



## Description

**[0001]** The invention relates to a roller tappet arrangement to transmit a driving force from a driving camshaft to a high pressure generating device of a high pressure fuel pump. Further, the invention relates to an arrangement of a high pressure fuel pump to pressurize a fuel in a fuel injection system of a combustion engine and an engine block of a combustion engine. Moreover, the invention relates to an engine box of the combustion engine comprising this arrangement.

**[0002]** The lubrication of a roller tappet arrangement can be quite complex, in particular if the roller tappet arrangement is a part of a so-called plug-in-pump which does not have its own housing, but is directly inserted into a receiving bore of an engine block, such that the engine block forms the housing of the pump.

**[0003]** It is for example known to use a separate lubrication jet line in the engine to get a lubricant to the area of the roller tappet arrangement. In some cases this separate and therefore complete new lubrication circuit is mounted in the engine in a specific direction. Alternatively to provide a less complex lubrication for the roller tappet arrangement of a high pressure fuel pump it is also known to lubricate the roller tappet arrangement by splash oil which is present in a driveshaft chamber where a driving camshaft is arranged which drives the roller tappet arrangement. With such a solution no constant lubrication of the roller tappet arrangement can be attained.

**[0004]** Therefore, currently there are lubrication solutions for the roller tappet arrangement known which are either very complex to manufacture or have the danger to not provide enough lubricant to the roller tappet arrangement such that a wear over time can occur. In any way the lubrication of in particular an inside of the roller tappet arrangement is difficult to realize.

**[0005]** Object of the invention is to provide an improved lubrication solution for a roller tappet arrangement of a high pressure fuel pump.

**[0006]** This object is attained with a roller tappet arrangement with the features of independent claim 1.

**[0007]** An arrangement of a high pressure fuel pump and an engine block of a combustion engine comprising this roller tappet arrangement as well as an engine box of the combustion engine comprising this arrangement are subject-matter of the further independent claims.

**[0008]** Preferred embodiments of the invention are subject-matter of the dependent claims.

**[0009]** A roller tappet arrangement to transmit a driving force from a driving camshaft to a high pressure generating device of a high pressure fuel pump comprises a roller tappet body to be moved along a moving axis in a receiving bore to receive the roller tappet body. The roller tappet body has a tappet wall surrounding a receptacle for a roller. Further, the arrangement comprises a roller being arranged in the receptacle to rollingly contact the driving camshaft and a guide pin extending through the tappet wall into the receptacle to guide the roller tappet

body in a defined orientation on the camshaft. The guide pin comprises a lubrication bore to guide a lubricant into the receptacle.

**[0010]** Usually in high pressure fuel pumps having a roller tappet arrangement a guide pin is plugged into a housing surrounding the roller tappet arrangement, e.g. the engine block of a combustion engine, to provide a preferred correct orientation of the roller tappet body on a surface of the camshaft.

**[0011]** In an optimized solution of the roller tappet arrangement the guide pin now has two functions, first to provide the correct orientation of the roller tappet body on the camshaft, and second to provide a built-in-lubrication circuit which results in a correct lubrication inside the roller tappet body. Therefore, a separate lubrication jet line which was provided in previous solutions can be avoided. Hence, the lubrication of the roller tappet body is less complex. Moreover, even with the less complex arrangement of the lubrication of the roller tappet body a more correct lubrication of elements of the roller tappet body can be attained compared to the lubrication of splash oil as the lubricant is guided in a directive manner into the inside, namely the receptacle, of the roller tappet body.

**[0012]** In order to provide an easy manufacture of the guide pin and also an easy assembly of the overall roller tappet arrangement the lubrication bore in the guide pin has the same length as the guide pin and therefore runs preferably from a first end of the guide pin to a second end of the guide pin.

**[0013]** In particular the lubrication of the elements in the receptacle of the roller tappet arrangement is critical. The lubrication of the outer surface of the roller tappet body, which is in direct contact with the receiving bore via a clearance is - as in the solutions before - provided by splash oil crawling up the clearance from the camshaft chamber. This splash oil lubricant is sufficient to lubricate the outer surface of the roller tappet body during its movement.

**[0014]** In a preferred embodiment, the guide pin is arranged in the tappet wall such that a jet of the lubricant escaping the lubrication bore into the receptacle can strike a holding area where the roller is held in the roller tappet body. Alternatively or additionally the guide pin can also be arranged in the tappet wall such that the jet of the lubricant can strike a roller surface of the roller. Alternatively or additionally the guide pin can also be arranged such that the jet of the lubricant can strike a contact area where a roller is in contact with the driving camshaft.

**[0015]** Therefore, due to the special arrangement of the guide pin in the tappet wall it is possible to lubricate different locations of the roller tappet body in a correct manner.

**[0016]** In a preferred embodiment a longitudinal axis of the guide pin is arranged perpendicular to the moving axis of the roller tappet body. With such an exemplary arrangement of the guide pin in particular a roller surface

of the roller which is arranged in the receptacle of the roller tappet body can be attained. Due to the rotational movement of the roller during the use of the roller tappet arrangement the lubricant can preferably be distributed over the whole roller surface and also in the whole volume of the receptacle. Therefore, the arrangement of a single guide pin having the lubrication bore is sufficient to provide overall lubrication of the elements arranged in the area of the roller tappet body receptacle.

**[0017]** In a preferred embodiment the longitudinal axis of the guide pin is arranged in an angle of between 10° to 85° to the moving axis of the roller tappet body. Hence, the guide pin is arranged in an inclined manner in the tappet wall and is preferably directed to the contact area where the roller is in contact with the driving camshaft. With such an arrangement it is possible to more efficiently lubricate the contact area between the roller surface and the surface of the driving camshaft. Also in this arrangement due to the rolling movement of the roller lubricant is distributed in the receptacle to lubricate also other elements being arranged in the receptacle of the roller tappet body.

**[0018]** In a preferred embodiment the lubrication bore comprises at least two branches exiting the guide pin into the receptacle. Preferably these two branches are arranged with an angle to each other such that they are directed into different directions in the receptacle. E.g. a first branch exits the guide pin such that the lubricant can strike the contact area of the roller surface and the surface of the camshaft. E.g. a second branch exits the guide pin such that the lubricant can strike only the roller surface. It is also possible to provide a branch which exits the guide pin such that the lubricant can strike a holding area where the roller is held in the roller tappet body. It is also possible to provide three branches, each of which is directed to any of the three above mentioned directions. Moreover it is possible to provide a plurality of branches such that in a cross sectional view of the guide pin a central opening is surrounded by a plurality of openings e.g. four openings. Therefore, with the easy manufacturing method of providing a plurality of branches a complex lubrication system of the elements of the receptacle can be provided.

**[0019]** In a preferred embodiment the tappet wall comprises a slot to engage with a receptacle end portion of the guide pin, the slot extending parallel to the moving axis of the roller tappet body. Hence, with this slot the roller tappet body is guided during its movement along the moving axis by the receptacle end portion of the guide pin.

**[0020]** In a preferred embodiment the lubrication bore is arranged to be connected to an engine lubrication circuit of a combustion engine. Therefore, an own lubrication circuit to lubricate only the roller tappet arrangement can be avoided and a synergistic effect can be attained.

**[0021]** In an arrangement of a high pressure fuel pump to pressurize fuel in a fuel injection system of a combustion engine and an engine block of the combustion en-

gine, the high pressure fuel pump is formed as a plug-in-pump and comprises the roller tappet arrangement as described above. The engine block comprises a receiving bore to receive the high pressure fuel pump with its roller tappet arrangement and comprises further a pin bore connecting an outside area of the engine block with the receiving bore, wherein the guide pin is secured in the pin bore via a screw-fit-connection or via a press-fit-connection. A plug-in-pump arrangement has the advantage that an own housing of the pump can be omitted making the pump more light-weight and smaller which are desirable characteristics if the space to insert a high pressure fuel pump into a combustion engine is limited. With a plug-in-pump an engine block provides a housing for the plug-in-pump by comprising a receiving bore into which the plug-in-pump is inserted. Therefore, the roller tappet arrangement is moving in this receiving bore. In this arrangement it is possible to provide as driving camshaft a camshaft of the combustion engine such that the plug-in-pump does not need its own driving camshaft. This also is advantageous as it is more space saving. To provide the correct orientation of the roller tappet body on the surface of the camshaft the guide pin is provided which is arranged in the engine block in a specially adapted pin bore. This pin bore is extending from the receiving bore where the plug-in-pump is inserted into to the outside area of the engine block such that it is possible to insert the guide pin after installment of the plug-in-pump in the receiving bore. To have a secure hold of the guide pin in the pin bore a screw-fit-connection or a press-fit-connection can be used.

**[0022]** In a preferred embodiment of the arrangement of the high pressure fuel pump and the combustion engine the guide pin is extending from the receiving bore into the pin bore wherein a separate plug device is extending from the outside area into the pin bore to seal the pin bore. In this preferred embodiment the plug device and the guide pin are arranged in a distance to each other to provide an orifice area for a connection with an engine lubrication circuit of the combustion engine. Due to this orifice area there is a complete design freedom to provide an opening in a wall of the pin wall where a connection to the engine lubrication circuit can be provided.

**[0023]** In an alternative embodiment the guide pin is extending from the receiving bore to the outside area and integrally comprises a plug device and a connection nipple to be connected with an engine lubrication circuit of the combustion engine. In this preferred embodiment the lubrication bore extends from the receiving bore to the outside area through the plug device and the connection nipple. Therefore, the connection with the engine lubrication circuit can be provided outside the engine block which can be easier to provide.

**[0024]** In a preferred embodiment the lubrication bore forms the only lubrication path in the engine block to guide a lubricant into the receiving bore. Therefore, additional lubricant pathes in the engine block can be avoided which makes the arrangement more easier to manufacture.

**[0025]** An engine box of a combustion engine comprises an arrangement of a high pressure fuel pump and an engine block as described above and a driving camshaft, wherein the camshaft is in permanent contact with the roller of the roller tappet arrangement to drive the roller tappet body along the moving axis. The camshaft can e. g. be a camshaft or a crankshaft of the combustion engine.

**[0026]** Preferred embodiments of the invention are described in the following with respect to the accompanying drawings, where

- Fig. 1 shows a longitudinal sectional view of an arrangement of a high pressure fuel pump and an engine block of a combustion engine, the high pressure fuel pump comprising a roller tappet arrangement;
- Fig. 2 shows a detailed longitudinal sectional view of Fig. 1 in the area of the roller tappet arrangement in a first embodiment;
- Fig. 3 shows a detailed longitudinal sectional view of Fig. 1 in the area of the roller tappet arrangement in a second embodiment;
- Fig. 4 shows a detailed view of Fig. 3 in an area where a guide pin and a plug device are provided in a pin bore in an engine block;
- Fig. 5 shows a detailed longitudinal sectional view of Fig. 1 in the area of the roller tappet arrangement in a third embodiment;
- Fig. 6 shows a detailed longitudinal sectional view of Fig. 1 in the area of the roller tappet arrangement in a fourth embodiment; and
- Fig. 7 shows a cross sectional view of a preferred embodiment of a guide pin shown in Fig. 1 to Fig. 6.

**[0027]** Fig. 1 shows a longitudinal sectional view of an arrangement 10 of a high pressure fuel pump 12 which is arranged in an engine block 14 of a combustion engine. The engine block 14 with the high pressure fuel pump 12 is arranged in an engine box 16 of the combustion engine, where also a camshaft 18 is located which can drive the high pressure fuel pump 12.

**[0028]** The high pressure fuel pump 12 does not comprise an own housing, but is arranged in a receiving bore 20 in the engine block 14 and is therefore constituted as a plug-in pump 22.

**[0029]** The high pressure fuel pump 12 comprises a high pressure generating device 24 with a pressurizing room 26 and a piston 28 which carries out a translational movement to minimize the volume of the pressurizing room 26 and thereby pressurize a fuel 30 with which the pressurizing room 26 is filled.

**[0030]** To move the piston 28 a roller tappet arrangement 32 is in contact with a cam area 34 of the camshaft 18 and due to this contact during a rotational movement of the camshaft 18 around a camshaft axis 36 the roller tappet arrangement 32 moves in the receiving bore 20 along a moving axis 38.

**[0031]** Via a spring 40 which biases the piston 38 onto the roller tappet arrangement 32 the piston 28 is in permanent contact with the roller tappet arrangement 32 and also moves along the moving axis 38. Hence, the roller tappet arrangement 32 transfers a driving force from the cam area 34 onto the piston 28.

**[0032]** To hold the roller tappet arrangement 32 in a correct orientation relative to the cam area 34 a guide pin 42 is provided which extends through a pin bore 44 in the engine block 14 from an outside area 46 to the receiving bore 20.

**[0033]** The roller tappet arrangement 32 and the guide pin 42 are described in greater detail in the following.

**[0034]** Fig. 2 shows a longitudinal sectional view of the roller tappet arrangement 32 and the guide pin 42 of Fig. 1 in a first embodiment.

**[0035]** The roller tappet arrangement 32 comprises a roller tappet body 48 which is located in the receiving bore 20 of the engine block 14 and is moving with a tappet wall 50 along receiving bore walls 52 of the receiving bore 20. The tappet wall 50 forms a hollow space which constitutes a receptacle 54 in which a roller 56 is provided. This roller 56 is in direct contact with a camshaft surface 58. The guide pin 42 extends through the tappet wall 50 into the receptacle 54 and comprises a lubrication bore 60 in its inside through which a lubricant 62 can be guided into the receptacle 54.

**[0036]** In the embodiment in Fig. 2 the guide pin 42 is arranged in the tappet wall 50 and the engine block 14 such that a longitudinal axis 64 of the guide pin 42 is arranged perpendicular to the moving axis 38 of the roller tappet arrangement 32. Therefore, the lubricant 62 escaping the lubrication bore 60 strikes a roller surface 66 of the roller 56.

**[0037]** In Fig. 2 the guide pin 42 extending from the receiving bore 20 to the outside area 46 integrally comprises a plug device 68 and a connection nipple 70. Via the plug device 68 the guide pin 42 is secured in the pin bore 44 and via the connection nipple 70 the lubrication bore 60 can be connected with a lubrication circuit 72 of the engine. The lubrication bore 60 extends fully through the guide pin 52, therefore also through the plug device 68 and the connection nipple 70 to the outside area 46.

**[0038]** In the embodiment shown in Fig. 2 the guide pin 42 is secured in the pin bore 44 via a press-fit connection 74.

**[0039]** Fig. 3 shows a longitudinal sectional view of a second embodiment of the roller tappet arrangement 32 and guide pin 42 in the engine block 14 of Fig. 1. In this embodiment the guide pin 42 is also arranged such that its longitudinal axis 64 is arranged perpendicular to the moving axis 38, but different to the embodiment shown in Fig. 2, the guide pin 42 is extending from the receiving bore 20 into the pin bore 44 but does not fully extend through the pin bore 44. The plug device 68 is a separate device which is extending from the outside area 46 into the pin bore 44. Inside the pin bore 44 the guide pin 42 and the plug device 68 are arranged in a distance 76 to

each other such that an orifice area 78 is provided.

**[0040]** As can be seen in Fig. 3 the plug device 68 is secured in the pin bore 44 via screw-fit connection 81.

**[0041]** Fig. 4 shows an enlarged view of the region around the orifice area 78 of Fig. 3. Here it can be seen that an orifice 80 of the lubrication circuit 72 of the engine opens into the orifice area 78 between the guide pin 42 and the plug device 68. Thereby, the orifice area 78 and also the lubrication bore 60 in the guide pin 42 are connected to the lubrication circuit 72.

**[0042]** Fig. 5 shows a longitudinal sectional view of a third embodiment of the roller tappet arrangement 32 and guide pin 42. The guide pin 42 - formed similar to the guide pin 42 of Fig. 2 with an integrally formed plug device 68 and connection nipple 70 - is arranged such that its longitudinal axis 64 is arranged in an angle  $\alpha$  relative to the moving axis 38. The angle alpha  $\alpha$  lies in the region of  $10^\circ$  to  $85^\circ$ . Depending on this angle  $\alpha$  the lubricant 62 escaping the lubrication bore 60 can strike either a contact area 82 where the roller 56 is in contact with the camshaft 18 or a holding area 84 where the roller 56 is held in the roller tappet body 48.

**[0043]** Fig. 6 shows a further possible embodiment of the guide pin 42 in a longitudinal sectional view. Here, the guide pin 42 is formed similar to the guide pin 42 shown in Fig. 2 with an integrally formed plug device 68 and connection nipple 70 and is also arranged such that the longitudinal axis 64 is perpendicular to the moving axis 38. Different to the previous embodiments the guide pin 42 shown in Fig. 6 comprises the lubrication bore 60 with three branches 86, all branches 86 exiting the guide pin 42 in a different direction. The result is that the lubricant 62 in the lubrication bore 60 partly escapes the lubrication bore 60 directed to the holding area 64, partly directed to the roller surface 66, and partly directed to the contact area 82.

**[0044]** Fig. 7 shows a cross sectional view of the guide pin 42 of Fig. 6 with the branches 86 in Fig. 6 shown in closed lines and additional branches which could be provided optionally shown in dotted lines.

**[0045]** All described embodiments of the guide pin 42 - formed integrally with the plug device 68 and connection nipple 70 or formed separately from the plug device 68 with an orifice area 78 in between - , the arrangement of the longitudinal axis 64 of the guide pin 42 relative to the moving axis 38 as well as the method to secure the plug device 68 and the guide pin 42 in the pin bore 44 - screw-fit connection 81 or press-fit connection 74 - can be exchanged if a different design is demanded.

**[0046]** In order to enable the roller tappet body 48 to move in the receiving bore 20 the guide pin 42 is received in the tappet wall 50 with a receptacle end portion 88 in a slot 90 which is provided in a tappet wall 50 and extends parallel to the moving axis 38.

**[0047]** In summary a guide pin 42 is provided which guides the roller tappet body 48 over the camshaft 18 and which comprises an integrated built-in lubrication bore 60 to ensure a double function of guiding and lubri-

cating without any additional lubrication circuit. Therefore, the lubrication bore 60 in the guide pin 42 is the only lubrication path in the engine block 14 which guides a lubricant 62 into the receiving bore 20. The guide pin 42 along with the lubrication bore 60 can be either horizontal or at an angle  $\alpha$  depending on the direction of lubrication which is necessary as for example shown in Fig. 3 and Fig. 5. The guide pin 42 can have either a screw-fit connection 81 or a press-fit connection 74 depending on the complexity of the engine configuration. The lubrication bore 60 in the guide pin 42 can have multiple outlets provided by different branches 86 depending on various locations where a lubrication is intended as for example shown in Fig. 6.

**[0048]** The advantages of the provided roller tappet arrangement 32 is that a single assembly is possible which integrates the guide pin 42 and the lubrication together for the roller tappet body 48. All connections can be within the guide pin 42 or the guide pin 42 can be connected externally with a pipe as for example shown in Fig. 2, Fig. 5 or Fig. 6. All in all a lower assembly time can be attained which leads to a cheaper system than conventional jet systems.

#### 25 Reference list

#### [0049]

- 10 arrangement
- 30 12 high pressure fuel pump
- 14 engine block
- 16 engine box
- 18 camshaft
- 20 receiving bore
- 35 22 plug-in pump
- 24 high pressure generating device
- 26 pressurizing room
- 28 piston
- 30 fuel
- 40 32 roller tappet arrangement
- 34 cam area
- 36 camshaft axis
- 38 moving axis
- 40 spring
- 45 42 guide pin
- 44 pin bore
- 46 outside area
- 48 roller tappet body
- 50 tappet wall
- 50 52 receiving bore wall
- 54 receptacle
- 56 roller
- 58 camshaft surface
- 60 lubrication bore
- 55 62 lubricant
- 64 longitudinal axis
- 66 roller surface
- 68 plug device

70	connection nipple
72	lubrication circuit
74	press-fit connection
76	distance
78	orifice area
80	orifice
81	screw-fit connection
82	contact area
84	holding area
86	branch
88	receptacle end portion
90	slot
$\alpha$	angle between moving axis and longitudinal axis

## Claims

1. Roller tappet arrangement (32) to transmit a driving force from a driving camshaft (18) to a high pressure generating device (24) of a high pressure fuel pump (12), the roller tappet arrangement (32) comprising:

- a roller tappet body (48) to be moved along a moving axis (38) in a receiving bore (20) to receive the roller tappet body (48), the roller tappet body (48) having a tappet wall (50) surrounding a receptacle (54) for a roller (56);
- a roller (56) being arranged in the receptacle (54) to rollingly contact the driving camshaft (18);
- a guide pin (42) extending through the tappet wall (50) into the receptacle (54) to guide the roller tappet body (48) in a defined orientation on the camshaft (18);

wherein the guide pin (42) comprises a lubrication bore (60) to guide a lubricant (62) into the receptacle (54).

2. Roller tappet arrangement (32) according to claim 1, **characterized in that** the guide pin (42) is arranged in the tappet wall (50) such that a jet of the lubricant (62) escaping the lubrication bore (60) into the receptacle (54) can strike:

- a holding area (84) where the roller (56) is held in the roller tappet body (48) and/or
- a roller surface (66) and/or
- a contact area (82) where the roller (56) is in contact with the driving camshaft (18).

3. Roller tappet arrangement (32) according to one of the claims 1 or 2, **characterized in that** a longitudinal axis (64) of the guide pin (42) is arranged perpendicular to the moving axis (38) of the roller tappet body (48).

4. Roller tappet arrangement (32) according to one of the claims 1 or 2,

**characterized in that** a longitudinal axis (64) of the guide pin (42) is arranged in an angle ( $\alpha$ ) of between 10° to 85° to the moving axis (38) of the roller tappet body (48).

5. Roller tappet arrangement (32) according to one of the claims 1 to 4,

**characterized in that** the lubrication bore (60) comprises at least two branches (86) exiting the guide pin (42) into the receptacle (54).

6. Roller tappet arrangement (32) according to one of the claims 1 to 5,

**characterized in that** the tappet wall (50) comprises a slot (90) to engage with a receptacle end portion (88) of the guide pin (42), the slot (90) extending parallel to the moving axis (38) of the roller tappet body (48).

7. Roller tappet arrangement (32) according to one of the claims 1 to 6,

**characterized in that** the lubrication bore (60) is arranged to be connected to an engine lubrication circuit (72) of a combustion engine.

8. Arrangement (10) of a high pressure fuel pump (12) to pressurize a fuel (30) in a fuel injection system of a combustion engine and an engine block (14) of the combustion engine, the high pressure fuel pump (12) being formed as a plug-in pump (22) and comprising a roller tappet arrangement (32) according to one of the claims 1 to 7, the engine block (14) comprising a receiving bore (20) to receive the high pressure fuel pump (12) with its roller tappet arrangement (32) and a pin bore (44) connecting an outside area (46) of the engine block (14) with the receiving bore (20), wherein the guide pin (42) is secured in the pin bore (44) via a screw-fit connection (81) or via a press-fit connection (74).

9. Arrangement (10) according to claim 8, **characterized in that** the guide pin (42) is extending from the receiving bore (20) into the pin bore (44), wherein a separate plug device (68) is extending from the outside area (46) into the pin bore (44) to seal the pin bore (44), wherein the plug device (68) and the guide pin (42) are arranged in a distance (76) to each other to provide an orifice area (78) for a connection with an engine lubrication circuit (72) of the combustion engine.

10. Arrangement (10) according to claim 8, **characterized in that** the guide pin (42) is extending from the receiving bore (20) to the outside area (46) and integrally comprises a plug device (68) and a connection nipple (70) to be connected with an engine lubrication circuit (72) of the combustion engine, the lubrication bore (60) extending from the receiving

bore (20) to the outside area (46) through the plug device (68) and the connection nipple (70).

11. Arrangement (10) according to one of the claims 8 to 10, 5  
**characterized in that** the lubrication bore (60) forming the only lubrication path in the engine block (14) to guide a lubricant (62) into the receiving bore (20).
12. Engine box (16) of a combustion engine, comprising 10  
an arrangement (10) according to one of the claims 8 to 11 and a driving camshaft (18), the camshaft (18) being in permanent contact with the roller (56) of the roller tappet arrangement (32) to drive the roller tappet body (48) along the moving axis (38). 15

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FIG 1

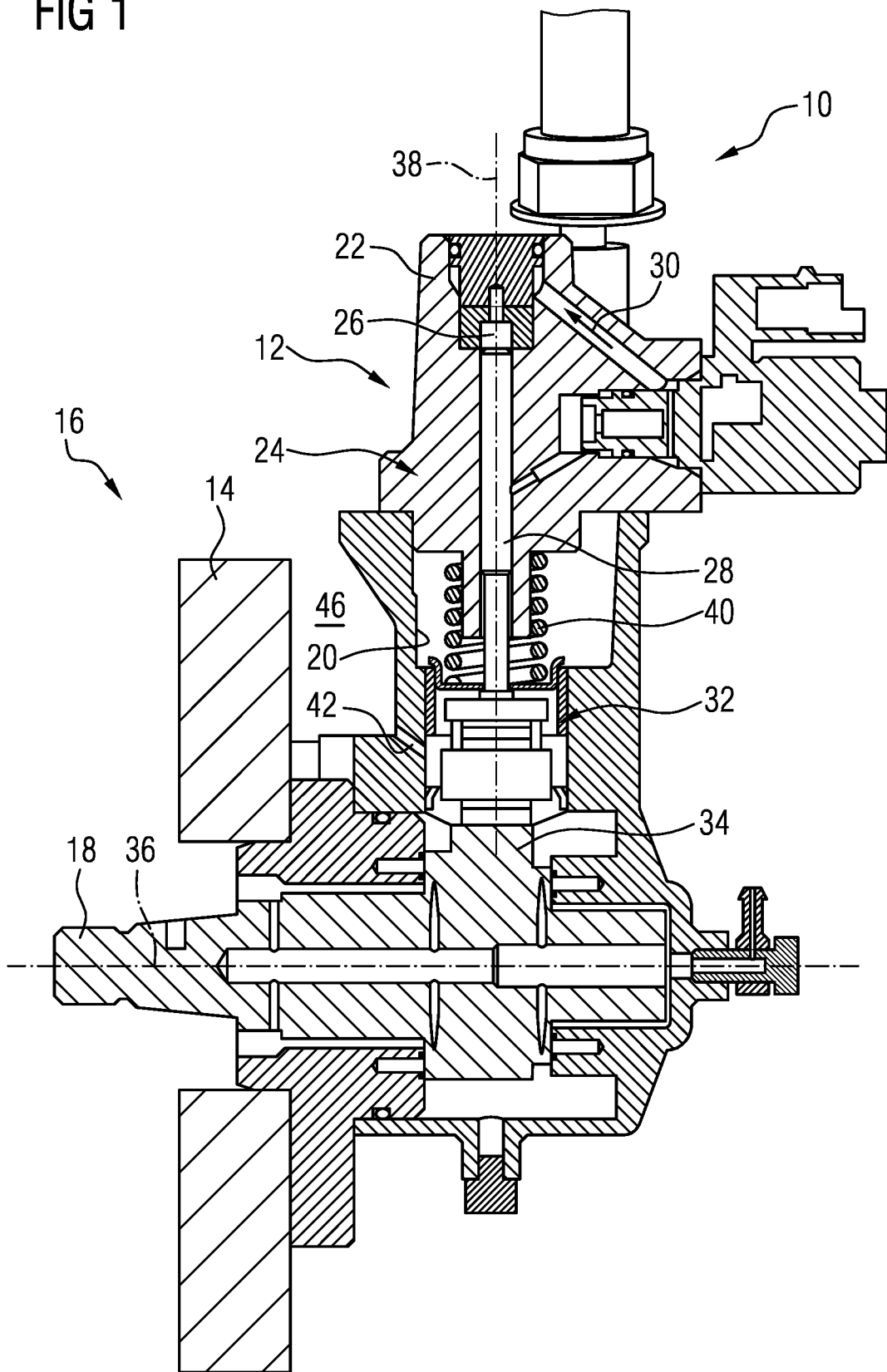


FIG 2

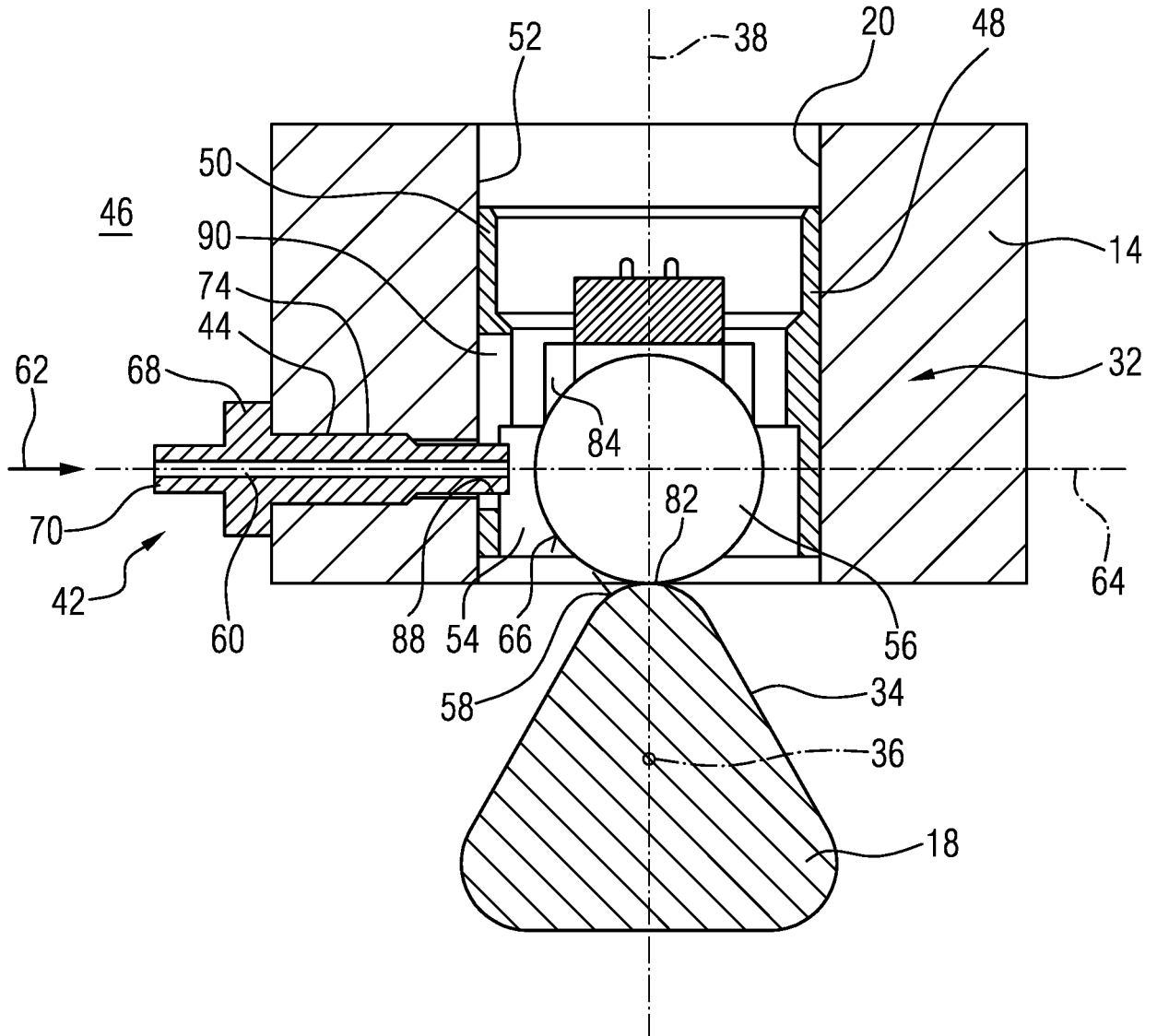


FIG 3

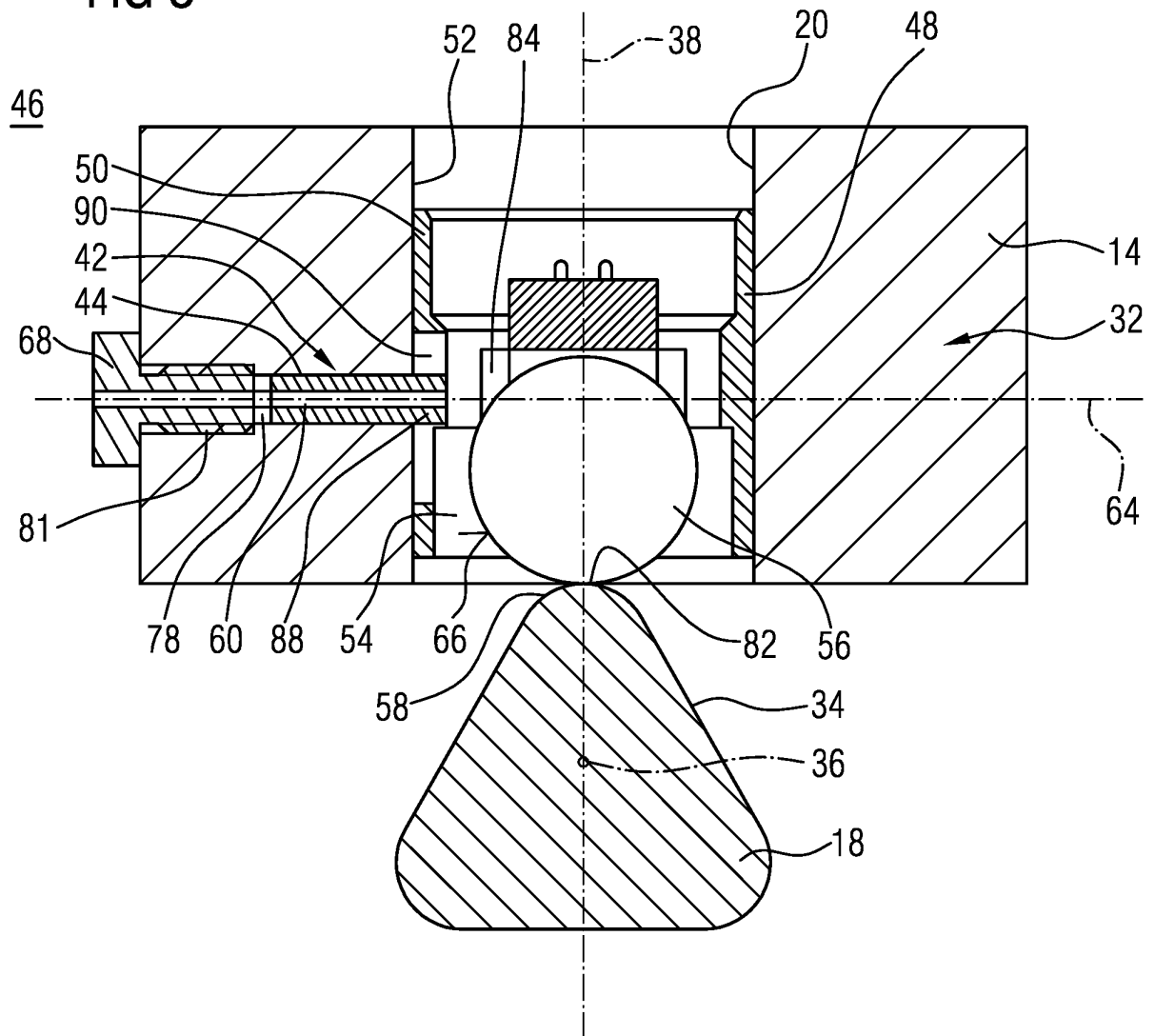


FIG 4

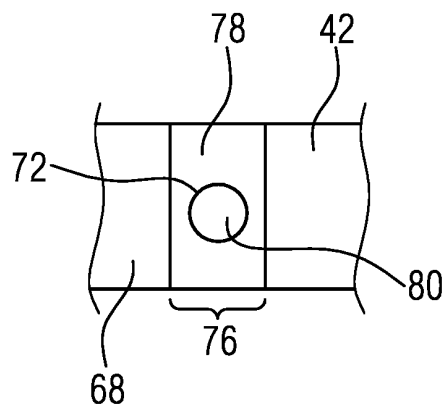


FIG 5

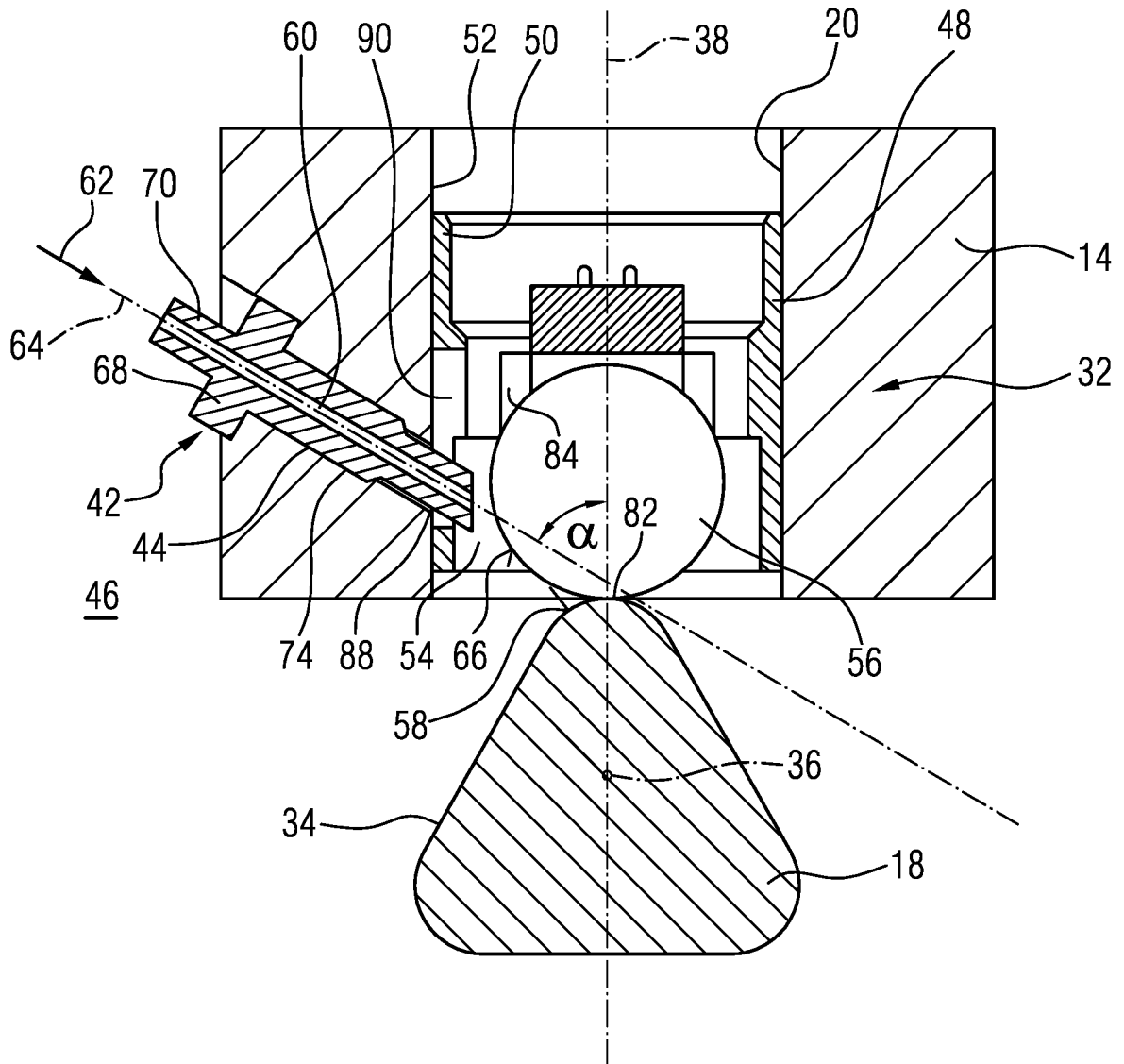
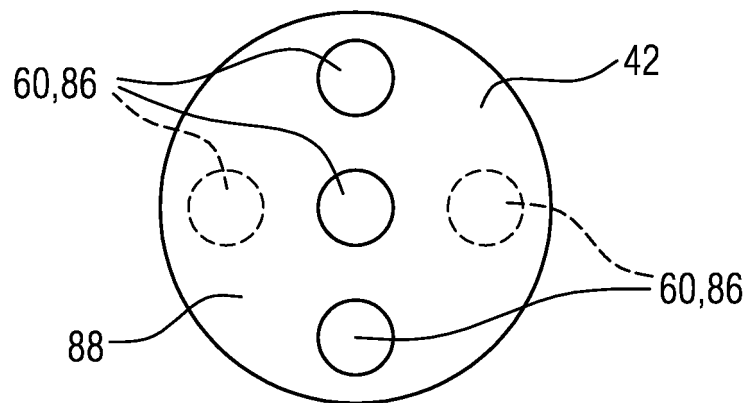




FIG 7





EUROPEAN SEARCH REPORT

Application Number  
EP 14 19 7522

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* abstract; figures 1,2 * * page 7 *	8,11,12	
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A	* abstract; figures 2,3 * * column 4, line 9 - line 23 * * page 6, line 12 - line 33 * * claim 1 *		
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 20 April 2015	Examiner Barunovic, Robert
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ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 14 19 7522

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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20-04-2015

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