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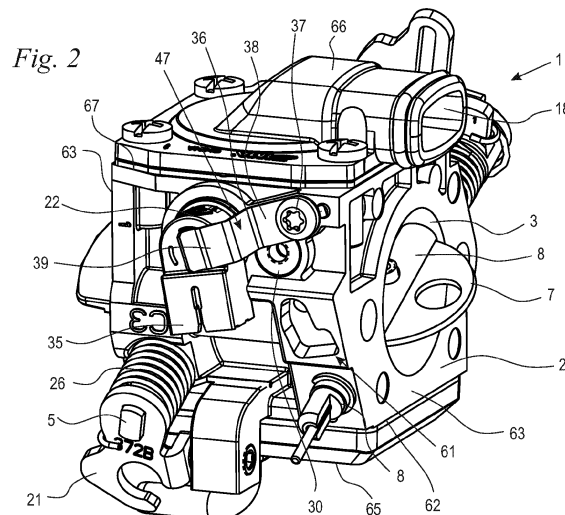
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(54) **CARBURETOR**

(57) A carburetor comprises a carburetor body (2), an intake channel (3), at least one fuel channel (42, 43) opening into the intake channel (3), a controllable fuel valve (22) arranged to control the amount of fuel flowing through the at least one fuel channel (42, 43), a particle retaining unit (30) arranged in the fuel channel (42, 43) upstream of the controllable fuel valve (22), and a throttle element (4) arranged in the intake channel (3) and being rotatably mounted in the carburetor body (2) by means

of a throttle shaft (5). The throttle shaft (5) protrudes from the carburetor body (2) on a first side (61) of the carburetor body (2). The controllable fuel valve (22) is arranged in a first bore (51) in the carburetor body (2) and is accessible from the exterior of the carburetor body (2). The particle retaining unit (30) is arranged in a second bore (52) in the carburetor body (2) and is accessible from the first side (61) of the carburetor body (2).



Description

[0001] The invention relates to a carburetor.

[0002] The US 2019/0120193 A1 shows a carburetor according to the preamble of claim 1. The carburetor comprises a filter element which is arranged at the outlet opening of a pressure chamber. The outlet is connected to the metering valve inlet.

[0003] The object of the invention is to provide a carburetor with an advantageous structure.

[0004] This object is achieved by a carburetor according to claim 1.

[0005] The carburetor comprises a throttle shaft which protrudes from the carburetor body on a first side. The controllable fuel valve is arranged in a first bore in the carburetor body. The particle retaining unit is arranged in a second bore in the carburetor body and is accessible from the first side of the carburetor body.

[0006] By arranging the particle retaining unit in a second bore in the carburetor body and making the particle retaining unit accessible from the first side of the carburetor body, both the throttle shaft and the particle retaining unit are accessible from the first side of the carburetor body. Carburetors are often used for two-stroke engines in handheld work tools such as chainsaws, cut-off machines, blowers, hedge trimmers, brush cutters or the like. In such handheld work tools there is usually little space. Also in other appliances, there can be little space and the carburetor can be poorly accessible. However, the throttle shaft has to be accessible to be activated by means of a trigger by the user. Therefore, at least one first side of the carburetor from which the throttle shaft protrudes has to be accessible. As the particle retaining unit is accessible from the first side of the carburetor, the particle retaining unit can be detached from the carburetor body and be assembled, cleaned or exchanged easily.

[0007] The controllable fuel valve is advantageously accessible from the first side of the carburetor body. As both the particle retaining unit and the controllable fuel valve are accessible from the same side of the carburetor body, both components can be easily assembled and/or exchanged.

[0008] The first bore and the second bore are advantageously parallel to each other. Like this, both bores can be easily manufactured in one manufacturing step and the position of the carburetor does not need to be changed in between.

[0009] Advantageously, the particle retaining unit can be removed from the carburetor body for cleaning or replacement. Both the particle retaining unit and the controllable fuel valve are advantageously held in the carburetor body by a joint holding unit. Like this, only one holding unit needs to be detached or loosened to remove both the particle retaining unit and the controllable fuel valve from the carburetor body. The number of separate parts for the carburetor is reduced.

[0010] An easy construction results when the holding

unit comprises a holding part that restricts movement of both the controllable fuel valve and the particle retaining unit in a direction out of the carburetor body. The holding unit restricts the movement advantageously in a direction parallel to the first and the second bore. The holding part is advantageously removably held on the carburetor body. For easy disassembly, advantageously at least one fixing screw is used for holding the holding part on the carburetor body.

[0011] The holding part lies advantageously against both the controllable fuel valve and the particle retaining unit. As the holding part lies against fuel valve and particle retaining unit, no additional means for holding the fuel valve and the particle retaining unit are needed and the number of parts is reduced.

[0012] Advantageously, the holding part is made from sheet metal. Like this, easy manufacturing of the holding part results. The particle retaining unit is advantageously held interchangeably in the second bore. The particle retaining unit can therefore be easily removed for cleaning or replacement.

[0013] An easy construction results when the particle retaining unit comprises an inlet opening and an outlet opening, wherein the outlet opening is formed at an annular gap between a body of the particle retaining unit and the second bore. The inlet opening of the particle retaining unit is advantageously formed on an end face of the body of the particle retaining unit.

[0014] The carburetor advantageously comprises a fuel compartment arranged upstream of the particle retaining unit. In one embodiment, the section of the fuel channel connecting the fuel compartment and the particle retaining unit could be formed as one single fuel line. In an alternative embodiment, the section of the fuel channel connecting the fuel compartment and the particle retaining unit is split into at least two branches. By splitting the section of the fuel channel into at least two branches, a required cross section can be provided even when there is only little space.

[0015] Advantageously, the first branch of the fuel channel is connected to the fuel compartment at a first connecting opening and the second branch is connected to the fuel compartment at a second connecting opening. The first connecting opening and the second connecting opening are advantageously arranged in a distance to each other. By arranging the first connecting opening and the second connecting opening in a distance to each other, venting of the system can be ensured even when the carburetor is tilted, for example when used in a handheld working tool. The particle retaining unit limits the flow cross section of the fuel channel advantageously to a maximum gap width of less than 0.25 mm, advantageously of not more than 0.2 mm.

[0016] An easy construction results when the particle retaining unit comprises a filter screen. Advantageously, the filter screen is made from stainless steel. The body of the particle retaining unit is advantageously nickel-plated.

[0017] The carburetor advantageously comprises a choke element which is arranged in the intake channel upstream of the throttle element and is rotatably mounted in the carburetor body by means of a choke shaft. Advantageously, the choke shaft protrudes from the carburetor body on the first side of the carburetor body. Therefore, the throttle shaft and the choke shaft protrude from the same side of the carburetor and the particle retaining unit is accessible from this side of the carburetor body.

[0018] The invention is described with reference to the drawings wherein:

Fig. 1 shows a schematic sectional illustration of a carburetor,

Fig. 2 shows a perspective view of a carburetor of fig. 1,

Fig. 3 shows a partial section of the carburetor along the line III - III in fig. 4,

Fig. 4 shows a partial sectional view of the carburetor along the line IV - IV in fig. 3,

Fig. 5 shows a perspective view of the particle retaining unit.

[0019] Fig. 1 shows a carburetor 1 which can be used for example for a two-stroke engine in a handheld work tool as for example a chainsaw, a cut-off machine, a blower, a hedge trimmer, a brush cutter or the like. The carburetor 1 can also be used with a four-stroke engine, especially with a mixture-lubricated four-stroke engine. The carburetor 1 comprises a carburetor body 2 in which an intake channel 3 is formed. In the intake channel 3, a throttle element 4 is rotatably mounted around a rotational axis 6 by means of a throttle shaft 5. With respect to the flow direction 28 in the intake channel 3 upstream of the throttle element 5, a choke element 7 is arranged. The choke element 7 is rotatably mounted around a rotational axis 9 by means of a choke shaft 8.

[0020] In the intake channel 3, a venturi 13 is formed. A main fuel opening 10 opens in the area of the venturi 13 into the intake channel 3. Downstream of the venturi 13, several idle fuel openings 11 open into the intake channel 3.

[0021] The carburetor 1 comprises a fuel pump 14. The fuel pump 14 can for example be a membrane pump driven by the fluctuating pressure in the interior space of a crankcase of an engine. The fuel pump 14 can also be an electrically driven fuel pump or any other type of fuel pump. The outlet of the fuel pump 14 is connected to a control chamber 15 via an inlet valve 19. The inlet valve 19 is connected by means of a lever 20 to a control membrane 16. The control membrane 16 separates the control chamber 15 from a compensating chamber 17. The compensating chamber 17 is connected by a compensating opening 18 to a reference pressure. The reference

pressure can for example be the pressure in the environment or the pressure on the clean side of an air filter of an engine. In case of negative pressure in the control chamber 15, the inlet valve 19 is opened and fuel delivered by the fuel pump 14 enters the control chamber 15.

[0022] The control chamber 15 is connected to the main fuel opening 10 and the idle fuel openings 11 by a fuel channel 41. In the fuel channel 41, a particle retaining unit 30 is arranged. The particle retaining unit 30 is arranged in the fuel channel 41 between the control chamber 15 and a controllable fuel valve 22. With respect to the direction of flow into the intake channel 3, the controllable fuel valve 22 is arranged downstream of the control chamber 15 and upstream of the controllable fuel valve 22. The controllable fuel valve 22 is controlled by a control unit 23. The control unit 23 can for example be the control unit of an engine to which the carburetor is attached. The controllable fuel valve 22 can for example be an electromagnetic valve.

[0023] Downstream of the controllable fuel valve 22, the fuel channel 41 splits into a main fuel channel 42 and an idle fuel channel 43. The main fuel channel 42 leads to the main fuel opening 10. The idle fuel channel 43 leads to an emulsion chamber 33. The emulsion chamber 33 is connected to the idle fuel openings 11 via channels 50. In the example, three channels 50 leading each to an idle fuel opening 11 are provided. In each channel 50, a fixed throttle 34 is arranged. In the main fuel channel 42, a fixed throttle 25 and a check valve 27 are arranged. In the idle fuel channel 43, an adjustable idle throttle 12 is arranged. The adjustable idle throttle 12 can for example be a needle valve and can advantageously be adjusted by a user.

[0024] Fig. 2 shows the carburetor 1 in detail. The carburetor body 2 has two end faces 63. The end faces 63 are arranged opposite to each other. The intake channel 3 extends from the one end face 63 to the other end face 63 and opens on both end faces 63 to the outside of the carburetor body 2. The carburetor body 2 has a first side 61 on which the throttle shaft 5 protrudes from the carburetor body 2. As shown in fig. 2, the first side 61 of the carburetor body 2 extends from the one end face 63 to the other end face 63. In the example, the choke shaft 8 protrudes from the carburetor body 2 on the first side 61 as well. As shown in fig. 2, a lever 21 is mounted on the portion of the throttle shaft 5 protruding on the first side 61 from the carburetor body 2. The lever 21 can for example be an actuating lever for the throttle element 4. For example, a Bowden cable connected to a trigger of a working tool can be attached to the lever 21. As shown in fig. 2, a spring 26 is arranged on the portion of the throttle shaft 5 protruding from the first side 61 of the carburetor body 2. The spring 26 extends between the first side 61 of the carburetor body 2 and the lever 21.

[0025] As shown in fig. 2, a first cover 65 is attached to the carburetor body 2 on a second side 62 of the carburetor body 2. The first cover 65 can for example delimit the fuel pump 14. A second cover 66 is arranged on a

third side 67 of the carburetor body 2. The second cover 66 can for example delimit the compensating chamber 17. As shown in fig. 2, the compensating opening 18 is arranged on the second cover 66. The third side 67 is arranged opposite to the second side 62. The first side 61 of the carburetor body 2 extends from the first cover 65 to the second cover 66. Between the covers 65 or 66 and the carburetor body 2, gaskets can be arranged.

[0026] Fig. 2 also shows the arrangement of the controllable fuel valve 22 and the particle retaining unit 30 in the carburetor body 2. Both the controllable fuel valve 22 and the particle retaining unit 30 project to the first side 61 of the carburetor body 2. Both the controllable fuel valve 22 and the particle retaining unit 30 are advantageously held in the carburetor 2 by a joint holding unit 47. The holding unit 47 comprises a holding part 36 and a fixing screw 37. The holding part 36 is fixed to the carburetor body 2 by means of the fixing screw 37. The holding part 36 comprises a first section 38 and a second section 39. The first section 38 lies against the particle retaining unit 30 and blocks the way of the particle retaining unit 30 out of the carburetor body 2. The second section 39 lies against the controllable fuel valve 22 and blocks the way of the controllable fuel valve 22 out of the carburetor body 22. As also shown in fig. 2, the controllable fuel valve 22 comprises a connector 35 for connection to the control unit 23.

[0027] Fig. 3 shows the arrangement of the particle retaining unit 30 and the control chamber 15 in the carburetor body 2. As shown, the control chamber 15 is formed as a recess in the third side 67 of the carburetor body 2. In the carburetor body 2, two branches 44 and 45 of the fuel channel 41 (fig. 1) are formed. Both branches 44 and 45 lead from the inside of the control chamber 15 to an inlet opening 48 of the particle retaining unit 30. The first branch 44 exits the control chamber 15 at a first connecting opening 58 arranged near the inlet opening 48. The second branch 45 exits the control chamber 15 at a second connecting opening 59. The second connecting opening 59 is arranged in a distance f to the first connecting opening 58. When the carburetor 1 is tilted during use, in many positions at least one of the openings 58 or 59 can ensure venting of the fuel system.

[0028] At the inlet opening 48, a filter screen 31 is arranged. Advantageously, the fuel channel 41, i.e. the branches 44 and 45, open vertically to the filter screen 31 at the inlet opening 48.

[0029] The particle retaining unit 30 is arranged in a bore 52. The bore 52 exits the carburetor body 2 on the first side 61. The particle retaining unit 30 has a body 32 which - in the example shown - is generally cylindrically formed. The body 32 holds a filter screen 31. The filter screen 31 is arranged at the inlet opening 48. Advantageously, the filter screen 31 is arranged above the body 32 of the particle retaining unit 30 in mounting position. In a handheld work tool, the mounting position is advantageously a position in which the work tool is placed on a flat, horizontal surface in a storage position.

[0030] In the body 32 of the particle unit 30, an inner chamber 54 is formed. The inner chamber 54 is formed as blind hole in the body 32 and opens out of the body 32 at the inlet opening 48. On the exterior of the body 32, a circumferential groove 57 (fig. 5) is formed. The circumferential groove 57 and the wall of the bore 52 form an annular gap 53 which is also shown in fig. 4. The inner chamber 54 is connected to the annular gap 53 by a cross bore 55 which extends through the body 32. The cross bore 55 is also shown in fig. 5. Fig. 5 shows also the circumferential groove 57. As also shown in fig. 3 and 5, the body 32 carries a seal 56 sealing the annular gap 53 with respect to the outside of carburetor body 2. The seal 56 is advantageously designed as an O-ring gasket.

[0031] As shown in fig. 4, the controllable fuel valve 22 is arranged in a bore 51. The controllable fuel valve has a body 29 which is partly arranged in the bore 51. The body 29 protrudes from the bore 51 to the exterior of the carburetor body 2. The bore 51 has a longitudinal axis 71. The bore 52 has a longitudinal axis 72. The longitudinal axes 71 and 72 are advantageously arranged parallel to each other. Therefore, the bores 51 and 52 are parallel to each other.

[0032] As shown in figures 3 and 4, the particle retaining unit 33 has an outlet opening 49 formed at the annular gap 53. From the annular gap 53, the two branches 44 and 45 of the fuel channel 41 lead to the controllable fuel valve 22. In an alternative embodiment, only one fuel branch could lead from the particle retaining unit 30 to the controllable fuel valve 22. More branches of the fuel line 41 are also possible.

[0033] In the embodiment shown, the two branches 44, 45 run parallel to each other and are arranged in a distance c to each other. The particle retaining unit 30 has an outer diameter d . The diameter d corresponds to the inner diameter of the bore 52. The distance c of the two branches 44, 45 is advantageously less than the diameter d of the particle retaining unit 30, especially less than half of the diameter d of the particle retaining unit 30. The branches 44 and 45 are manufactured as bores 40 extending from the end face 63. The bores 40 run through the bore 52 of the particle retaining unit 30. The bores 40 are closed to the outside by plugs 46.

[0034] Fig. 5 shows the structure of the filter screen 31 of the particle retaining unit 30. The filter screen 31 comprises longitudinal slits 60 arranged parallel to each other. Each slit 60 has a gap width b . Only particles having an extension of less than the gap width b in at least one direction can pass through the filter screen 31. Like this, clogging of the controllable fuel valve 22 with particles contained in the fuel, originating for example from the metal cutting production of the carburetor body 2, can be easily avoided.

[0035] Advantageously, the particle retaining unit 30 limits the flow cross section of the fuel channel 41 to a maximum gap width b of less than 0.25 mm, advantageously not more than 0.2 mm. Advantageously, the gap width b is 0.08 mm to 0.25 mm. The filter screen 31 is

advantageously made from stainless steel. The body 32 of the particle retaining unit 30 is advantageously nickel-plated to avoid deposits.

[0036] In an alternative embodiment, the filter screen 31 of the particle retaining unit 30 comprises a mesh, advantageously a wire mesh. The mesh advantageously has a gap width of less than 0.25 mm, advantageously not more than 0.2 mm. Preferably, the gap width of the mesh is 0.08 mm to 0.12 mm. In case of a wire mesh, the diameter of the wire is advantageously 0.7 mm to 0.9 mm.

[0037] As both bores 51 and 52 open to the same first side 61 of the carburetor body 2, both the controllable fuel valve 22 and the particle retaining unit 30 are accessible from the same side of the carburetor body 2. As both the particle retaining unit 30 and the controllable fuel valve 22 are held in the carburetor body 2 by the same holding unit 47, easy construction with a small number of parts results. By removing the holding unit 47, the particle retaining unit 30 and/or the controllable fuel valve 22 can be disassembled and cleaned or exchanged. The holding unit 47 is advantageously made from sheet metal. In other embodiments, the holding unit 47 can be made from other materials and can be made as a form part for example from plastics.

Claims

1. Carburetor comprising a carburetor body (2), an intake channel (3), at least one fuel channel (42, 43) opening into the intake channel (3), a controllable fuel valve (22) arranged to control the amount of fuel flowing through the at least one fuel channel (42, 43), a particle retaining unit (30) arranged in the fuel channel (42, 43) upstream of the controllable fuel valve (22), and a throttle element (4) arranged in the intake channel (3) and being rotatably mounted in the carburetor body (2) by means of a throttle shaft (5), wherein the throttle shaft (5) protrudes from the carburetor body (2) on a first side (61) of the carburetor body (2), wherein the controllable fuel valve (22) is arranged in a first bore (51) in the carburetor body (2) and is accessible from the exterior of the carburetor body (2),
characterized in that the particle retaining unit (30) is arranged in a second bore (52) in the carburetor body (2) and is accessible from the first side (61) of the carburetor body (2).
2. Carburetor according to claim 1,
characterized in that the controllable fuel valve (22) is accessible from the first side (61) of the carburetor body (2).
3. Carburetor according to claim 1 or 2,
characterized in that the first bore (51) and the second bore (52) are parallel to each other.
4. Carburetor according to any of the claims 1 to 3,
characterized in that both the particle retaining unit (30) and the controllable fuel valve (22) are held in the carburetor body (2) by a joint holding unit (47).
5. Carburetor according to claim 4,
characterized in that the holding unit (47) comprises a holding part (36) that restricts movement of both the controllable fuel valve (22) and the particle retaining unit (30) in a direction out of the carburetor body (2).
6. Carburetor according to claim 5,
characterized in that the holding part (47) is removably held on the carburetor body (2), especially by a fixing screw (37).
7. Carburetor according to claim 5 or 6,
characterized in that the holding part (36) lies against both the controllable fuel valve (22) and the particle retaining unit (30).
8. Carburetor according to any of the claims 5 to 7,
characterized in that the holding part (36) is made from sheet metal.
9. Carburetor according to any of the claims 1 to 8,
characterized in that the particle retaining unit (30) is interchangeably held in the second bore (52).
10. Carburetor according to any of the claims 1 to 9,
characterized in that the particle retaining unit (30) comprises an inlet opening (48) and an outlet opening (49), wherein the outlet opening (49) is formed at an annular gap (53) between a body (32) of the particle retaining unit (30) and the second bore (52).
11. Carburetor according to any of the claims 1 to 10,
characterized in that the carburetor (1) comprises a fuel compartment arranged upstream of the particle retaining unit (30), wherein the section of the fuel channel (41) connecting the fuel compartment and the particle retaining unit (30) is advantageously split into at least two branches (44, 45).
12. Carburetor according to claim 11,
characterized in that a first branch (44) of the fuel channel (41) is connected to the fuel compartment at a first connecting opening (58) and a second branch (45) is connected to the fuel compartment at a second connecting opening (59), wherein the first opening (58) and the second opening (59) are arranged in a distance (f) to each other.
13. Carburetor according to any of the claims 1 to 12,
characterized in that the particle retaining unit (30) limits the flow cross section of the fuel channel (41) to a maximum gap width (b) of less than 0,25 mm.

14. Carburetor according to any of the claims 1 to 13,
characterized in that the particle retaining unit (30)
comprises a filter screen (31).
15. Carburetor according to any of the claims 1 to 14, 5
characterized in that the filter screen (31) is made
from stainless steel.
16. Carburetor according to any of the claims 1 to 15, 10
characterized in that the body (32) of the particle
retaining unit (30) is nickel-plated.
17. Carburetor according to any of the claims 1 to 16, 15
characterized in that a choke element (7) is ar-
ranged in the intake channel (3) upstream of the
throttle element (4) and is rotatably mounted in the
carburetor body (2) by means of a choke shaft (8),
wherein the choke shaft (8) protrudes from the car-
buretor body (2) on the first side (61) of the carburetor
body (2). 20

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Fig. 1

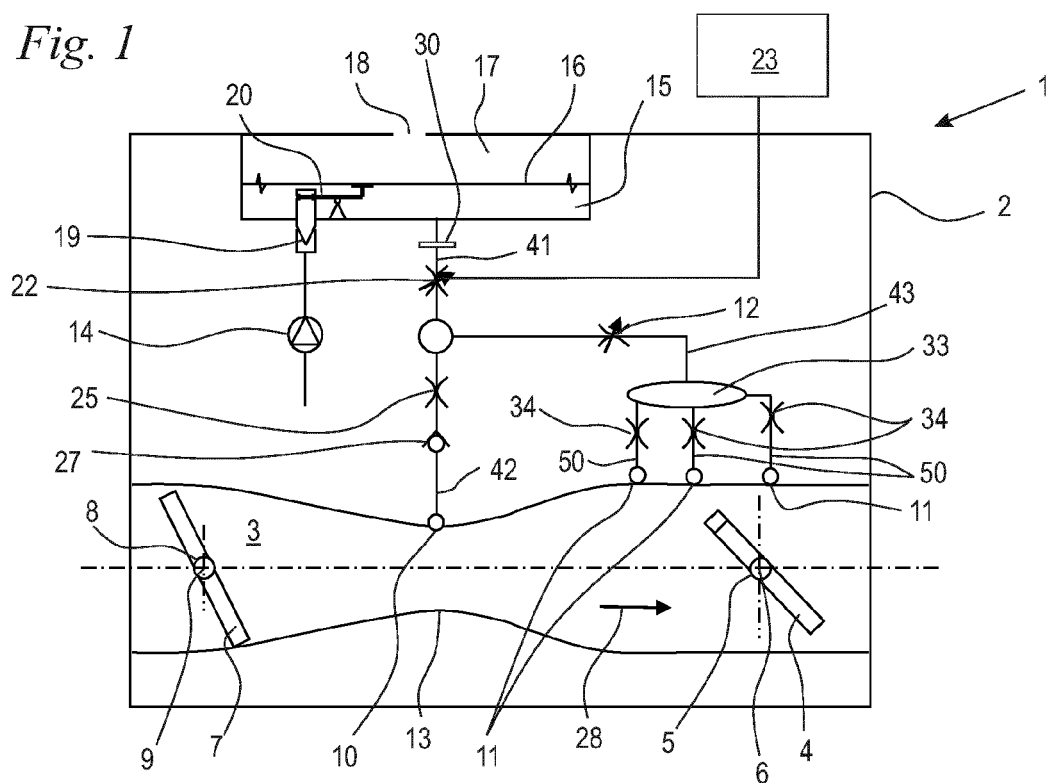


Fig. 2

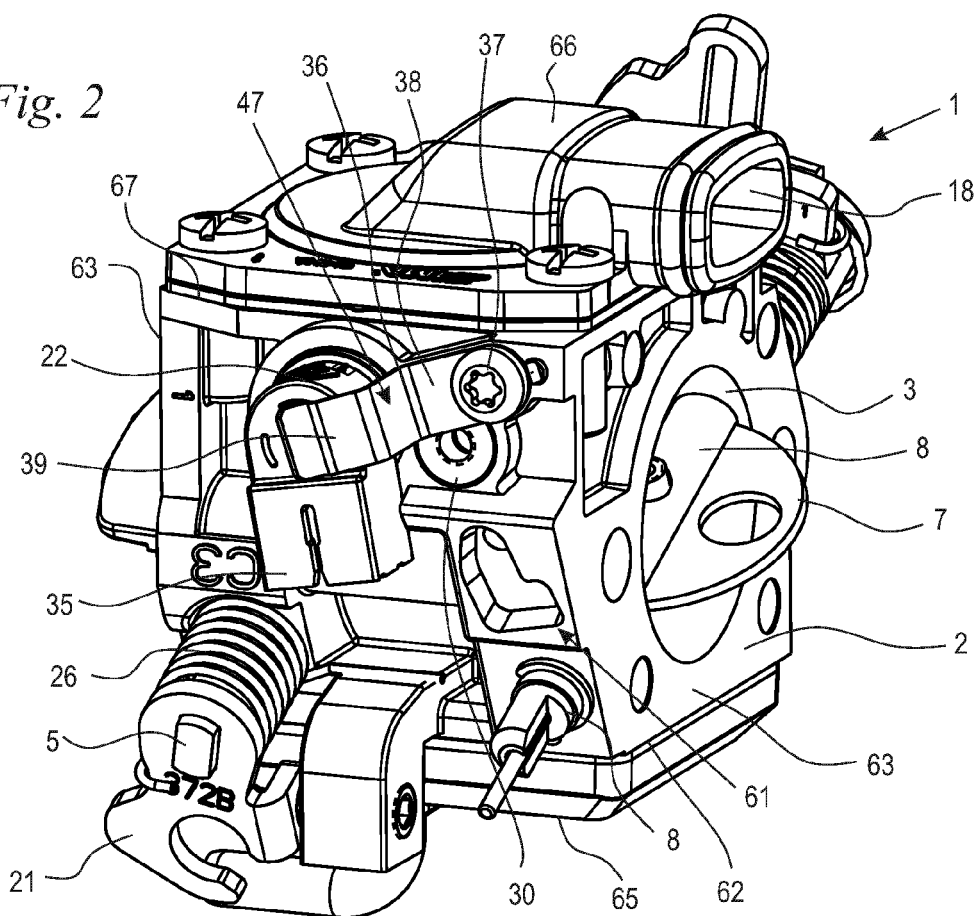


Fig. 3

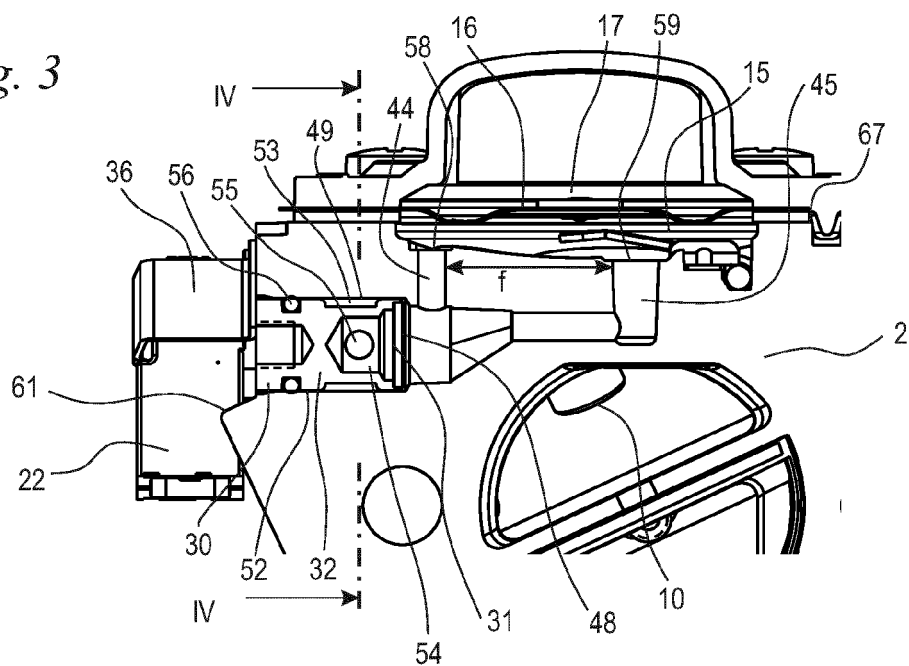


Fig. 4

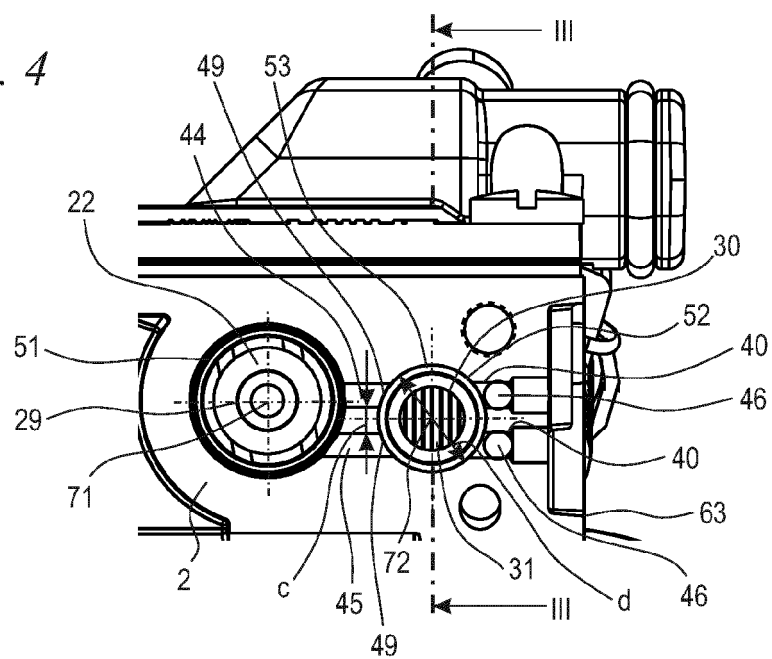
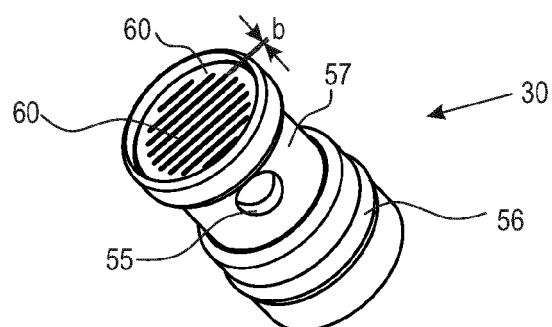


Fig. 5





EUROPEAN SEARCH REPORT

Application Number

EP 22 17 0420

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EPO FORM 1503 03.82 (P04C01)

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			F02M
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 13 October 2022	Examiner Godrie, Pierre
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	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 17 0420

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13-10-2022

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REFERENCES CITED IN THE DESCRIPTION

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