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(54) Active or passive flow divider.

(57) A flow divider for hydraulic applications comprising, in a circular chamber (14), a rotating crown wheel toothed inside (15), at least two angularly spaced toothed wheels (16), each supported by a rotating shaft (17) and engaged with said crown wheel (15), a deflector element (18) tangentially fixed to each of said toothed wheels (16) and to the teeth of said crown wheel (15) so as to define two converging delivery chambers (20,22), a fluid inlet/sucking hole (23) located in an intermediate position between every two consecutive toothed wheels and a fluid outlet/delivery hole (25) on a level with both converging delivery chambers.

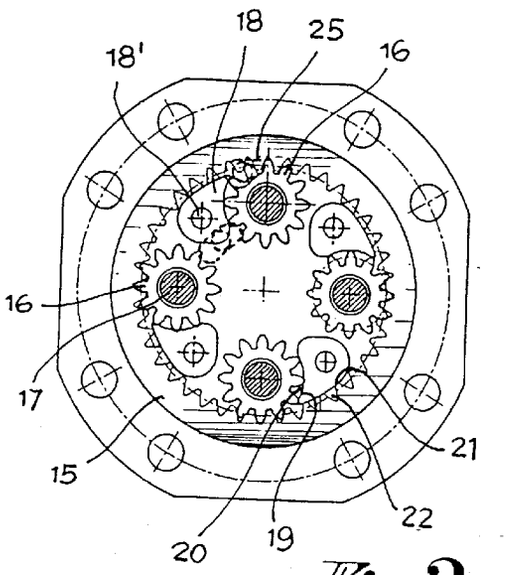

Fig. 2

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The present invention concerns a flow divider designed to divide a single flow of fluid into a number of separate flows of fluid flowing out of a dividing chamber.

At present, multistage flow dividers on the one hand and inside-gear pumps on the other hand are known in the field of hydraulic systems. Such dividers generally comprise several in-line dividing stages, connected to and controlled by common shafts. Their lengths and sizes are always considerable and proportional to the number of stages. Besides, they always require a pump upstream, which supplies the flow to be divided through the various consecutive stages. On the other hand, the inside-gear pumps are usually single-stage and unable for multiple division of the outflowing fluid.

It is an object of this invention to provide a flow divider which is simpler in structure, compact and economical, obtained starting from gear means like the ones located in any inside-gear pumps, though permitting production of a number of separate flows of fluid.

Another object of the invention is to provide a flow divider in which both the division point and the outlet points of separate flows of fluid are distributed in a circle, around a centre axis, and are not in line on the same axis as in known dividers.

A further object of the invention is to provide a device which may be advantageously arranged and used according to different modalities:

- as a passive multistage flow divider in which the flow to be divided is supplied by a pump located upstream;
- as an active multistage divider embodying an additional gear functioning as a pump, thus eliminating the need for a special external pump;
- as a multistage pump, and inversely;
- as a hydraulic motor, also with a variable torque, according to the stages supplied with fluid each time.

The said objects and advantages are achieved by a flow divider as claimed at least in claim 1.

Further details of the invention will become apparent from the continuation of the description, illustrated by way of example in the accompanying drawings, in which:

Fig. 1 shows a partial, axial sectional view of a passive flow divider;

Fig. 2 shows a cross sectional view of the flow divider, according to arrows II-II in Fig. 1;

Fig. 3 shows an end sectional view of the flow divider in the direction of arrow A in Fig. 1;

Fig. 4 shows a sectional view of the divider body according to arrows IV-IV in Fig. 1, in order to illustrate the arrangement of the flow inlet and outlet openings;

Fig. 5 shows a sectional view of a detail according to line V in Fig. 4;

Fig. 6 shows a sectional view of another detail according to line VI in Fig. 4;

Fig. 7 shows a partial, axial sectional view of a flow divider with a pump incorporated; and

Fig. 8 shows a cross sectional view of the embodiment illustrated in Fig. 7.

The drawings illustrate a four-stage divider, but stages might be different in number without thereby affecting the scope of the inventive concept of the invention.

The device includes a casing 10 constituted preferably by two semi-bodies 11, 12 pack-connected to each other, with an intermediate annular element 13. The casing 10 defines a circular chamber 14 including a crown wheel toothed inside 15 whose X axis coincides with the casing axis. Laterally, the crown wheel 15 is rotably supported between both half-bodies 11,12 and peripherally it is supported by the annular element 13. In order to reduce any rolling friction, the crown wheel 15 may be mounted on hydraulic suspensions or on rolling bodies - not illustrated.

Again, within such chamber 14, inside the crown wheel 15, toothed wheels 16 - four in the embodiment described herein - are arranged angularly spaced from one another, along a circumference which is concentric with the crown wheel 15. Each toothed wheel 16 is supported by a shaft 17 mounted between the semi-bodies 11,12, parallelly to the X axis of said crown wheel 15. The assembly is such - see Figures 1 and 2 - that the toothed wheels 16 engage with the crown wheel toothed inside 15 and rotate accordingly on the respective shafts 17.

Between the semi-bodies 11,12, proximate to each of the toothed wheels 16 and to the crown wheel toothed inside 15, a stationary deflector element 18 is fixed to one of the semi-bodies in 18'. The deflector element 18 comprises a first wall 19 tangent to the crests of the toothed wheel 16 so as to define, with some of the teeth thereof, a first delivery chamber 20, and a second wall 21 tangent to the crests of the crown wheel 15 so as to define, with some of the teeth thereof, a second delivery chamber 22.

In a semi-body (12) located between every two toothed wheels 16, away from the crown wheel 15, namely on a level with the parts of the deflector elements 18 facing the X axis, there are provided fluid inlet/suction holes 23 branching out from a centre hole 24 - see Figures 4 and 5 - which is connected to a fluid delivery duct according to arrow E.

On the other hand, every two delivery chambers 20,22 defined by each deflector element 18 converge in a fluid outlet/delivery hole 25 provided in such a semi-body (12) on a level where the teeth of the crown wheel 15 and of the wheel 16 are engaged - see Figures 4 and 6.

The outlet/delivery holes 25 are connected to ducts which permit delivery of fluid to users, accord-

ing to arrow U in Fig. 6. In practice, every toothed wheel 16 interacts with the crown wheel and with a deflector thus constituting a dividing stage.

The embodiment thus described, corresponding to Figures 1 and 2, constitutes an arrangement designed to be used as a passive flow divider. The crown wheel 15 causes rotation of the toothed wheels 16 with respect to the deflector elements 18.

Then, the fluid flowing in the direction of arrow E which is delivered by a pump connected to the centre hole 24 and which arrives to the chamber 14 through the inlet holes 23, is divided and distributed towards the points of use through the delivery outlets 25 with constant flow rates, independently on the pressure upstream. Pressure differential between inside the chamber 14 and the outlet holes 25 causes rotation of the crown wheel and toothed wheels.

Starting from this embodiment of a passive divider, it is possible to arrange an active divider by simply adding a centre gear 26, which engages with all the toothed wheels 16 and which is connected to and actuated with a control shaft 27 on the X axis, as shown in Figures 7 and 8. The shaft may receive rotary motion from a power take-off, whereas the gear 26 connected thereto controls rotation of the toothed wheels 16 and, through them, of the crown wheel 15. Fluid inlet and division towards the points of use are performed as described above, but no pumps are required upstream, pump effect being achieved by integrating the centre gear 26 with the toothed wheels 16 connected thereto.

The same embodiment may also be used as a multistage pump in order to suck the fluid through the holes 23 and deliver it through the holes 25, with the possibility of adding up outlet deliveries downstream the device. In fact, engaging teeth are also used to compress fluid like in a gear pump.

It is also important to point out that the assembly, in the embodiment shown in Figures 7 and 8, may also be used as a hydraulic motor, by simply causing inverse rotation of the rotating elements, with the fluid being sucked through the holes 23 and delivered through the holes 25, and namely as a variable-torque hydraulic motor by varying the number of the stages employed.

Finally, from a structural point of view, it should be noticed that side walls may be provided on a level with the delivery chambers 20,22 of each dividing stage, such walls being fixed in sliding contact with the rotating elements or movable, for movable o pressure balanced contact with the said elements.

Claims

1. A flow divider for hydraulic applications, characterized in that it comprises a composite casing (10) which defines a circular chamber (14), a crown wheel toothed inside (15) mounted and rotating in said chamber (14), at least two toothed wheels (16) angularly spaced in such chamber, each supported by a rotating shaft (17) and engaged with the said crown wheel (15), a deflector element (18) fixed in said chamber tangentially to each of the toothed wheels (16) and to the teeth of said crown wheel (15) and such to define a first delivery chamber (20) with some teeth of the toothed wheel and a second delivery chamber (22) with some teeth of the crown wheel, a fluid inlet/suction hole (23) provided in said casing in an intermediate position between every two consecutive toothed wheels (16) on a level with the part of each deflector element (18) facing the centre, and a fluid outlet/delivery hole (25) provided in such casing on a level with the first and the second delivery chambers (20,22) defined by each deflector element (18), said delivery chambers (20,21) converging towards the teeth of a toothed wheel and the crown wheel being engaged each time.

2. A flow divider as claimed in claim 1 used as a passive flow divider, wherein the fluid is delivered to the inlet holes (20) by a pump connected thereto and divided through the outlet holes (22), the toothed wheels and the crown wheel being rotated by the fluid flowing through said chamber (14).

3. A flow divider as claimed in claim 1 used as an active fluid divider, wherein a centre gear (26), provided axially to the crown wheel (15), is connected to a control shaft (27) and engages with all the toothed wheels (16) so as to cause rotation thereof and of the crown wheel (15).

4. A flow divider as claimed in claim 3 used as a multistage pump, wherein the fluid is sucked through the inlet holes (20) and delivered through the outlet holes (22) or, inversely, as a hydraulic motor.

5. A flow divider as claimed in claim 1 and in any of claims 2-4, wherein said casing (10) comprises two opposite semi-bodies pack-assembled to each other and an intermediate annular element, or two semi-bodies one of which includes a chamber for the crown wheel (15), and wherein the crown wheel (15) is rotably mounted in said casing on hydraulic suspensions or on rolling bodies.

6. A flow divider as claimed in claim 1 and in any of claims 2-5, wherein the casing (10) comprises side walls on a level with the delivery chambers (20,21), such walls being in fixed sliding contact or in movable pressure balanced sliding contact.

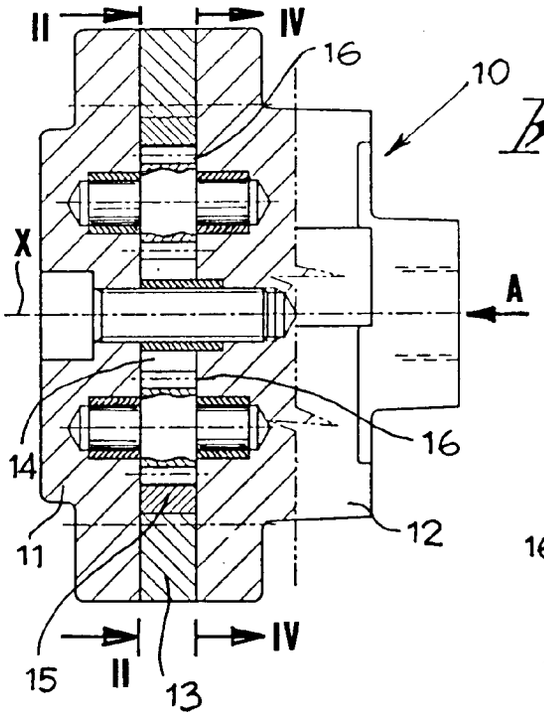

Fig. 1

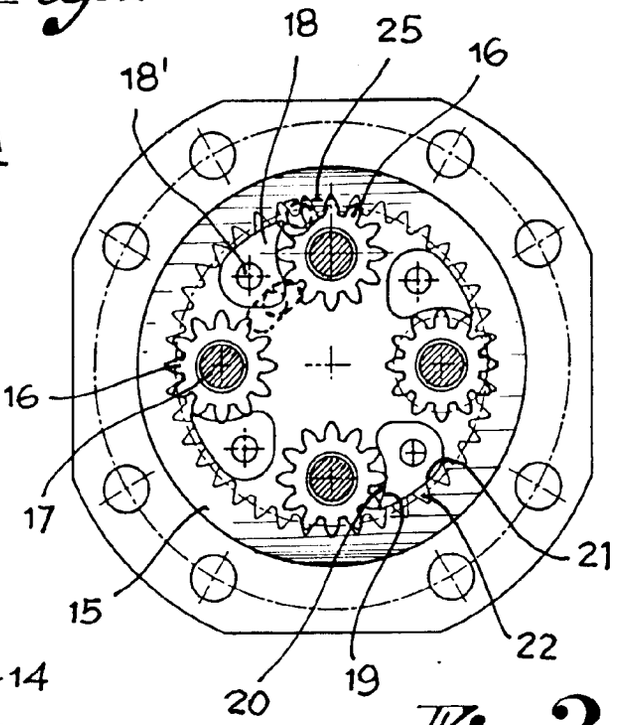

Fig. 2

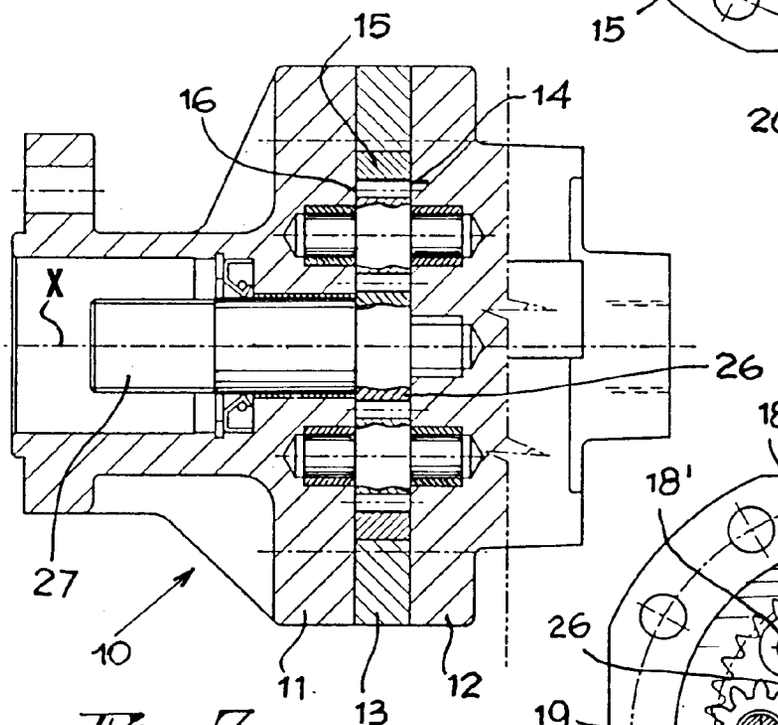

Fig. 7

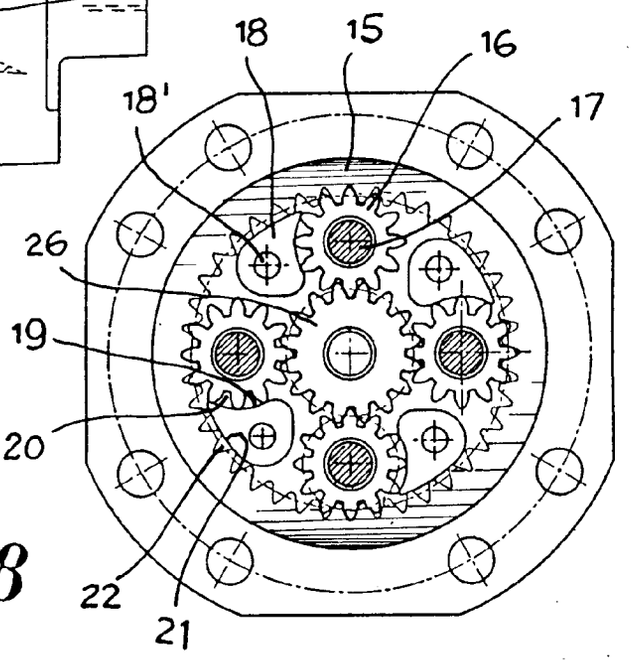

Fig. 8

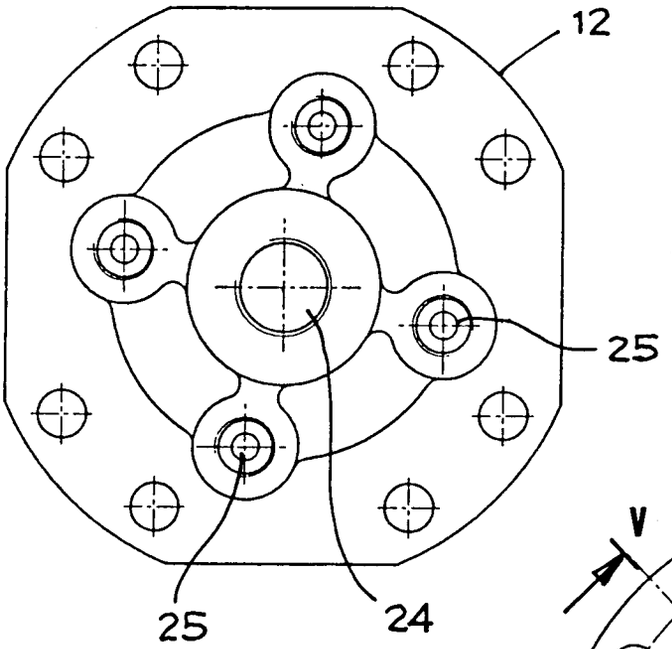

Fig. 3

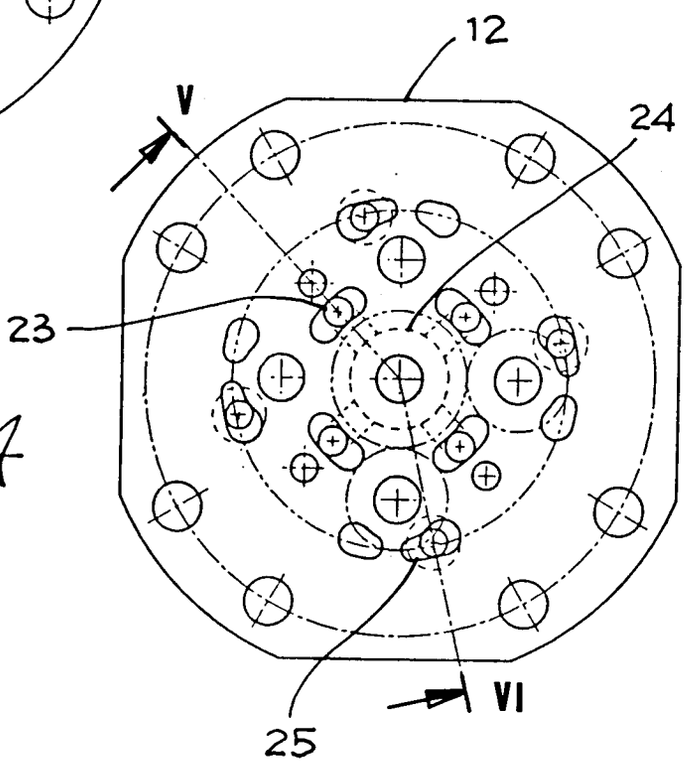

Fig. 4

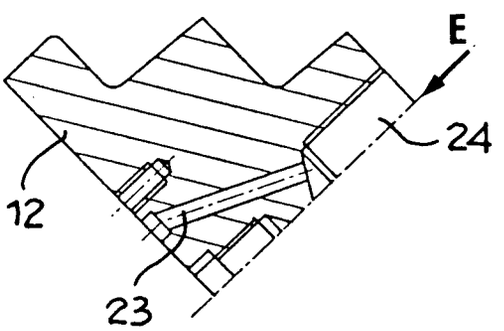

Fig. 5

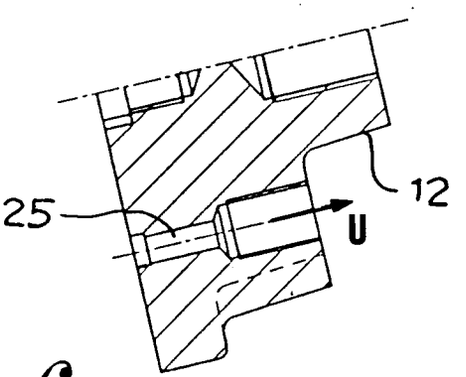

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0564

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	GB-A-870 019 (CHEMSTRAND CORPORATION) * page 1, line 22 - page 2, line 34 * * page 2, line 59 - page 4, line 33; figures 1-5 *	1-4	F04C2/14
Y	DE-C-871 692 (WUNDER) * page 1, line 5 - line 60; figures *	1,2	
Y	DE-A-21 00 403 (LUCAS INDUSTRIES LTD.) * page 2 - page 4; figures *	3,4	
A	US-A-2 457 465 (GROSSER) * column 1, line 44 - column 2, line 25; figures 1-3 * * column 2, line 40 - column 3, line 23 *	5,6	
A	FR-A-2 089 179 (CNTRUM TECHNIKI OKRETOWEJ PRZEDSIEBIORSTWO PANSTWOWE WYODREBNIONE) * page 2, line 35 - page 3, line 20; figures *	6	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F04C
F01C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 April 1995	Kapoulas, T

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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