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(71) Applicant: **ADRIATICA LAVORAZIONI
MECCANICHE S.p.A.
Corso Trento e Trieste 118
I-68034 Lanciano (CH)(IT)**

(72) Inventor: **Bernardeschi, Carlo
Via Vittorio Veneto 180
I-56025 Pontedera (PI)(IT)**

(74) Representative: **De Carli, Erberto et al
ING. BARZANO' & ZANARDO MILANO S.p.A.
Via Borgonuovo, 10
I-20121 Milano(IT)**

(54) **Circulation pump for circulating the cooling liquid for internal combustion engines.**

(57) A circulation pump for circulating the cooling liquid for internal combustion engines comprises, provided inside the pump body (11), a tank (12) suitable for collecting the liquid which is formed, in very small amounts, inside the pump in the neighbourhood of the sealing ring (15) between the pump

body (11) and the pump impeller (18) both due to the condensation of the vapour generated there, and due to the incomplete effectiveness of the sealing ring (15) in particular during the period of running-in and the initial bedding of said sealing ring (15).

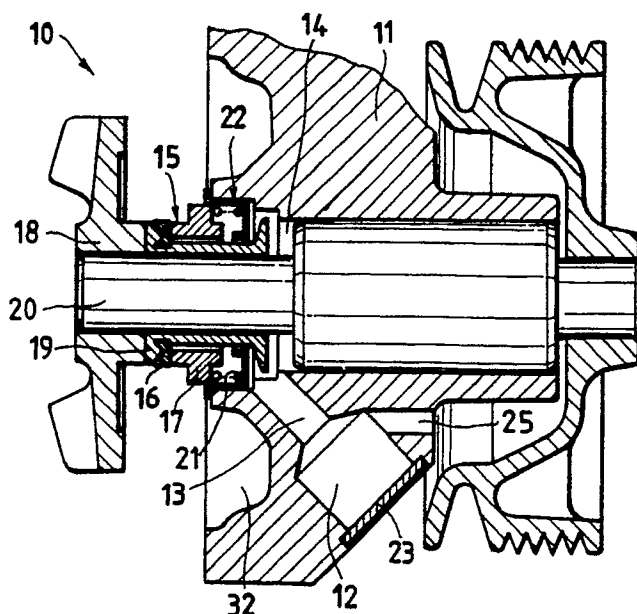


Fig.2

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CIRCULATION PUMP FOR CIRCULATING THE COOLING LIQUID FOR INTERNAL COMBUSTION ENGINES

The present invention is concerned with a circulation pump for circulating the cooling liquid for internal combustion engines.

It is well-known that the circulation pumps which cause the internal combustion engines cooling liquid to circulate are schematically constituted by a fixed structural portion, generally denominated "pump body", inside whose interior a rotary shaft is housed, which transmits the revolutionary motion to an impeller of the type with centrifugal blades installed externally relatively to the pump body, inside the circulation loop of the cooling liquid; between the fixed portion of the pump (i.e., the pump body) and the impeller a sealing gasket is interposed. Said sealing gasket is constituted by two portions, the one of which, constrained to the pump body, is generally made from a ceramic material and the other of which is made from a much softer material, capable of fitting the contact surface of the first gasket portion.

The above said technology, by known well proven and widely diffused, is the most appropriate one if one wants to prevent the cooling liquid from penetrating the interior of the pump, causing damages to said pump

It is well-known as well that in all pump types a drain channel is provided in the pump body, which drain channel puts the chamber inside which said sealing gasket is housed into communication with the external environment, being thus useful in order to cause the liquid which may be produced inside said chamber, to drain.

The causes for such production of liquid matter are various. Said production can occur owing to the continuous evaporation of the liquid film formed between the mutual contact surfaces of the two portions of the sealing gasket -- which evaporation is caused by the overheating generated by the friction between said contact surfaces -- and due to the unavoidable leakages of liquid which take place along the perimeter of the gasket and are caused, e.g., by a not perfect fitting up of the gasket; and finally, owing to the not complete effectiveness of the gasket during the first operating hours, when the contact surface of that portion of the gasket which is integral with the pump body, must still perfectly fit the contact surface of that portion of the gasket, which is integral with the impeller.

The amount of liquid which is produced inside the interior of the gasket housing chamber, owing to the above causes, is very small; however, should the above said drain channel not be provided, said production would be enough to cause in the long term the damaging of the bearing fastened to the pump body in a position adjacent to the same

gasket housing chamber.

Obviously, besides performing the function of causing the small amount of liquid generated inside the pump due to the above causes to drain to the outside, the above said drain channel provided through the pump body also allows the cooling liquid possibly leaked -- in much larger amounts -- into the interior of the pump when the sealing gasket is not perfectly operating, to escape to the outside; therefore, in such event, the above said drain channel also constitutes an useful means in order to detect the malfunctioning of the sealing gasket and hence, summing-up, the malfunctioning of the circulation pump.

Precisely this particular secondary function of the drain channel can cause wrong interpretations by those operating in this sector, who are often induced to mistake the normal residue produced in the pump body by the very small amounts of liquid exiting the drain channel for the symptom of a much more serious loss of tightness of the pump and therefore to undertake improper measures; in particular, such unfortunate mistakes can occur during the initial period of pump operation, during which the cooling liquid can actually leak into the interior of the pump in a relatively larger amount, in that the perfect matching of the contact surfaces of both portions which compose the sealing gasket has not taken place yet.

In order to prevent the risk of wrong interpretation as above said, in some cases some solutions and contrivances were proposed, which essentially consist in the application of small collecting vessels to collect the liquid exiting the drain channel. Said collecting vessel are large enough in order to collect the very small amounts of liquid matter generated due any of the above said causes during the normal operation of the pump, and to cause them to settle; on the contrary, in the event that an abnormal leakage of cooling liquid takes place through the sealing gasket, the corresponding amount of cooling liquid cannot be contained any longer inside the collecting vessel, and, once again, this is a symptom of pump malfunctioning.

Although it is functionally efficacious, the above mentioned solution causes anyway a not negligible increase in the industrial costs of production of the pump and in the long run can show risks of breakage or of detachment of the fastening edges of the vessels, owing to the continuous vibrations, or due to possible impacts, unless resort is made to burdensome modifications of the pump body, useful to generate points of support or constraint for said vessels.

The purpose of the instant invention is of pro-

posing a circulation pump for circulating the cooling liquid for internal combustion engines in which the discharge of the liquid matter which is formed in the nearby of the sealing gasket takes place in a reliable and industrially cheap way.

Such a purpose is achieved by means of a circulation pump for circulating the cooling liquid for internal combustion engines, comprising a pump body inside whose interior a revolutionary shaft is installed, which transmits the revolutionary motion to an impeller installed outside the body pump and installed inside the circulation loop of the cooling liquid, with a sealing gasket being interposed between said pump body and said impeller, characterized in that said circulation pump comprised, provided inside the pump body, a tank suitable for collecting the liquid which is formed inside the interior of the pump in the nearby of the sealing gasket, which tank is in communication with a channel leading to the outside of said pump body.

In order to better understand the functional and structural features of the instant finding, in the following some exemplifying forms of practical embodiment of the same finding are disclosed by referring to the hereto attached drawing tables in which:

Figure 1 shows a partial plan view of a pump according to the present invention;

Figure 2 shows a sectional view made along the path line II-II of Figure 1;

Figure 3 shows a view in detail of a special component of the pump in its initial fitting-up position;

Figure 4 is still a detail view showing the end fitting-up position of the same component as of Figure 3;

Figures 5, 6, 7 and 8 are equivalent to Figures 1, 2, 3 and 4, but refer to a different exemplifying form of practical embodiment of the invention;

Figures 9 and 10 show, according to views corresponding to those shown in Figures 1 and 2, a further exemplifying form of practical embodiment of the invention.

Referring to Figure 1, with the reference numeral 10 a pump according to the present invention is generally indicated. In particular, the pump body 11 is provided with a hollow 12 obtained, in the specific case herein shown, as an enbloc piece with the pump body, by means of machining operations with tool machines. As it can be better seen in Figure 2, the hollow 12 has a cylindrical shape and is radiused to a coaxial duct 13 which connects the interior of said hollow with the chamber 14 inside which the sealing gasket -- generally indicated with the reference numeral 15 -- is housed.

Said gasket 15 is subdivided, as shown in figure, into two portions 16 and 17, the one of which is integral with the impeller 18 through a support ring 19 constrained to the shaft 20; the other sealing gasket portion, 17, is urged against the first portion 16, by means of an elastic element 21 which reacts against the shell 22 constrained to the pump body 11.

In the above structure, anyway already known from the prior art, the two portions 16 and 17 of the gasket 15 are respectively made from a ceramic material and carbon, such as to achieve the best results in terms of tightness against the dispersions or the leakages of the liquid contained inside the region 32.

Thus, the hollow 12 becomes capable of constituting a collecting tank inside which the liquid coming from the chamber 14 is collected, when said hollow 12 is frontally stopped by means of a cap 23, which is installed in its end position by means of a forcing operation. In Figures 3 and 4, the two positions can be observed in detail, and on an enlarged scale, which the cap 23 takes relatively to the pump body 11, before and after the above said forcing operation; the end position is taken, as one can see from Figure 4, at the cost of a deformation of the wall 24 of the seat, which is made from a softer and lower-tenacity material, e.g., cast iron, caused by the same cap, made from a harder and higher-tenacity material, such as, e.g., steel. Said operation of forcing and deformation secures the perfect tightness of the stopping of the tank, with a very low industrial manufacturing cost.

The tank 12 is connected with the outside of the pump body by means of the channel 25; this connection performs the task of keeping low the pressure value inside the tank, such as to enable the liquid coming from the chamber 14 to easily drain through the duct 13; the diameter of this latter can also reach relatively small values by virtue of the presence of the channel 25 and, what's more important in this respect, the drain of the liquid through the duct 13 can continue to take place also when, as time goes on, the free cross section of the same duct gets narrower owing to the continuous sedimentation of the substances contained in the cooling liquid used for the cooling of the internal combustion engines.

The feature consisting of placing the collecting tank 12 into communication with the outside is also displayed by the different form of practical embodiment illustrated in Figures 5, 6, 7 and 8. Also in this case, the same structural elements as of the preceding form of practical embodiment are present and are indicated with the same reference numerals, with an apex added; what is different in the two solutions, is the arrangement of the tank 12', which in this second case is vertical and not

oblique, as well as the different construction technology used, in that the second pump body 11' is manufactured by means of an aluminum casting operation, differently from the preceding pump body 11, which is made from cast iron by machining with tool machines.

In this second solution, the collecting tank 12' is put into communication with the outside through the ring chamber 14' and a drain channel 26 provided parallel to the axis of the pump by means of a simple groove provided at the bearing housing surface (the bearing is not shown in the figures), which bearing is interposed between the pump body and the shaft integral with the impeller. The drain of the liquid along the duct 13' is favoured in this case not so much in that an increase in the internal pressure inside the tank 12' is prevented, but rather because the occurrence of a depressure inside the chamber 14' is prevented; both of these circumstances would in fact hinder the liquid from freely draining from the chamber 14' to the tank 12'.

The volume of the collecting tank is, in any case, large enough to prevent the liquid -- i.e., the liquid which, as said, is formed in very small amounts inside the chamber 14 or 14' owing to the above specified causes -- from escaping from the pump body to the outside.

The exemplifying form of practical embodiment shown in Figures 9 and 10, wherein the hereinabove described elements are indicated with the same reference numerals with a double apex added, is similar to the form of practical embodiment depicted in Figures 1 and 2. However, in this case the tank 12'' is of extended shape and furthermore the channel 25 is replaced by a passage 27 provided in the pump body 11'' at the peripheral edge of the cap 23''. Said passage 27 is in direct communication with the duct 13'' and with the tank 12'', and leads to the outside.

The advantages deriving from said tank being directly provided in the pump body can be easily understood and essentially derive from a decrease in the production costs, and the achievement of a highly reliable and effective solution. Obviously, the solution can be applied in different forms to the various types of pumps which can be used for the cooling of the internal combustion engines; the tank stopping cap can be differently conceived, and the connection of the same tank with the outside can be differently accomplished as well.

Claims

1. Circulation pump for circulating the cooling liquid for internal combustion engines, comprising a pump body inside whose interior a revolutionary

shaft is installed, which transmits the revolutionary motion to an impeller installed outside the body pump and installed inside the circulation loop of the cooling liquid, with a sealing gasket being interposed between said pump body and said impeller, characterized in that said circulation pump comprises, provided inside the pump body, a tank suitable for collecting the liquid which is formed inside the interior of the pump in the nearby of the sealing gasket, which tank is in communication with a channel leading to the outside of said pump body.

2. Circulation pump according to claim 1, characterized in that said tank is defined by a hollow provided as an enbloc piece with the pump body, to which a stopping cap is applied.

3. Circulation pump according to claim 2, wherein said hollow is obtained by carrying out operations of machining of said pump body with tool machines.

4. Circulation pump according to claim 2, characterized in that said hollow is provided by means of an operation of casting of said pump body from a metal material.

5. Circulation pump according to claim 2, characterized in that said closing cap is applied to said hollow by means of a forcing operation in which the side surface of the cap is pressed against the wall of the hollow up to cause said hollow wall to get deformed, in that the hardness and tenacity of the material which constitutes said cap is higher than of the material which constitutes said pump body.

6. Circulation pump according to claim 1, characterized in that said channel leading to the outside of said pump body is directly connected with said tank.

7. Circulation pump according to claim 1, characterized in that said channel leading to the outside of said pump body is connected with a chamber inside which said pump sealing gasket is housed.

8. Circulation pump according to claim 1, 6, 7, characterized in that the position of said tank in said pump body is such, that the liquid matter gets collected inside it by gravity.

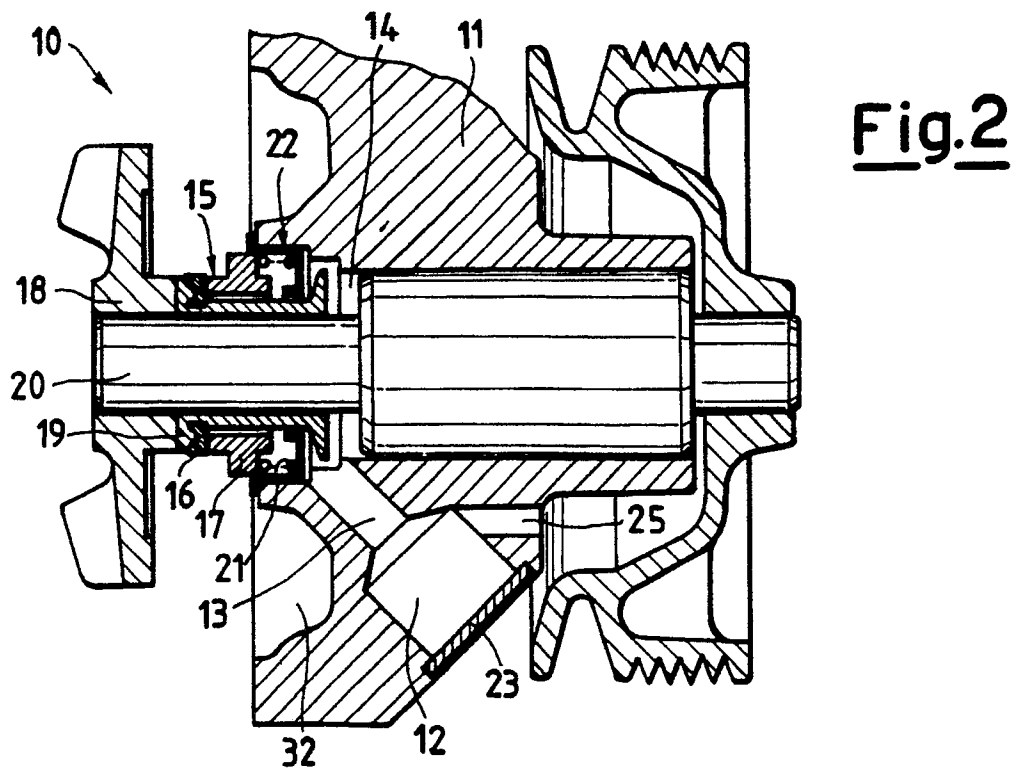
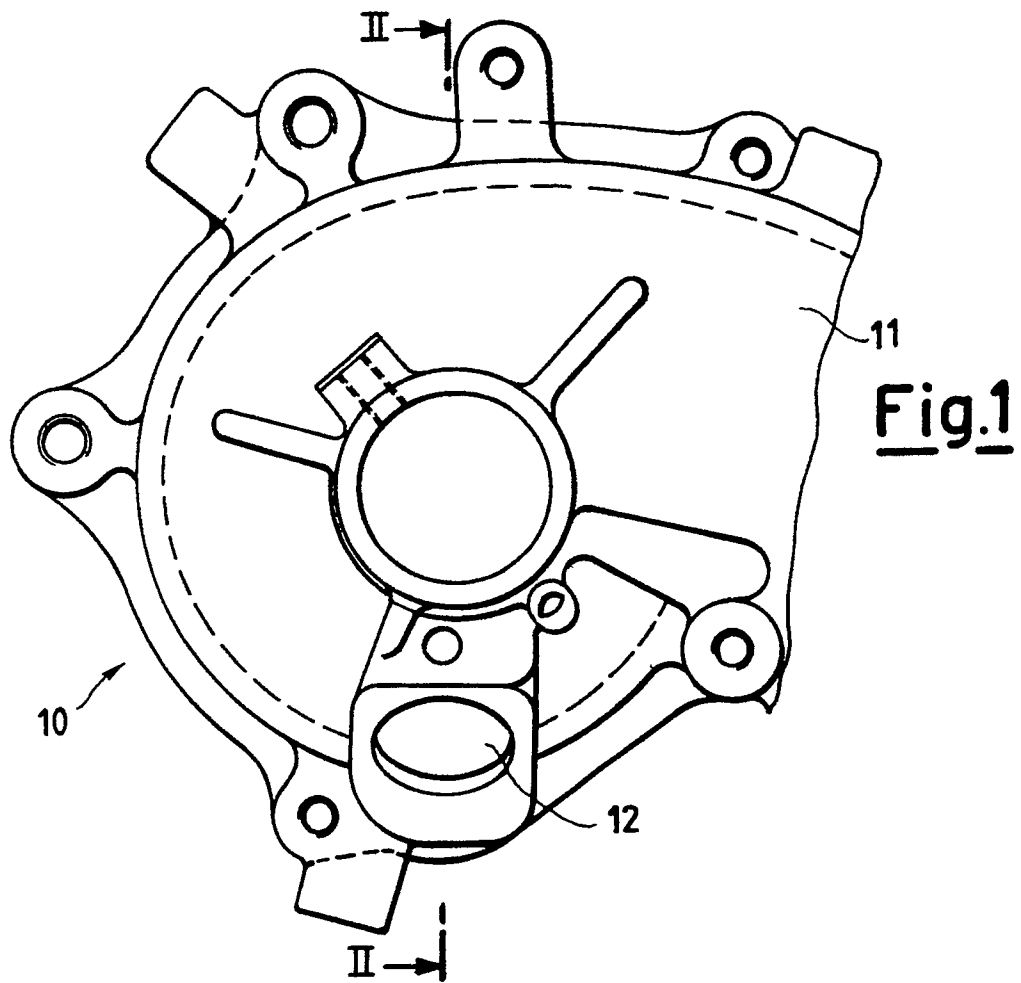


Fig.3

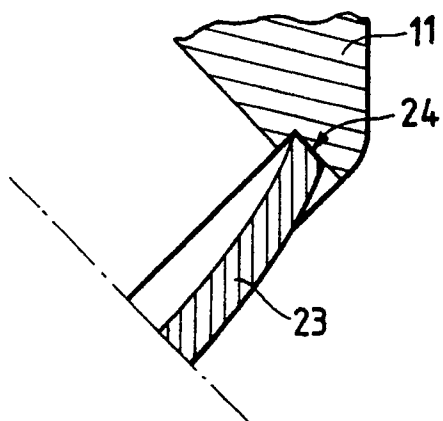


Fig.4

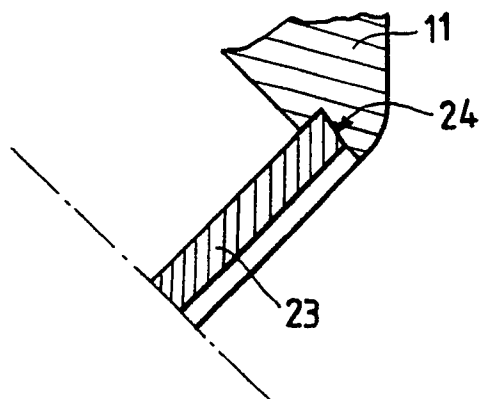


Fig.7

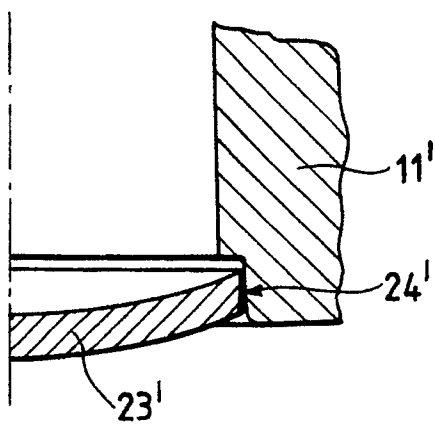


Fig.8

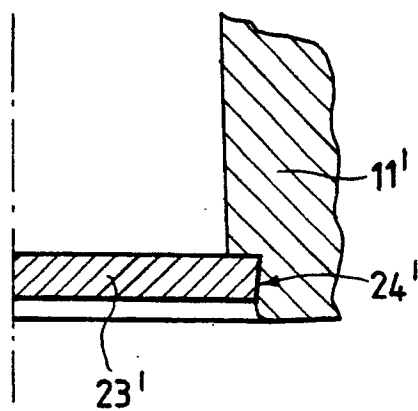


Fig.5

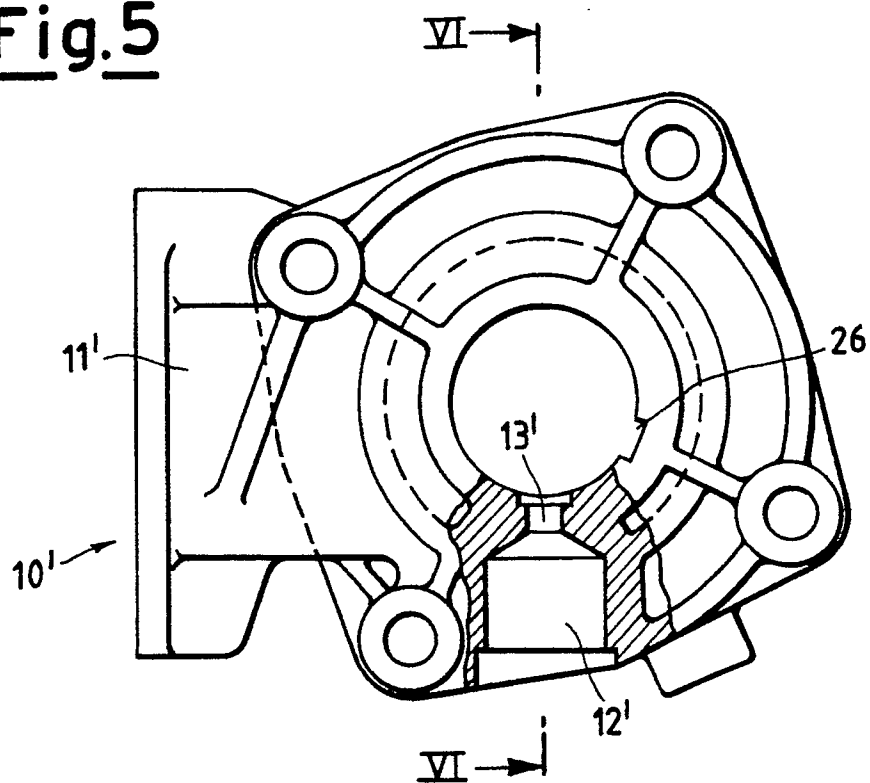


Fig.6

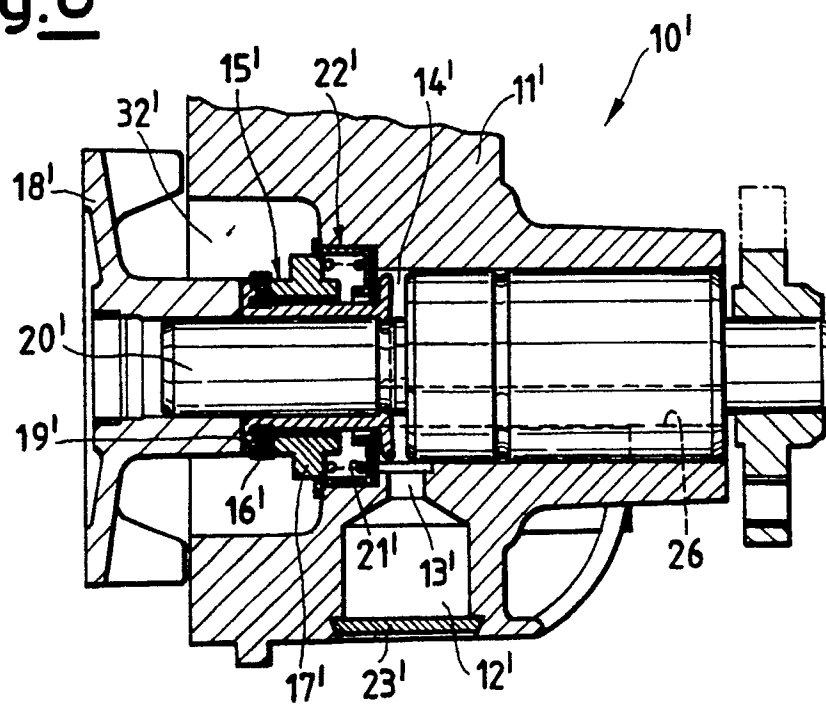


Fig.9

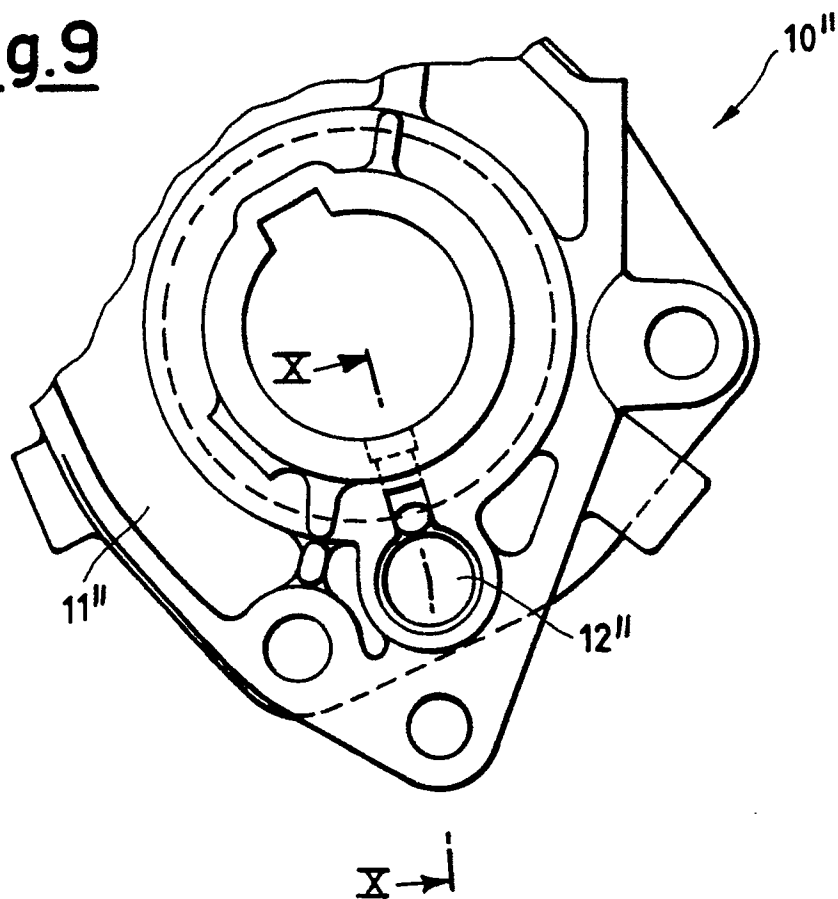
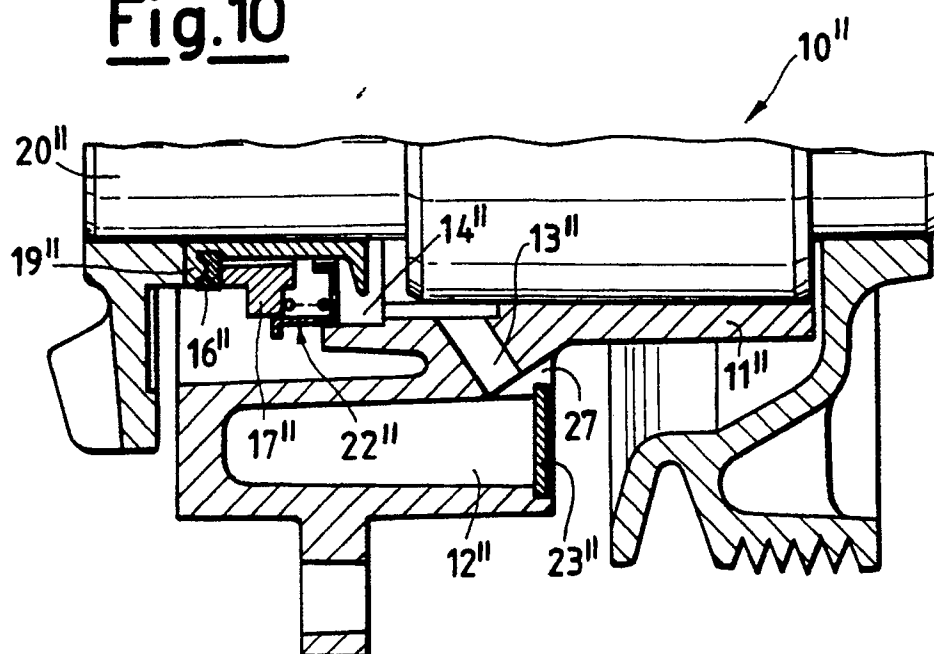


Fig.10





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EUROPEAN SEARCH REPORT

Application Number

EP 90 20 2949

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.5)
X	GB-A-2 033 979 (BMW) * Abstract; page 1, lines 4-11,73-101; figures * - - -	1,4,6-8	F 04 D 29/42
A P,X	DE-A-3 931 938 (AISIN SEIKIKI K.K.) * Abstract; column 1, lines 3-7,49-53; column 2, lines 14-52; figures * - - -	2,5 1,4,6-8	
A A	US-A-2 375 085 (CURTIS) * Page 1, left-hand column, lines 1-7, right-hand column, line 34 - page 2, right-hand column, line 7; figures * - - - - -	2,5	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F 04 D
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		15 January 91	ZIDI K.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			