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DESCRIPTION DE202007001227U1

[0001]

¹³ The innovation relates to an oil filter according to the preamble of claim 1.

[0002]

¹⁷ Generic oil filters are known from practice, for example from the lubricating oil circuit of an internal combustion engine in the automotive industry.

¹⁹ A heat exchanger is often provided in the same lubricating oil circuit as the oil filter. Under certain operating conditions of the engine, for example when the engine oil is cold and therefore highly viscous, it is hardly possible for the oil to flow through a heat exchanger.

[0003]

²⁵ In order to design the lubricating oil circuit as economically as possible, heat exchanger bypass valves are increasingly being avoided for cost reasons.

²⁷ Instead of flowing through a heat exchanger bypass valve, which opens in this case, the highly viscous oil passes through a bypass opening from the crude oil channel, for example, into the oil filter, namely onto the raw side of the filter element.

[0004]

³³ As soon as the oil heats up due to the operation of the internal combustion engine, its viscosity decreases.

³⁵ Accordingly, the flow resistance of the heat exchanger decreases and the volume flow of the oil through the exchanger increases, so that the volume flow through the bypass opening is reduced to the same extent.

[0005]

⁴¹ When the oil has reached its operating temperature, the distribution of the oil volume flow through the exchanger on the one hand and through the bypass bore on the other hand is determined by the specified free cross-sectional area of the bypass opening.

[0006]

⁴⁷ The innovation is based on the task of improving a generic oil filter in such a way that the bypass opening and thus the oil filter can be manufactured as easily and inexpensively as possible and that changes to the volume flow distribution can be carried out using the simplest and most inexpensive means possible.

[0007]

⁵⁴ This object is achieved by an oil filter having the features of claim 1.

[0008]

⁵⁸ Advantageously, such an oil filter can be provided in an oil module according to claim 19.

[0009]

⁶² In other words, the innovation proposes that the bypass opening should not be designed solely to determine the oil volume flow.

⁶⁴ In this case, as is conventionally the case, the diameter of the bypass opening would have to be designed to accommodate the desired volume flow.

⁶⁶ In practice, this means that during the casting production of oil filter housings, a pin is provided in the casting mold which creates the bypass opening in the casting body and which is then removed from the casting body, e.g.

⁶⁹ B. remains in the mold.

⁷⁰ Due to the small cross-sectional areas required for the bypass opening, the pin has only a small diameter, making it very sensitive to mechanical damage, which has an economically disadvantageous effect on the manufacturing process of a corresponding oil filter housing.

⁷³ In addition, the intended oil volume flow that passes through this bypass opening is determined structurally exclusively by the diameter of the bypass opening, and since this determination is made on the housing side of the oil filter, subsequent changes are hardly possible or only possible with great effort.

[0010]

⁸⁰ According to the proposal, however, the bypass opening is deliberately oversized, i.e. it has a larger cross-section than would actually be required for the intended volume flow rate of the oil.

⁸⁰ The passage of oil through the bypass opening is therefore proposed to be impeded by a blocking body, so that the desired throttling effect of the bypass opening is achieved.

[0011]

⁸⁷ Based on the manufacturing process described above, a pin with a significantly larger diameter and correspondingly significantly improved mechanical robustness can be used when casting the oil filter housing, which creates a correspondingly oversized opening in the housing of the oil filter.

⁹¹ This has a positive economic impact on the manufacturing process, as disruptions to the manufacturing process are significantly less likely and the scrap rate can be significantly reduced.

[0012]

⁹⁷ In addition, the blocking body, i.e. a second component, can be manufactured independently of the oil filter housing, so that by using different blocking bodies, or by different positioning of the blocking body and thus different coverage of the bypass opening, different effective, free flow cross-sections for the oil can be created, so that the desired volume flows can be easily set structurally, which are to be guided through the bypass opening as a volume fraction of the oil flow.

¹⁰³ In this way, requests for changes from the manufacturer can be implemented quickly and inexpensively, and if necessary, identical oil filter housings can be adapted to different purposes and, as part of this adaptation, have different effective cross-sections of the bypass opening.

[0013]

¹¹⁰ The reduction of the oversized cross-section of the bypass opening can be achieved, for example, by the blocking body extending into the bypass opening, not as a sealing component, but in such a way that the blocking body only partially fills the bypass opening and leaves a correspondingly reduced clear cross-section of the bypass opening free, through which the desired partial flow of oil can pass.

[0014]

¹¹⁸ Alternatively, the blocking body can be designed in such a way that it does not extend into the opening, but rather up to the housing wall into which the bypass opening opens.

¹²⁰ In this way, the housing wall forms a stop for the locking body, whereby the locking body partially rests on the wall and partially covers the mouth of the bypass opening.

[0015]

- ¹²⁵ According to a further alternative, it can be provided that the blocking body neither extends into the bypass opening nor rests against the wall surrounding the mouth of the bypass opening, but rather that the blocking body is arranged at a distance from the wall and in front of the mouth of the bypass opening, so that a flow deflection of the oil volume flow results.
- ¹²⁹ Regardless of the size of the cross-sectional area of the blocking body, an additional possibility for influencing the dimensioning of the oil volume flow arises from the fact that the distance at which the blocking body is located in front of the mouth of the bypass opening can be adjusted.

[0016]

- ¹³⁶ In the three variants mentioned above, the blocking body can be smaller than the cross-sectional area of the bypass opening.

[0017]

- ¹⁴¹ In the second and third variants, i.e. when the blocking body does not extend into the bypass opening, the blocking body can be larger than the cross-sectional area of the bypass opening, whereby the positioning of the blocking body still sets the desired free opening cross-section of the bypass opening or creates the desired throttling effect.

[0018]

- ¹⁴⁸ Advantageously, the bypass opening can connect the crude oil channel with the crude oil side of the filter chamber in which the filter insert is located, so that the oil passing through the bypass opening reaches the crude oil side of the filter.
- ¹⁵¹ In this way, the bypass opening can be designed as a connecting bore between these two cavities of the oil filter in a space-saving and economical manner without the need for a longer channel, whereby, regardless of the positioning of the bypass opening, it is economically advantageous to design this as a bore that can be produced easily and quickly - possibly without post-processing - when casting the oil filter.

[0019]

- ¹⁵⁹ In an advantageous and widely used design of the oil filter, which provides a replaceable filter insert, an oil-permeable filter medium is held between two so-called end plates.
- ¹⁶¹ In such a design, the blocking body can advantageously be provided on an end plate, so that no additional component has to be created and handled and the blocking body automatically reaches its desired position, which reduces the flow through the bypass opening, during the

assembly of the filter insert, which is required anyway.

[0020]

¹⁷¹ In a particularly cost-effective design, the locking body can be designed as an extension of the end plate, so that it is manufactured as one piece with the end plate and neither additional tools nor the assembly of several individual parts are required.

[0021]

¹⁷⁷ Alternatively, the locking body can be designed as a separate component which can be attached to the end plate.

¹⁷⁹ In this way, for example, by utilizing a principle of identical parts, basically identical filter inserts or at least basically identical end plates can be used, for which different blocking bodies with, for example, different dimensions can be used depending on the intended application and filter type.

[0022]

¹⁸⁶ If the locking body is arranged on the filter insert, the filter insert can advantageously be guided automatically in the filter housing so that the correct positioning of the locking body in front of or in the bypass opening is automatically ensured.

¹⁸⁹ For this purpose, it is advantageous to provide guide elements that interact with one another, i.e. that correspond to one another, in the housing on the one hand and on the filter insert on the other hand, for example an inclined surface inside the filter housing, along which a projection of the filter insert slides during assembly of the filter insert when the filter insert is increasingly immersed deeper into the filter housing.

¹⁹⁴ When the filter insert reaches the end of this movement, the guide elements ensure that the locking body assumes its effective position assigned to the bypass opening.

[0023]

¹⁹⁹ In a filter design that is widely used in practice with a cylindrical cavity in the filter housing and with an essentially cylindrical filter insert, the desired guide elements can be designed on the housing side as a type of projection or step that runs circumferentially in the cavity of the filter housing along the inner circumference of the housing and guides the filter insert in an approximately helical manner at an angle, running into the depth of the housing.

[0024]

²⁰⁷ As an alternative to the design of the locking body on the filter insert, it can advantageously be provided to design the locking body as a separate component which can be fastened in the

housing of the oil filter.

211 In this way, oil filter inserts in series production can continue to be used unchanged and the change in the bypass opening only affects the housing, in which the design of the bypass opening by dimensioning the corresponding opening diameter was previously only provided for.

[0025]

219 In a particularly cost-effective design, the locking body can be made of plastic and be hollow, e.g.

221 B. sleeve-like with a pin-like locking body.

222 This design avoids accumulations of material which could lead to indentations in the surface when the plastic material cools down and thus affect the cross-section of the locking body.

224 Rather, the internally hollow structure of the locking body ensures precise external dimensions of the locking body, which are advantageous for the desired dimensioning of the free passage cross-section through which the partial volume flow of the oil is to pass.

227 The effective cross-section of the locking body is ensured by the fact that the hollow locking body is designed to be closed over its entire cross-section, for example by a U-shaped or H-shaped cross-section.

230 The pin-shaped, sleeve-like hollow locking body mentioned above can, for example, For example, it can be provided that this locking body has a front end plate at one end, which reliably closes the cavity.

[0026]

236 As an alternative to such a sleeve-like design, a blocking body with, for example, a cross-shaped or star-shaped cross-section can be provided in order to avoid the aforementioned material accumulations.

[0027]

242 It is advantageous to integrate as many components of the oil circuit as possible by creating a so-called oil module, as is now widely known in practice.

244 The oil module comprises both the oil filter and the heat exchanger, and since both components are combined in one oil module, an optimal adaptation of the two components to each other is possible, including the bypass opening, so that in such an oil module the oil filter can be designed as proposed.

[0028]

251 This shows

[0029]

256 Fig. 1 a vertical section through an oil filter,

[0030]

260 Fig. 2 shows a detail from Fig. 1 on an enlarged scale compared to Fig. 1,

[0031]

264 Fig. 3 a perspective view into the oil filter housing of the oil filter of Fig. 1 and

[0032]

268 Fig. 4 to Fig. 8 show further embodiments, each in representations similar to that of Fig. 2.

[0033]

272 In the drawings, 1 designates an oil filter which is part of an oil module which also includes a heat exchanger.

274 The oil filter 1 has a housing 2 which is closed with a screw cap 3 and which is essentially cup-shaped and accommodates an essentially cylindrical filter insert 4.

[0034]

279 The filter insert 4 has an upper end plate 5, which is connected to the screw cap 3 by a locking or snap connection, and furthermore a zigzag-folded oil-permeable filter medium 6, which is held between the upper end plate 5 and a lower end plate 7.

282 The filter insert 4 is flowed through radially from the outside to the inside and the filter medium 6 is secured against collapse under the conditions prevailing during operation of the oil filter 1 by a so-called support dome 8, which is hollow and perforated so that the pure oil filtered through the filter insert 4 can reach the interior of the support dome 8 and drain downwards.

[0035]

289 The lower end disk 7 forms a sleeve-like hollow blocking body 9 which extends through a bypass opening 10.

291 The bypass opening 10 is designed as a bore in the wall of the housing 2 and connects the filter chamber in which the filter insert 4 is located with a crude oil channel 11.

293 Around the blocking body 9, a free or clear cross-section 12 of the bypass opening 10 is created in the form of an annular gap, as is particularly clear from Fig. 2.

295 Regardless of whether the locking body 9 is arranged exactly centrally within the bypass

opening 10, the desired clear cross section 12 results in a structurally intended size and determines the partial volume flow of the oil that passes through the bypass opening 10.

[0036]

302 Fig. 3 shows a perspective view of the interior of the partially sectioned housing 2, wherein no built-in components in the housing are shown, such as e.g.

304 B. the support dome 8 shown in Fig. 1.

305 It is clear that a step running diagonally downwards is provided as a guide element 14 in the housing wall, whereby in Fig. 3 on the right the guide element 14 occupies its highest point, slopes down to the left in a screw-like manner along the housing wall and finally, on the far left, leads vertically downwards to the bottom of the filter chamber.

[0037]

312 From Fig. 1 it can be seen that the lower end plate 7 has a nose-like projection 15 which rests against the guide element 14.

314 Since the guide element 14 is also extended as a step on the broken-away half of the filter housing 2 (not shown in Fig. 3), namely symmetrically to the portion of the guide element 14 shown, running downwards from the right, highest point, a vertical slot is created in the housing wall between the two vertical sections of the guide element 14, into which slot the projection 15 dips, as can be seen from Fig. 1.

[0038]

322 Due to the circumferential and obliquely downward orientation of the guide element 14 and the projection 15, which represent two guide elements that interact with one another, an automatic forced guidance of the filter insert 4 is provided when the latter is increasingly immersed deeper into the filter housing 2, so that at the end of this movement the locking body 9 automatically assumes its intended position, which can be seen from Fig. 1 and Fig. 2, and extends into the bypass opening 10.

[0039]

331 Fig. 4 shows another embodiment.

332 In this case, the blocking body 9 rests against the wall of the housing 2 and only partially covers the bypass opening 10, so that, starting from the entire cross section of the bypass opening 10, a reduced, approximately crescent-shaped free or clear cross section 12 of the bypass opening 10 results.

336 The diameter of the blocking body 9 can be smaller, equal to or larger than the diameter of the bypass opening 10 .

[0040]

- 342 Fig. 5 shows a further embodiment, wherein here the blocking body 9 is not guided into the bypass opening 10 or onto the wall of the housing 2, but is located at a distance in front of the mouth of the bypass opening 10.
- 345 The reduced effective flow cross-section, which is decisive for determining the partial volume flow that passes through the bypass opening 10, is determined by the distance that exists between the blocking body 9 and the housing wall.
- 348 In the illustrated embodiment of Fig. 5, an annular gap is created through which the oil flowing from the bypass opening 10 can escape laterally under the locking body 9.
- 350 In the illustrated embodiment of Fig. 5, the diameter of the blocking body 9 is larger than that of the bypass opening 10.
- 352 However, the blocking body can have a cross-section of the same size or a smaller cross-section than the bypass opening 10.

[0041]

- 357 Fig. 6 shows an embodiment in which the lower end disk 7 has a region which forms the blocking body 9 for the bypass opening 10.
- 359 The bypass opening 10 is not only designed as a bore, but as a short channel in which the wall of the housing 2 forms an annular hollow nozzle 16. The throttling effect by the blocking body 9 – in this case by the lower end plate 7 – is achieved, as in the embodiment of Fig. 6, by the flow deflection and the small gap between the blocking body 9 and the mouth of the bypass opening 10.

[0042]

- 367 Because the housing 2 has the nozzle 16 extending into the filter chamber, the entire filter insert can remain unchanged and it does not have to be positioned in a specific rotational position like the filter insert in the embodiment of Fig. 1 to Fig. 3.
- 370 By means of differently designed filter inserts or by means of spacers which determine a specific position of the filter insert in the filter chamber, namely the distance between the end plate 7 and the nozzle 16, the throttling effect of the bypass opening 10 can be influenced without having to make changes to the housing 2 or to the nozzle 16.

[0043]

- 377 As an alternative to the design of a blocking body 9 in the form of a pin as in the embodiment of Fig. 1 and Fig. 3, it can be provided to design the blocking body 9 as a rib running all the way under the lower end plate 7, so that the throttling effect would be generated similarly to the embodiment of Fig. 5 by arranging the annular blocking body in front of the mouth of the bypass opening 10 instead of the pin-like blocking body 9 in Fig. 5.

382 In this case, an alignment of the filter insert in accordance with the angle of rotation would not be necessary, but rather the filter insert 4 would create the desired throttling point in any rotational position with the annular locking body provided under the lower end plate 7.

[0044]

396 If the ring were designed somewhat differently, for example with a larger or smaller diameter, a throttling effect similar to the embodiment of Fig. 4 could be achieved, in which case too the pin-shaped blocking body 9, as shown in Fig. 4, would be replaced by an annular blocking body under the lower end disk 7, which would rest against the housing 2 and partially cover the mouth of the bypass opening 10.

[0045]

396 In the embodiment of Fig. 7, the locking body 9 is designed as a separate component 17, which can be plugged onto a nozzle which is designed as part of the housing and also serves for mounting the support dome 8, as can be seen from Fig. 1.

399 The component 17 is placed so deeply on the respective nozzle that sufficient space remains above it to accommodate the filter insert 4, in particular the lower end plate 7 and an annular seal 18 provided thereon.

[0046]

405 The component 17 has an increased material thickness above the bypass opening 10 in the form of a thickening extending downwards, so that the distance to the housing 2 surrounding the bypass opening 10 is reduced and a gap is created which enables the desired throttling effect of the blocking body 9.

[0047]

412 The correct distance between the locking body 9 and the mouth of the bypass opening 10 is ensured by spacer feet 19 which are arranged around the bypass opening 10 on the component 17 and are supported against the housing 2.

[0048]

418 The component 17 can be secured against lifting forces, for example, by spacers (not shown) which extend to the lower end plate 7, or by a collar which rests against the nozzle formed by the housing 2 and prevents tilting movements of the component 17.

421 Such a collar can e.g.

422 B. run upwards from the illustrated component 17, in the direction of the filter insert 4 .

[0049]

427 A collar can also be provided to limit the distance by which the component 17 can be pushed onto the nozzle formed by the housing 2, so that the distance or gap between the component 17 and the mouth of the bypass opening 10 is determined and no spacer feet 19 are required.

430 Such a collar can e.g.

431 B. run downwards from the component 17 shown.

[0050]

435 Fig. 7 shows that in the illustrated embodiment, the component 17 is not rotationally symmetrical.

437 However, in contrast to the embodiment shown, the component 17 can be designed to be rotationally symmetrical, so that it can be mounted without any problems and, regardless of its angle of rotation orientation, always covers the bypass opening 10 and forms the desired annular gap.

[0051]

444 Similar to the embodiment of Fig. 7, a component similar to the component 17 can be provided, which forms the locking body 9 simply by its material thickness, without having an area with an enlarged cross section.

[0052]

450 The component 17 of Fig. 7 or a similar component can be held at its intended installation location, in which it has the desired, defined distance from the bypass opening 10, by being pressed downwards by the filter insert 4 onto the nozzle, which also carries the support dome 8.

454 For example, the component 17 can have a circumferential collar which rests against the lower end plate 7 or the seal 18 of the filter insert 4.

[0053]

459 If the component 17 has not been pushed far enough onto the nozzle of the housing 2, i.e. if there is too large a gap between the locking body 9 and the bypass opening 10 and thus an insufficient throttling effect of the locking body 9, then when the filter insert 4 is inserted into the filter chamber, the component 17 is pushed further onto the nozzle of the housing 2 until it is in its structurally intended position.

[0054]

467 Instead of an annular collar running around the nozzle of the housing 2, a spacer can also be provided which extends upwards from the component 7 in the area of the blocking body 9 and rests against the lower end plate 7, so that especially in this area of the blocking body 9 after assembly of the filter insert 7 it is ensured that the component 17 and thus the blocking body 9 are at the correct distance in front of the bypass opening 10.

[0055]

475 In the embodiments of Fig. 1 and Fig. 4, the winding of the bypass opening 10 is not completely covered by the blocking body 9.

477 However, if the opening is completely covered by the blocking body 9, according to the embodiments 5 to 7, there is a distance between the blocking body 9 and the housing wall which surrounds the mouth of the bypass opening 10.

[0056]

483 Deviating from these embodiments, a locking body 9 can be provided according to Fig. 8, which can be held or mounted in any manner, e.g.

485 B. similar to one of the previously described embodiments, or which can be glued to the housing wall surrounding the mouth of the bypass opening, so that these details are not specifically shown in Fig. 8.

488 The blocking body 9 differs from the blocking bodies of the previously described embodiments in that it completely covers the mouth of the bypass opening 10 and at the same time also rests against the housing wall of the housing 2.

491 A flow through the bypass opening 10 and an oil discharge into the filter chamber is made possible by the fact that throttle channels 20 are provided in the lower region of the blocking body 9, which extend purely by way of example in a cross-shaped or star-shaped manner in several directions and whose cross sections are dimensioned so small that the desired throttling effect of the bypass opening 10 is achieved by the blocking body 9.

[0057]

499 These throttle channels 20 can be provided as impressions in the surface of the locking body 9 in a simple and cost-effective manner.

501 Because the blocking body 9 rests against the wall of the housing 2, the defined and structurally intended cross-sectional area through which the oil can flow from the bypass opening 10 into the filter chamber is fixed, without undesirable tolerances occurring due to different distances between the blocking body 9 and the housing 2.

505 The blocking body 9 is shown purely schematically in Fig. 8; it can, for example, be provided on the lower end plate 7 of the filter insert 4, similar to the embodiment in Fig. 1, or as a separate component, similar to the embodiment in Fig. 7.

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CLAIMS DE202007001227U1

1.

¹³ Oil filter of the lubricating oil circuit of an internal combustion engine, with a housing, a crude oil channel running through the housing, and a bypass opening through which the crude oil channel can flow and connects it to another cavity in the oil filter, characterized in that a blocking body (9) is provided which covers the free cross section of the bypass opening (10) in such a way that a flow channel leading through the bypass opening (10) remains at least partially free and the blocking body (9) forms a throttle point for the oil flowing through the bypass opening (10).

2.

²³ Oil filter according to claim 1, characterized in that the blocking body (9) extends into the bypass opening (10), only partially fills it and reduces the free cross section of the bypass opening (10).

3.

²⁸ Oil filter according to claim 1, characterized in that the blocking body (9) extends to the wall which surrounds the bypass opening (10) and rests against this wall and reduces the free outlet cross-section of the mouth of the bypass opening (10).

4.

³⁴ Oil filter according to claim 3, characterized in that the blocking body (9) has throttle channels (20) in its surface adjacent to the wall, which lead from the bypass opening (10) into the other cavity.

5.

⁴¹ Oil filter according to claim 1, characterized in that the blocking body (9) extends up to the wall which surrounds the bypass opening (10), is spaced from this wall, and forms a flow obstacle for the oil emerging from the bypass opening (10) in front of the mouth of the bypass opening (10).

6.

⁴⁸ Oil filter according to one of claims 3 to 5, characterized in that the cross-sectional area of the blocking body (9) is larger than the cross-section of the bypass opening (10).

7.

⁵³ Oil filter according to one of the preceding claims, characterized in that a filter chamber having a filter insert (4) forms the other cavity, wherein the bypass opening (10) connects the crude oil channel (11) with the crude oil side of the filter chamber.

8.

⁵⁹ Oil filter according to one of claims 1 to 7, characterized in that the blocking body (9) is provided on a component provided in the housing (2), which has a function already provided for the oil filter (1).

9.

⁶⁵ Oil filter according to claim 8, characterized by a replaceable filter insert (4) which has an oil-permeable filter medium (6) and at least one end plate (7), wherein the end plate (7) has the blocking body (9).

10.

⁷¹ Oil filter according to claim 9, characterized in that the blocking body (9) is designed as a separate component that can be fastened to the end plate (7).

11.

⁷⁶ Oil filter according to claim 9, characterized in that the end disk (7) forms the blocking body (9).

12.

⁸⁰ Oil filter according to claim 11, characterized in that the blocking body (9) is designed as an

extension formed in one piece from the end plate (7).

13.

⁸⁶ Oil filter according to one of the preceding claims, characterized in that corresponding guide elements are provided in the housing (2) on the one hand and on the component having the blocking body (9) on the other hand, which automatically align the component during a movement dipping into the housing (2) in such a way that the blocking body (9) assumes its position interacting with the bypass opening (10).

14.

⁹⁴ Oil filter according to claim 13, characterized in that the housing (2) has a substantially cylindrical cavity, and that the guide elements (14) provided in the housing (2) run circumferentially and obliquely along the housing wall.

15.

¹⁰⁰ Oil filter according to one of claims 1 to 7, characterized in that the blocking body (9) is designed as a separate component (17) that can be fastened in the housing.

17.

¹⁰⁵ Oil filter according to one of the preceding claims, characterized in that the locking body (9) is designed as a substantially cylindrical pin.

18.

¹¹⁰ Oil filter according to one of the preceding claims, characterized in that the blocking body (9) consists of plastic and is hollow.

19.

¹¹⁵ Oil filter according to one of the preceding claims, characterized in that the bypass opening (10) is designed as a bore.

20.

¹²⁰ Oil module of the lubricating oil circuit of an internal combustion engine, with an oil filter and a heat exchanger, characterized in that the oil filter (1) is designed according to one of the preceding claims.