective pumping chamber 15 an automatic unidirectional valve 215 is arranged, which is housed in a seat 220 formed in a respective suction duct 55.

[0096] Moreover, the pump 10 comprises a delivery manifold 150, adapted for placing each pumping chamber 15 in communication with a dispenser of the pressurised fluid and/or a device fed by the pressurised fluid.

[0097] The delivery manifold 150 comprises a body 155, as will be explained better hereinafter, equipped with a cavity shaped to define a duct 160 (see figure 6). The duct 160 is shaped like a longitudinal path P,

[0098] Preferably, the path P of the duct 160 of the delivery manifold 150 is identical to that of the duct 80 of the suction manifold 70.

[0099] The duct 160 comprises a plurality of longitudinal segments.

[0100] For example, the duct 160 comprises a first longitudinal segment 160a, a second longitudinal segment 160b and a third longitudinal segment 160c.

[0101] For example, said segments 160a,160b,160c are shaped like the segments 80a,80b,80c of the duct 80 of the suction manifold 70.

[0102] Moreover, the duct 160 comprises a plurality of chambers 160d, each arranged between two longitudinal segments of the duct 160 and placed in fluid communication with them.

[0103] For example, the duct 160 comprises three chambers 160d, each adapted for connecting the ends of two adjacent segments 160a,160b,160c.

[0104] Said chambers 160d are placed at the vertices of the triangle defined by the path P of the duct 160.

[0105] The chambers 160d are shaped like cylindrical surfaces, for example equipped with a central axis perpendicular to the longitudinal axes of the adjacent longitudinal segments.

[0106] For example, such cylindrical surfaces comprise joining openings adapted for placing every chamber 160d in communication with the respective adjacent segments.

[0107] The chambers 160d have a larger cross section than the cross section of the longitudinal segments.

[0108] The duct 160 of the delivery manifold 150 comprises a plurality of distribution mouths 165, for example having a circular shape, formed in the body 155.

[0109] In the preferred embodiment, the duct 160 comprises three distribution mouths 165, one for every pumping chamber 15.

[0110] This does not rule out the possibility that the duct 160 can comprise more than 3 distribution mouths 165, for example one for every pumping chamber 15. The distribution mouths 165 all face in the same direction, for example said distribution mouths 165 lie on a same plane.

[0111] The distribution mouths 165 of the delivery manifold 150 are equally spaced apart along the duct 160.

[0112] For example, every distribution mouth 165 is positioned between at least two adjacent segments 160a, 160b, 160c.

[0113] Specifically, every distribution mouth 165 is formed at a respective chamber 160d.

[0114] Moreover, the central axes of the distribution mouths 165 are substantially perpendicular to the longitudinal axes of the adjacent segments 160a,160b,160c. For example, the distribution mouths 165 have a central axis arranged close to, for example at, a respective vertex of the triangle identified by the path P of the duct 160.

[0115] Every distribution mouth 165 of the delivery manifold 150 is equipped with a centring ring 170.

[0116] The centring ring 170 is equipped with an outer surface 180, for example cylindrical.

[0117] The outer surface 180 has a central axis parallel to the central axis of the respective distribution mouth 165.

[0118] Each distribution mouth 165 of the delivery manifold 150 also comprises a housing seat 190, inside which an automatic unidirectional valve 195 of the pump 10 is at least partially received.

[0119] The housing seat 195 is at least partially contained in a respective chamber 180d and can for example be conical in shape with concavity facing towards the pumping chamber 15.

[0120] Each distribution mouth 165 of the delivery manifold 150 comprises a fixing plate 225.

[0121] Such a plate 225 has a pair of through holes 230, for example arranged beside the respective distribution mouth 165 in diametrically opposite positions with respect to it.

[0122] Each through hole 230 comprises a bushing 235, for example made of metallic material, inserted concentrically to it.

[0123] The duct 160 of the delivery manifold 150 also comprises an access mouth 240, for example having a circular shape, formed in the body 155.

[0124] Said access mouth 240 places the duct 160 in communication with the outside. In particular, the access mouth 240 of the delivery manifold 150 is adapted for being connected to a dispenser of the pressurised fluid and/or a device fed by the pressurised fluid.

[0125] The access mouth 240 is arranged between two distribution mouths 165 and is, for example, equally spaced from them.

[0126] For example, the access mouth 240 is formed in the first segment 160a of the duct 160.

[0127] Preferably, the access mouth 240 lies on a different plane from the plane on which the distribution mouths 165 lie.

[0128] The access mouth 240 comprises a collar 240a for removably fixing a tube, for example said collar 240a projects towards the outside of the duct 160. Preferably, the collar 240a has a longitudinal axis parallel to the plane on which the distribution mouths 165 lie.

[0129] The duct 160 of the delivery manifold 150 comprises at least one withdrawal mouth 245, for example adapted for being connected to a further dispenser and/or a further device fed by the pressurised fluid.

[0130] The withdrawal mouth 245 is formed in the body 160 and, for example, has a circular shape.

[0131] Preferably, the duct 160 of the delivery manifold 150 comprises two withdrawal mouths 245.

[0132] However, this does not rule out the possibility that the duct 160 can comprise a greater number of withdrawal mouths 245.

[0133] Every withdrawal mouth 245 is distinct from the access mouth 240 and can, for example, have a smaller passage area than the passage area of the access mouth 240.

[0134] Each withdrawal mouth 245 is arranged between two distribution mouths 165 of the delivery manifold 150 and is, for example, equally spaced from them. Preferably, the withdrawal mouths 245 place the second segment 160b and the third segment 160c of the duct 80 in communication with the outside. Every withdrawal mouth 245 lies on a different plane from the plane on which the distribution mouths 165 lie.

[0135] Each withdrawal mouth 245 comprises a collar 245a for removably fixing a tube, for example said collar 245a projects towards the outside of the duct 160. Preferably, the collar 245a has a longitudinal axis parallel to the plane on which the distribution mouths 165 lie.

[0136] Each withdrawal mouth 245 comprises a threading, for example formed on an inner surface of the collar 245a, for removably fixing a tube equipped with a matching threading.

[0137] The body 155 of the delivery manifold 150 shaped to define the duct 160 has a substantially annular shape.

[0138] In practice, the body 155 is equipped with an inner surface 250, which delimits the duct 160 in the radial direction, and with an outer surface 255, opposite to the inner surface 250.

[0139] The outer surface 250 defines a central opening 260, which does not communicate with the duct 160.

[0140] The body 155 has a wall 265, defined as the body portion 155 comprised between the outer surface 255 and the inner surface 250, the thickness of which is practically constant along the entire path P of the duct 160.

[0141] The body 155 consists of a monoblock made of plastic material, for example through rotational moulding.

[0142] The plastic material can for example be polyethylene, polypropylene or polyamide.

[0143] The delivery manifold 150 is fixed to the pump 10 through threaded members inserted, through the through holes 230 (and the bushings 235) of every fixing plate 225, in suitable threaded holes formed in the corresponding heads 45. The delivery manifold 150 is fixed so that every distribution mouth 165 faces the outer opening 65 of a respective delivery duct 50.

[0144] Moreover, every centring ring 170 is inserted, for example with low clearance, in a seat 175 formed in a respective opening 65 of a delivery duct 50 (see figure 9).

[0145] In practice, the outer surface 180 of the centring ring 170 is inserted in contact in a matching inner surface 185, for example cylindrical, of the seat 175.

[0146] In addition, when the delivery manifold 150 is fixed to the pump 10, the central opening 260 of the outer surface 255 of the body 155 wraps, with a lot of clearance, around the grooved tang 30 of the shaft 25 and for example, a protective collar of said grooved tang (not illustrated in the figures).

[0147] Between every distribution mouth 165 of the delivery manifold 150 and every respective pumping chamber 15 an automatic unidirectional valve 195 is arranged, which is housed in the seat 190 formed in a respective suction duct 55.

[0148] Every valve 195 has a radial portion 200, which is arranged in contact between an abutment surface 205 of the seat 190 of the distribution mouth 165 and an abutment surface 210 of the seat 175 of the delivery duct 50.

[0149] Preferably, the abutment surfaces 205,210 are shaped like flat annular surfaces lying on a plane perpendicular to the central axis of the distribution mouth 165.

[0150] For example, the abutment surface 205 of the distribution mouth 165 is formed at the free end of the centring ring 170.

[0151] Hereinafter a method for making a manifold 70,150 made of plastic material for pumps 10 is illustrated.

[0152] In particular, it concerns a method for making a suction manifold 70 and a delivery manifold 150 for a pump 10.

[0153] The method starts with obtaining a monoblock body 75,155 equipped with an inner cavity shaped like a duct 80,160 through rotational moulding.

[0154] Such a step comprises the following sub-steps.

[0155] It begins with providing a mould equipped with a forming cavity for the manifold 70,150, for example a mould equipped with a forming cavity for the suction manifold 70 and a mould equipped with a forming cavity for the delivery manifold 150.

[0156] Each forming cavity of the moulds has an inner surface substantially matching the outer surface 135,255 of the respective body 75,155 to be formed.

[0157] In particular, every forming cavity is shaped like an annular duct.

[0158] Each forming cavity comprises a recess, for example having a circular shape, facing towards the outside of the annular duct of the cavity itself, shaped to define a respective collar 125a,240a.

[0159] The forming cavity of the mould for the delivery manifold 150 comprises a plurality of projections, for example having a frusto-conical shape, facing towards the centre of the annular duct of the cavity itself, each of which is shaped to define a respective housing seat 190 of an automatic unidirectional valve 195. Said forming cavity of the mould for the delivery manifold 150 also comprises at least one recess, for example having a cylindrical shape, facing towards the outside of the annular duct of the cavity itself, shaped to define a collar 245a. Every mould is made in at least two separable shells.

[0160] Thereafter, a predetermined amount of powdered plastic material is arranged inside every forming cavity.

[0161] Said plastic material has a particle size comprised between MPS 150 μn and MPS 500 μn xx.

[0162] The volume of said amount of plastic material is less than the inner volume of each forming cavity.

[0163] For example, the weight of the amount of plastic material inserted inside the forming cavity is determined as a function of the thickness of the wall 145,265 of the respective body 75,150 that it is wished to obtain.

[0164] After having inserted the plastic material, each mould is hermetically closed. Thereafter, each mould is heated and simultaneously set in rotation with respect to at least one longitudinal axis thereof and a transversal axis thereof so as to soften the plastic material and make it adhere to the inner walls of the forming cavity thanks to the centrifugal force, defining the monoblock body 75,155 and the respective inner cavity shaped like the duct 80,160.

[0165] The method then proceeds by cooling down every mould so as to solidify the plastic material.

[0166] For example, during the step of cooling down every mould, it is foreseen to keep the mould in rotation with respect to at least one longitudinal axis thereof and a transversal axis thereof.

[0167] The step of obtaining a monoblock body 75,155 through rotational moulding ends with the sub-step that foresees opening each mould and extracting the monoblock body 75,155.

[0168] At this point, the wall 145,265 of the respective body 75,155 is perforated, making an opening on it, formed at the free end of the respective collar 125a,240a, which places the duct 80,160 in communication with the outside and which defines a respective access mouth 125,240.

[0169] In the same step a plurality of through holes distinct from the access mouth 125,240 and that place the duct 80,160 in communication with the outside are made in the body 75,155, each defining a distribution mouth 85,165.

[0170] In particular, in the body 155 said through holes are made at the seats 190 of the valves 195.

[0171] The method proceeds with the step of making at least one through hole in the body 155 of the delivery manifold 150, formed at the free end of the collar 245a, which places the duct 160 in communication with the outside defining a withdrawal mouth 245.

[0172] The suction manifold 70 and the delivery manifold 150 are now ready to be installed on the pump 10.

[0173] The invention thus conceived can undergo numerous modifications and variants all of which are covered by the inventive concept.

[0174] Moreover, all of the details can be replaced by other technically equivalent elements.

[0175] In practice, the materials used, as well as the contingent shapes and sizes, can be whatever according to requirements without for this reason departing from the scope of protection of the following claims.

Claims

1. A manifold (70,150) for a multi-stage pump (10) equipped with a plurality of pumping chambers (15), wherein the manifold (70,150) comprises a body (75,155) shaped to define a duct (80,160) having an access mouth (125,240) and a plurality of distribution mouths (85,165), wherein each distribution mouth (85,165) is adapted for being connected to a respective pumping chamber (15) of the pump (10), and wherein the body (75,155) consists of a monoblock made of plastic material.

2. The manifold (70,150) according to claim 1, wherein the body (75,155) is made through rotational moulding of plastic material.

3. The manifold (70,150) according to claim 1, wherein the duct (80,160) is shaped as a path (P) closed in a loop.

4. The manifold (70,150) according to claim 1, wherein the body (75,155) has a substantially annular shape.

5. The manifold (150) according to claim 1, wherein the duct (160) comprises a withdrawal mouth (245) distinct from the access mouth (240) and from the distribution mouths (165).

6. The manifold (70,150) according to claim 1, wherein each distribution mouth (85,165) comprises a plate (110,225) for fixing to the respective pumping chamber of the pump (10).

7. A multi-stage pump (10) comprising a plurality of pumping chambers (15) and a manifold (70,150) equipped with a body (75,155) shaped to define a duct (80,160) having an access mouth (125,240) and a plurality of distribution mouths (85,165), wherein each distribution mouth (85,165) is connected to a respective pumping chamber (15) of the pump (10), wherein the body (75,155) consists of a monoblock made of plastic material.

8. The pump (10) according to claim 7, wherein each pumping chamber (15) comprises a delivery duct (50), each distribution mouth (85) of the manifold (70) being connected to a respective delivery duct (50).

9. The pump (10) according to claim 7, wherein each pumping chamber (15) comprises a suction duct (55), each distribution mouth (165) of the manifold (150) being connected to a respective suction duct (55).

10. The pump (10) according to claim 7, wherein between each pumping chamber (15) and the respective distribution mouth (165) of the manifold (150) an automatic unidirectional valve (195) is arranged.

11. The pump (10) according to claim 10, wherein each distribution mouth (165) comprises a seat (190) for housing said automatic unidirectional valve (195).

12. A method for making a manifold (70,150) of plastic material for multi-stage pumps (10) comprising the steps of:

- obtaining a monoblock body (75,155) equipped with an inner cavity shaped like a duct (80,160) through rotational moulding; and
- perforating a wall (145,265) of the monoblock body (75,155) making at least one through opening on it along the duct (80,160) defining an access mouth (125,240) of a manifold (70,155) for multi-stage pumps (10) and a plurality of through holes along the duct (80,160) each defining a distribution mouth (85,165) of a manifold (70,155) for multi-stage pumps (10).

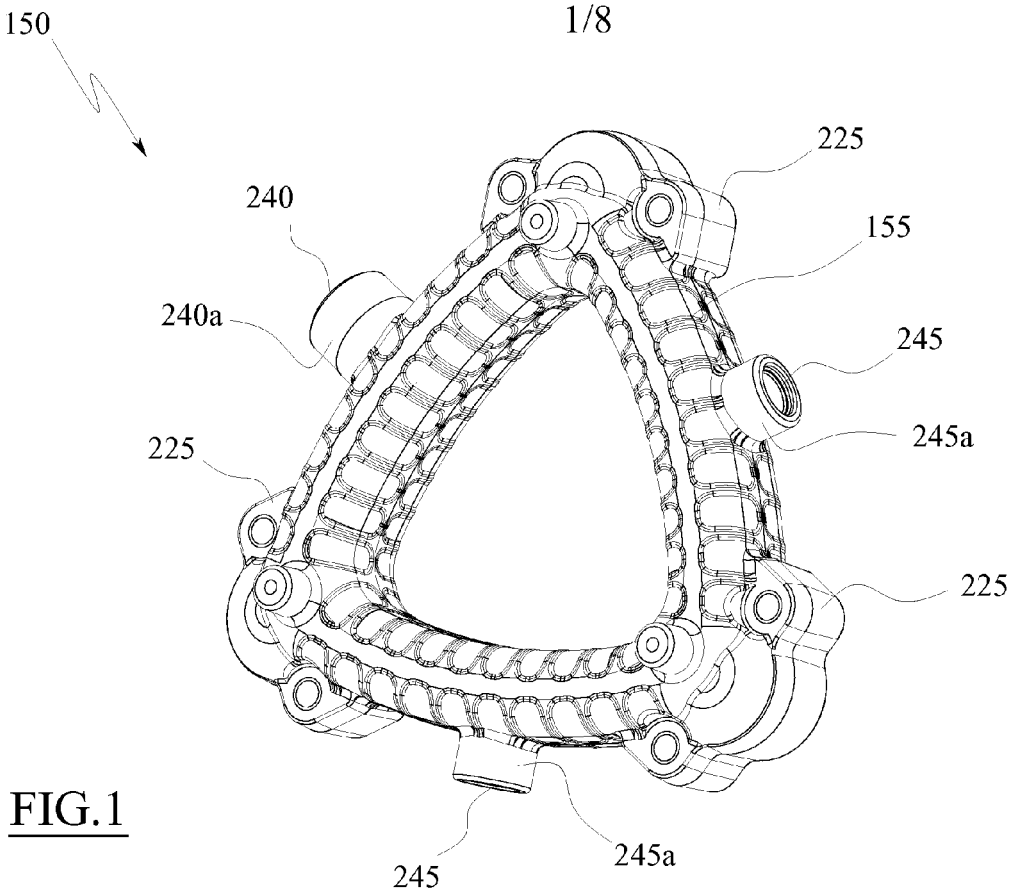
150
225
240
155
240a
245
225
245a
225
245
245a

FIG.1

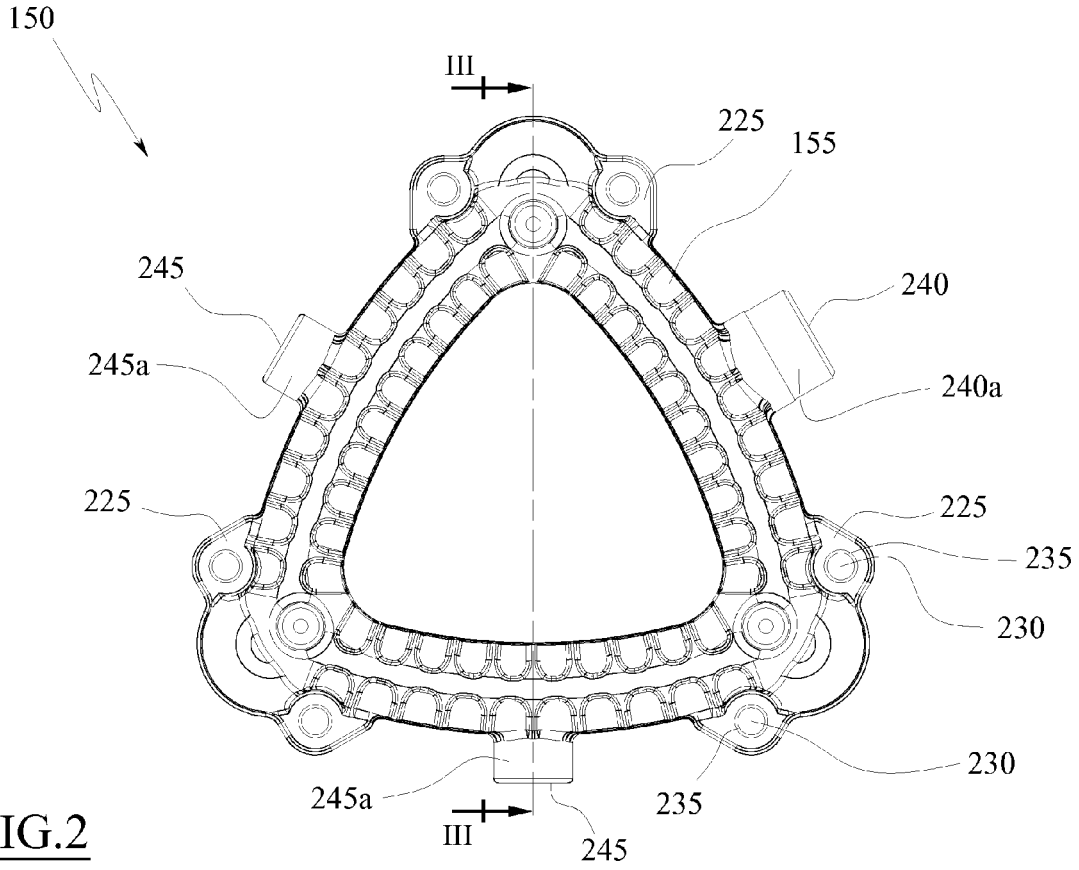
150
III
225
155
245
240
245a
240a
225
225
235
230
230
245a
III
235
245

FIG.2

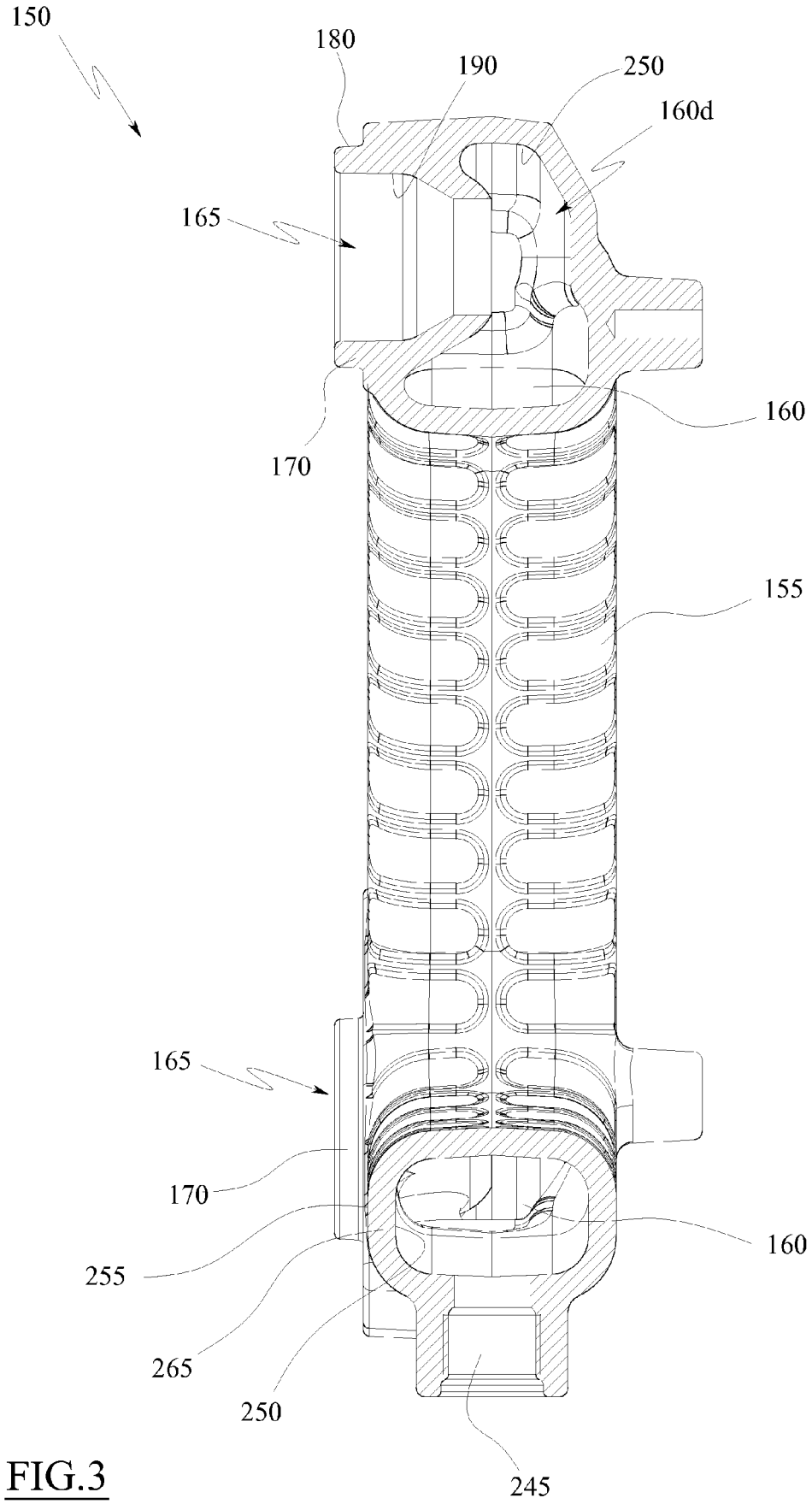

FIG.3

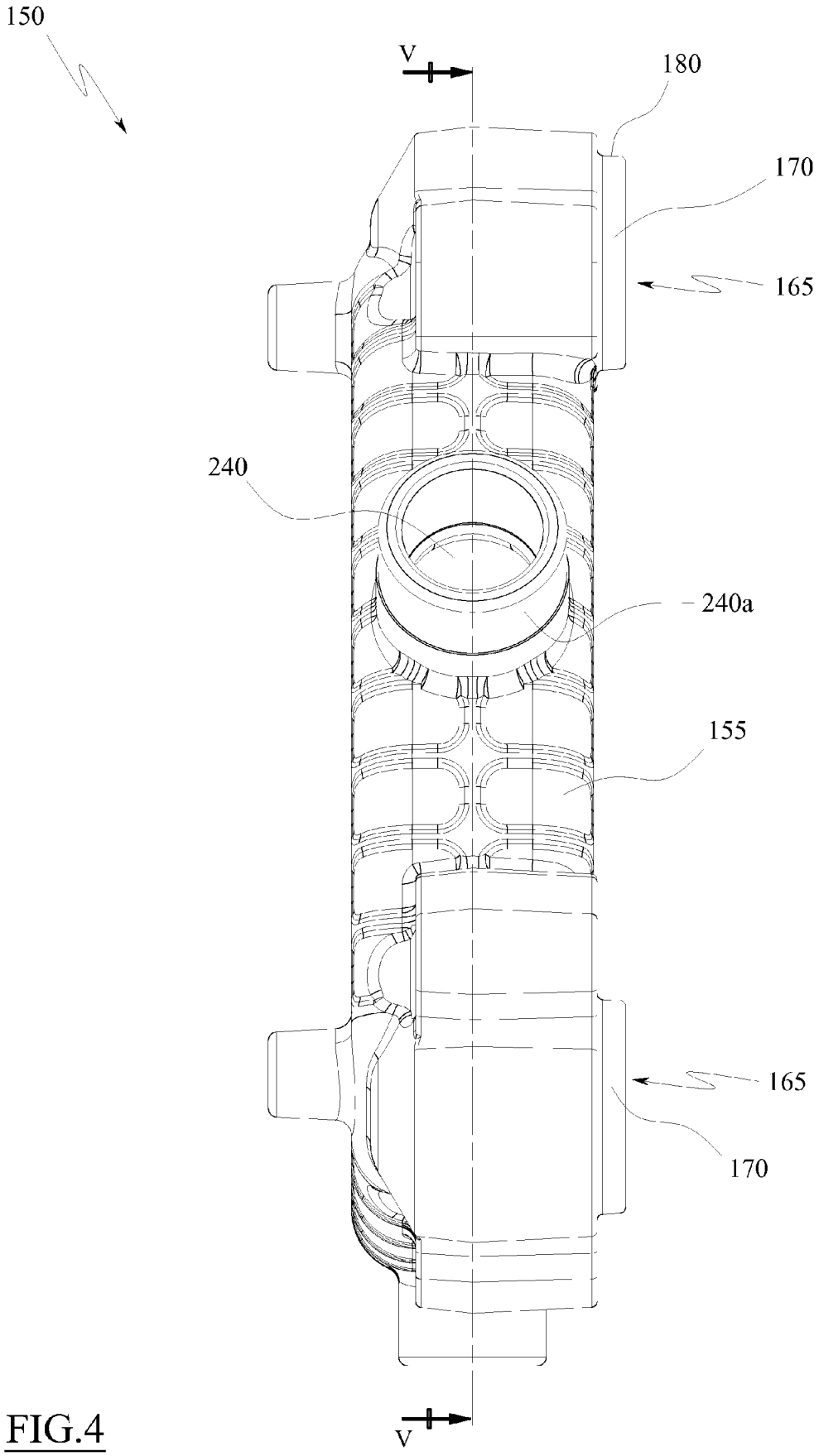

FIG.4

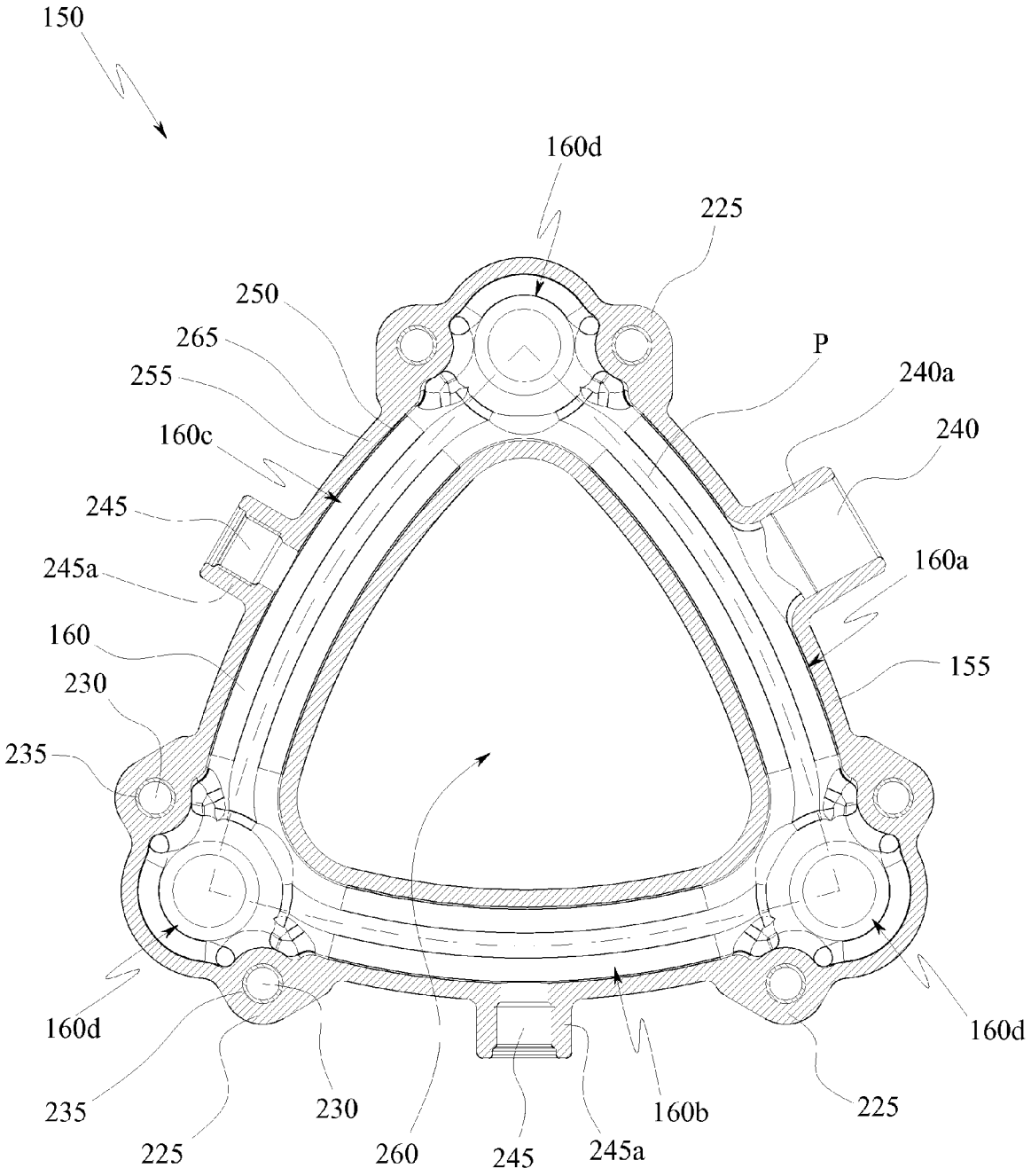
150
160d
225
250
265
255
160c
245
245a
160
230
235
P
240a
240
160a
155
160d
235
225
230
260
245
245a
160b
225
160d

FIG.5

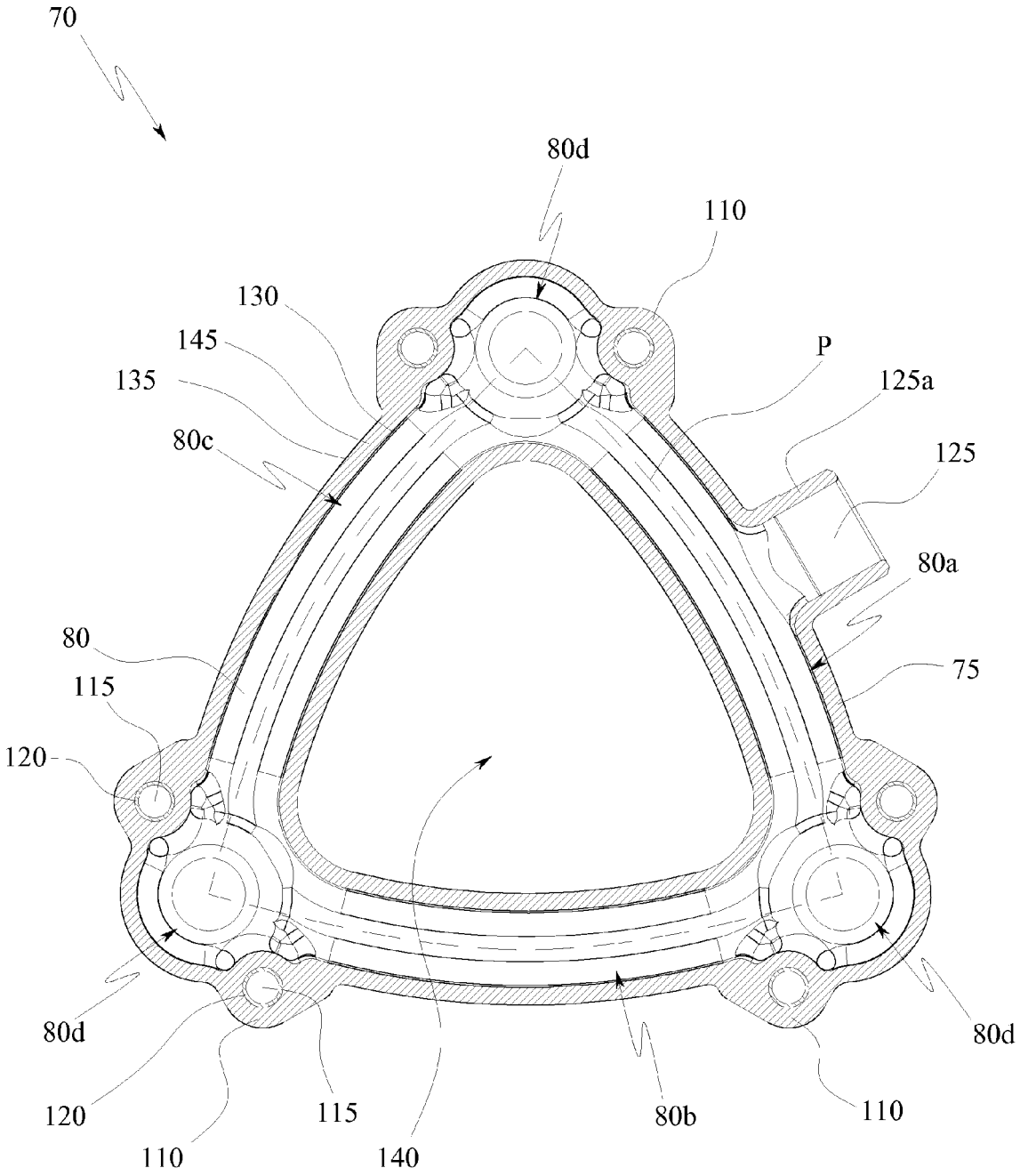
70
80d
110
130
145
135
80c
P
125a
125
80a
80
115
75
120
80d
120
115
80b
110
80d
110
140

FIG.6

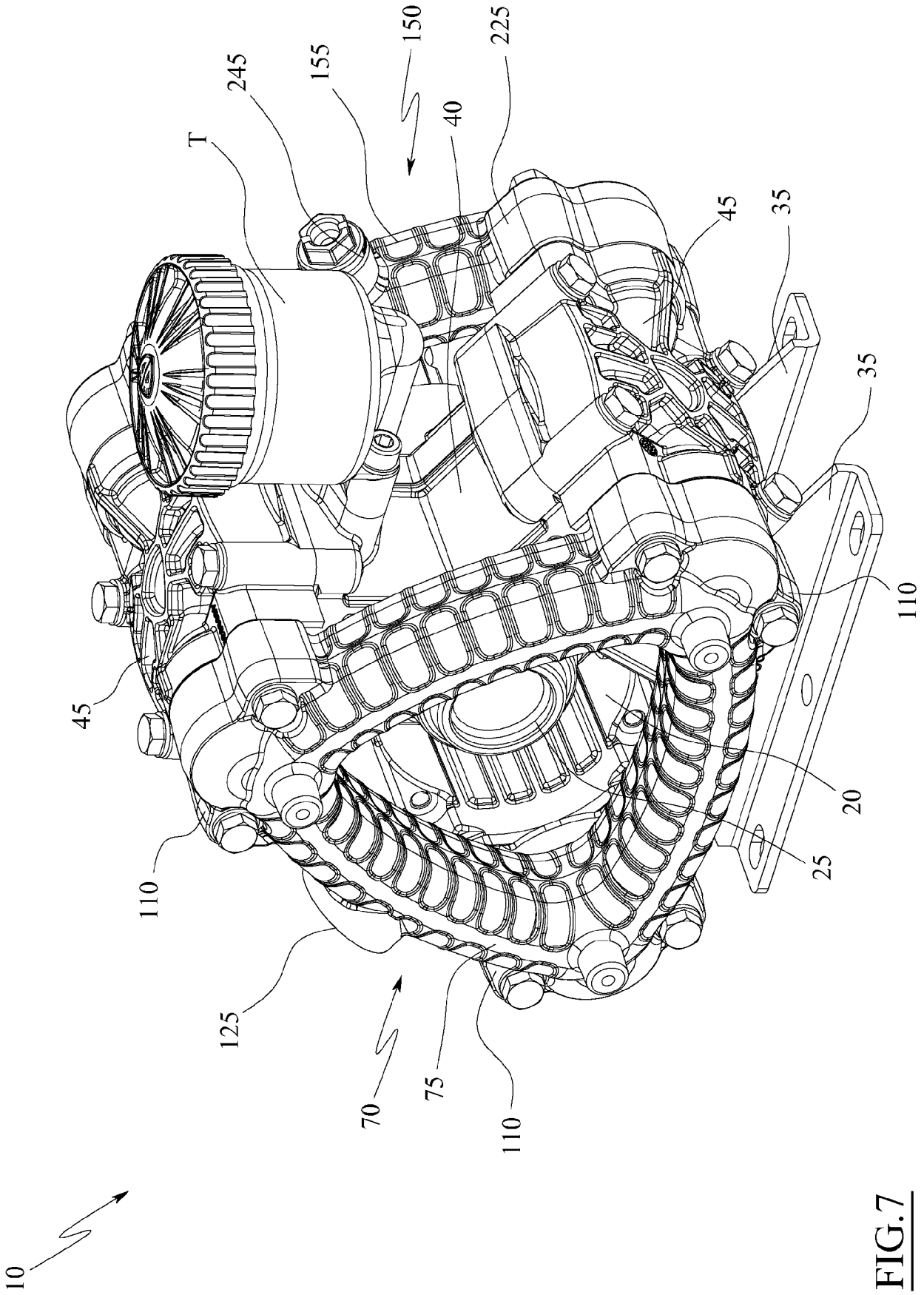

FIG.7

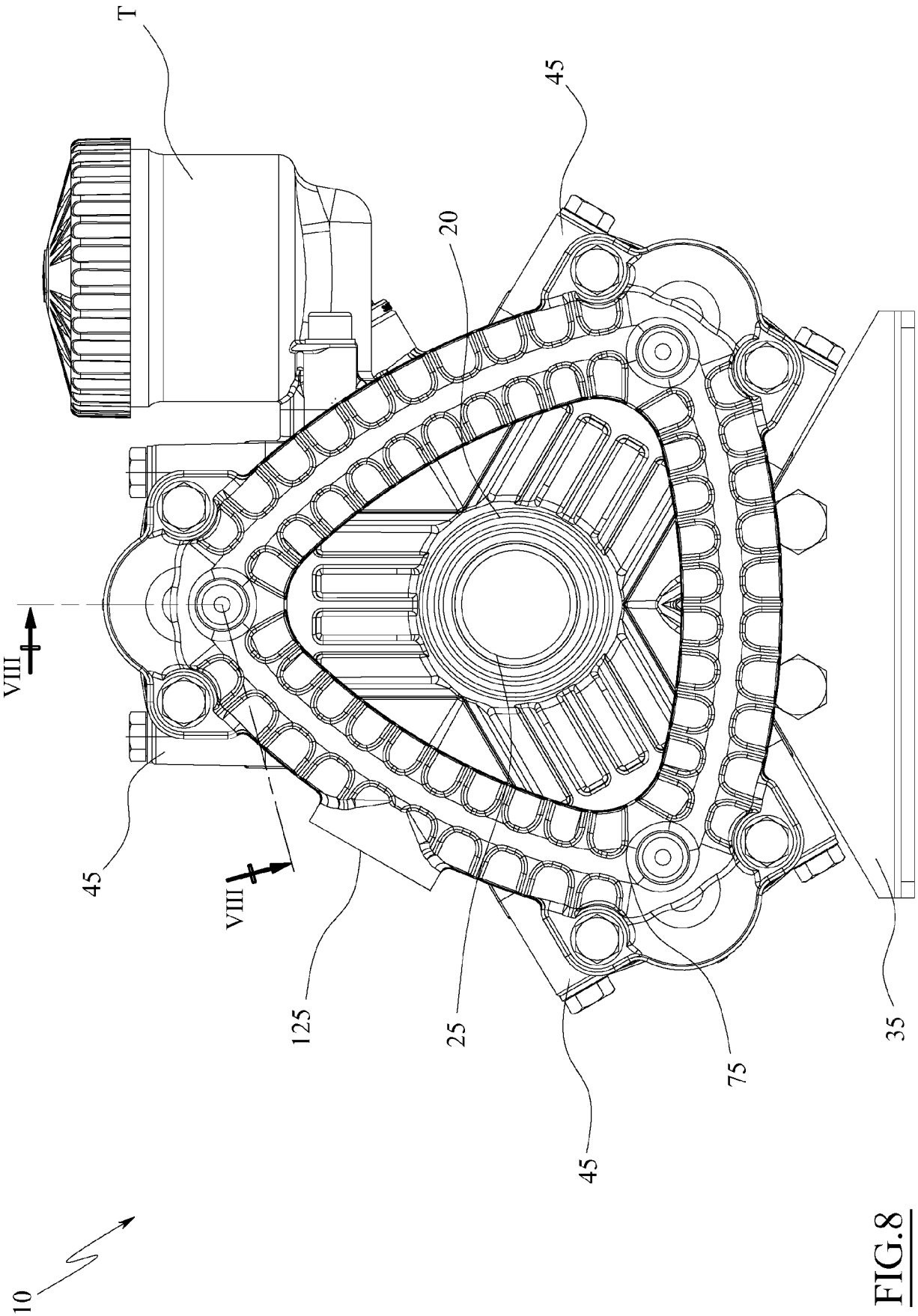

FIG.8

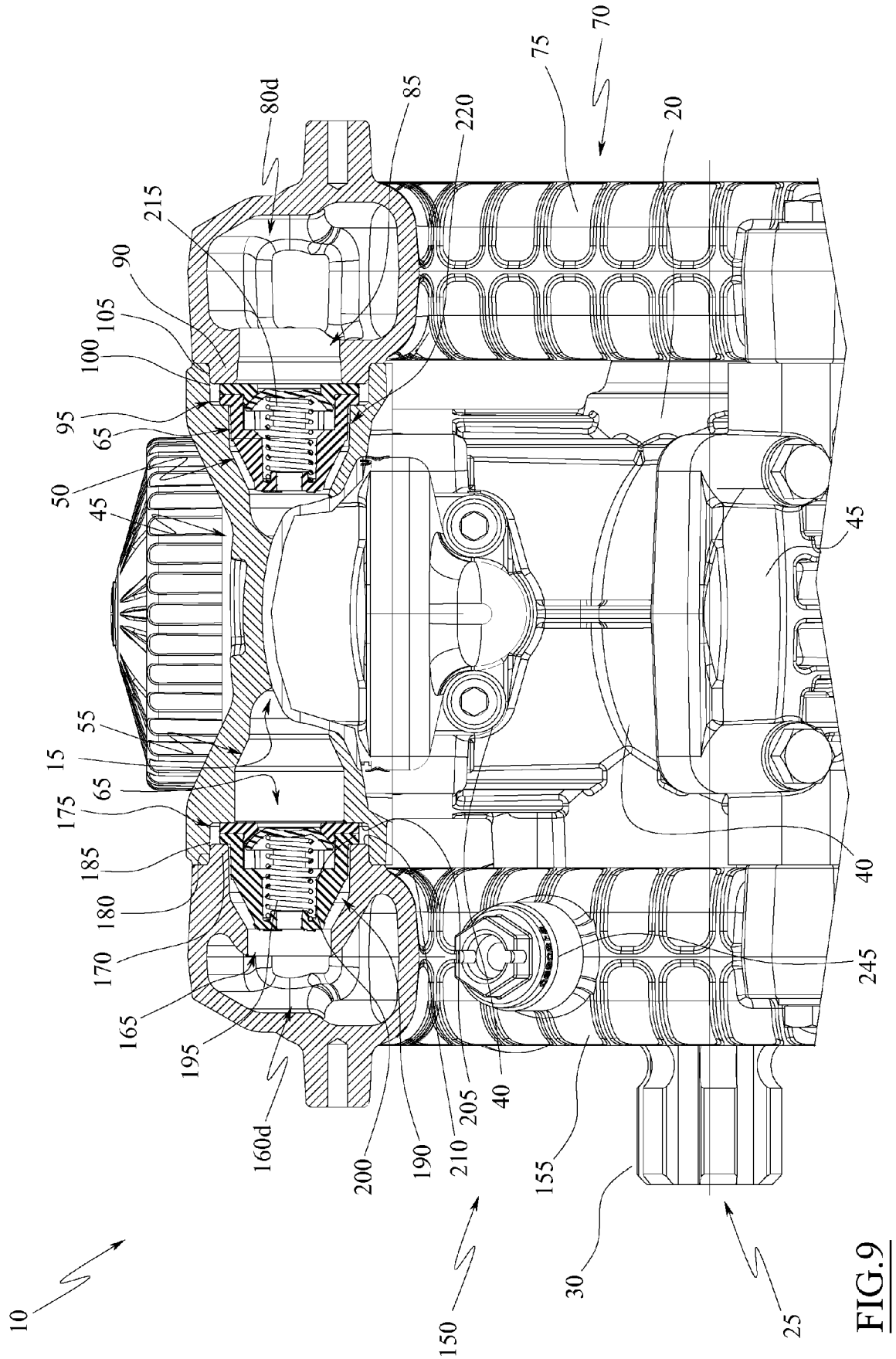
10
150
25
30
155
160d
165
170
175
180
185
195
200
205
210
215
220
245
15
20
40
45
50
55
65
70
75
80d
85
90
95
100
105

FIG.9

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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 8325

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Place of search	Date of completion of the search	Examiner
Munich	11 April 2018	Olona Laglera, C

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