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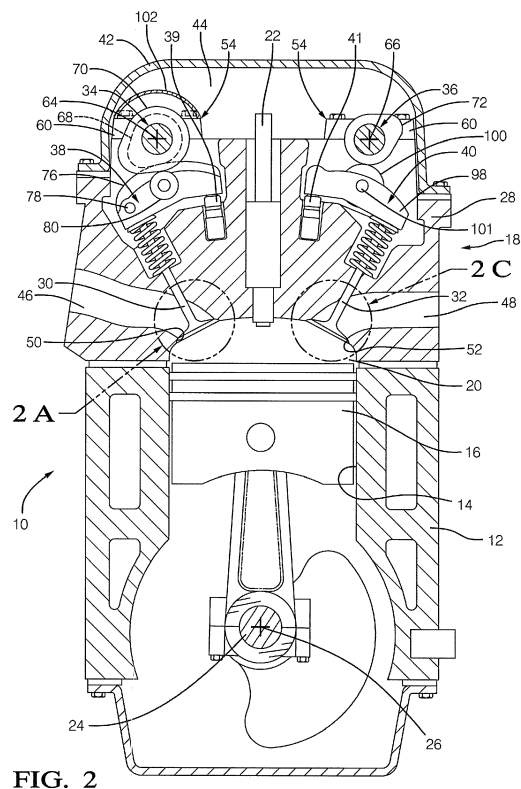
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Cylinder head assembly with oil reflector for lubrication of a rocker arm

(57)

A cylinder head assembly includes a cylinder head defining a port for selectively communicating air to a combustion chamber of an engine or for selectively discharging exhaust gases from the combustion chamber. The cylinder head also defines a valve seat between the port and the combustion chamber. A combustion valve is mounted in the cylinder head and is selectively seated and unseated with the valve seat. A camshaft with a lobe is mounted in the cylinder head. A rocker arm is engaged with the combustion valve and has a follower for following the lobe. An oil spray source provides a spray of oil while an oil reflector is configured to receive the spray of oil and direct the spray of oil to the follower to provide lubrication between the interface of the follower and the lobe.



Description

TECHNICAL FIELD

[0001] The present invention relates to an internal combustion engine with a rocker arm for transmitting opening and closing motion from a camshaft to a combustion valve; more particularly to such an internal combustion engine with a rocker arm which is switchable between a high lift mode and a low lift mode; and even more particularly to such an internal combustion engine which includes an oil reflector for receiving a spray of oil and directing the spray of oil to a follower of the rocker arm.

BACKGROUND OF INVENTION

[0002] It is known in art of internal combustion engines to provide variable valve actuation devices which are switchable between a low lift mode and high lift mode, thereby opening a combustion valve, for example an intake valve, to a low lift and a high lift respectively. One such variable valve actuation device is disclosed in United States Patent Application Publication No. US 2009/0078225 to Hendriksma, hereinafter referred to as Hendriksma. Hendriksma teaches a rocker arm with a rocker arm body within which is mounted a center high lift follower which is selectively allowed to pivot relative to the rocker arm body. A pair of low lift followers are mounted to the rocker arm body and flank the high lift follower. The high lift follower follows a high lift lobe of a camshaft to selectively transmit high valve lifting motion to a combustion valve while the low lift followers follow respective low lift lobes of the camshaft to selectively transmit low valve lifting motion to the combustion valve.

[0003] A latching mechanism is provided to selectively allow the high lift follower to pivot relative to the rocker arm body and to selectively prevent the high lift follower from pivoting relative to the rocker arm body. In order to position the latching mechanism to prevent the high lift follower from pivoting relative to the rocker arm body, thereby allowing high valve lifting motion to be transmitted to the combustion valve from the high lift lobe, pressurized oil is supplied to the latching mechanism. The pressurized oil urges a lock pin into engagement with the high lift follower. A spray hole is provided in the rocker arm body to allow some of the pressurized oil supplied to the latching mechanism to be sprayed onto the interface between the high lift follower and the high lift lobe, thereby lubricating the interface between the high lift follower and the high lift lobe.

[0004] Conversely, in order to position the latching mechanism to allow the high lift follower to pivot relative to the rocker arm body, thereby allowing low valve lifting motion to be transmitted to the combustion valve from the low lift lobes, oil is drained from the latching mechanism and a latch spring pushes the lock pin out of engagement with the high lift follower. Consequently, the high lift lobe causes the high lift follower to pivot cyclically

within the rocker arm body. Since pressurized oil is not being supplied to the latching mechanism, oil is not sprayed onto interface between the high lift follower and the high lift lobe which may be acceptable in the low lift mode because the load between the high lift lobe and the high lift follower is relatively low.

[0005] The rocker arm of Hendriksma is considered to be a default low lift two-step rocker arm because the rocker arm is placed in the low lift mode when no pressurized oil is supplied to the latching mechanism. It is known to provide a two-step rocker arm similar to the rocker arm of Hendriksma with the exception of modifying the latching mechanism to place the rocker arm in the high lift mode when pressurized oil is not supplied to the latching mechanism, thereby resulting in a default high lift two-step rocker arm. Such a modified latching mechanism is disclosed in Fig. 2 of United States Patent No. 7,761,217 to Waters et al., hereinafter referred to as Waters. However, since pressurized oil is not used to place the latching mechanism in the high lift mode, pressurized oil is not available from the latching mechanism to lubricate the interface between the high lift lobe and the high lift follower. Consequently, an oil spray bar may be provided exclusively for lubricating the interface between the high lift lobe and the high lift follower. The addition of an oil spray bar exclusively for lubricating the interface between the high lift lobe and the high lift follower may add cost and complexity and may require an oil pump of increased capacity which may lead to decreased fuel efficiency of the internal combustion engine.

[0006] What is needed is an internal combustion engine which minimizes or eliminates one or more of the shortcomings as set forth above.

SUMMARY OF THE INVENTION

[0007] A cylinder head assembly for an internal combustion engine comprises a piston reciprocable within a cylinder, a crankshaft rotated by the piston, and a combustion chamber defined between the cylinder head assembly and the piston. The cylinder head assembly allows air into the combustion chamber and allows exhaust gases out of the combustion chamber. Furthermore the cylinder head assembly comprises a cylinder head defining a port for selectively communicating the air to the combustion chamber or for selectively discharging the exhaust gases from the combustion chamber. The cylinder head also defines a valve seat between the port and the combustion chamber. Moreover the cylinder head assembly comprises a combustion valve mounted in the cylinder head and selectively seated and unseated with the valve seat. Further the cylinder head assembly comprises a camshaft mounted in the cylinder head, rotatable about a camshaft axis, and having a lobe. Besides the cylinder head assembly comprises a rocker arm engaged with the combustion valve and having a follower for following the lobe of the camshaft, whereby rotation of the camshaft about the camshaft axis causes the rock-

er arm to pivot thereby seating and unseating the combustion valve with the valve seat in a cyclic pattern. Moreover the cylinder head assembly comprises an oil spray source providing a spray of oil and an oil reflector configured to receive the spray of oil and direct the spray of oil to the follower to provide lubrication between the follower and the lobe.

[0008] In another embodiment, the cylinder head assembly for an internal combustion engine comprises a piston reciprocable within a cylinder, a crankshaft rotated by the piston, a combustion chamber defined between the cylinder head assembly and the piston. The cylinder head assembly allows air into the combustion chamber and also allows exhaust gases out of the combustion chamber. The cylinder head assembly includes a cylinder head defining a port for selectively communicating the air to the combustion chamber or for selectively discharging the exhaust gases from the combustion chamber. The cylinder head also defines a valve seat between the port and the combustion chamber. The cylinder head assembly comprises also a combustion valve which is mounted in the cylinder head and is selectively seated and unseated with the valve seat. Moreover the cylinder head assembly comprises a camshaft mounted in the cylinder head is rotatable about a camshaft axis and has a high lift lobe and a low lift lobe. Besides the cylinder head assembly comprises the rocker arm which is engaged with the combustion valve and has a high lift follower and a low lift follower. The rocker arm is switchable between 1) a high lift mode for receiving high lift valve opening and closing motion from the high lift lobe of the camshaft and 2) a low lift mode for receiving low lift opening and closing motion from the low lift lobe of the camshaft, whereby rotation of the camshaft about the camshaft axis causes the rocker arm to pivot, thereby seating and unseating the combustion valve with the valve seat in a cyclic pattern. Moreover the cylinder head assembly comprises an oil spray source providing a spray of oil and an oil reflector. The oil reflector is configured to receive the spray of oil and direct the spray of oil to one of the high lift follower and the low lift follower providing lubrication between the interface of the high lift follower and the high lift lobe or between the interface of the low lift follower and the low lift lobe. Furthermore the cylinder head assembly comprises a camshaft bearing defined by a first semicircular recess in the cylinder head and a second semicircular recess defined in a bearing cap. The bearing cap is fastened to the cylinder head and capturing the camshaft between the first semicircular recess and the second semicircular recess to define a journal bearing interface between the camshaft bearing and the camshaft. The camshaft bearing is the oil spray source. Further the cylinder head assembly further comprises an oil gallery defined within the cylinder head and in fluid communication with the camshaft bearing to supply oil to lubricate the journal bearing interface. The oil supplied to the camshaft bearing is discharged from the journal bearing interface to generate the spray of oil. The

oil reflector comprises a mounting portion for securing the oil reflector to the cylinder head assembly; and a directing portion extending from the mounting portion to receive and direct the spray of oil. The mounting portion and the bearing cap are secured to the cylinder head with a fastener such that the bearing cap is captured between the mounting portion and the cylinder head. The mounting portion is planar. The directing portion has a concave side and a convex side such that the concave side receives and directs the spray of oil. The directing portion can be substantially dome-shaped. The cylinder head assembly further comprises a cylinder head, a camshaft with a lobe mounted within a camshaft bearing, and a rocker arm with a follower for following the lobe, the camshaft and the camshaft bearing defining the journal bearing interface lubricated with pressurized oil from the oil gallery. The oil is discharged from the journal bearing interface to form the spray of oil. The cylinder head further comprises the oil reflector configured to receive the spray of oil and direct the spray of oil to the follower to provide lubrication between the follower and the lobe.

[0009] Further features and advantages of the invention will appear more clearly on a reading of the following detailed description of the preferred embodiment of the invention, which is given by way of non-limiting example only and with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0010] This invention will be further described with reference to the accompanying drawings in which:

Fig. 1 is a schematic drawing of an internal combustion engine in accordance with the invention;

Fig. 2 is an elevation cross-sectional view of the internal combustion engine of Fig. 1 taken through section line 2-2;

Fig. 2A is an enlarged view of an intake valve and an intake valve seat of Fig. 2 shown in the intake closed position;

Fig. 2B is an enlarged view of the intake valve and the intake valve seat of Fig. 2 shown in the intake open position;

Fig. 2C is an enlarged view of an exhaust valve and an exhaust valve seat of Fig. 2 shown in the exhaust closed position;

Fig. 2D is an enlarged view of the exhaust valve and the exhaust valve seat of Fig. 2 shown in the exhaust open position;

Fig. 3 is an elevation view of a camshaft bearing of the internal combustion engine in accordance with the invention;

Fig. 4 is a cross-sectional view of a rocker arm of the internal combustion engine in accordance with the invention;

Fig. 5 is an isometric view of an oil spray reflector of the internal combustion engine in accordance with the invention;

Fig. 6 is a cross-sectional view of the oil spray reflector of Fig. 5, now shown in conjunction with a portion of the internal combustion engine in accordance with the invention; and

Fig. 7 is an isometric view of an alternative oil spray reflector of the internal combustion engine in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] In accordance with a preferred embodiment of this invention and referring to Figs. 1 and 2, an internal combustion engine 10 with an engine block 12 is shown. As shown, internal combustion engine 10 is a multi-cylinder engine, however, for brevity, only one cylinder 14 defined by engine block 12 and the components and features relating to cylinder 14 will be described since cylinder 14 is substantially the same as the others. A piston 16 is reciprocable within cylinder 14 and a cylinder head assembly 18 is mounted to engine block 12 such that a combustion chamber 20 is defined between piston 16 and cylinder head assembly 18. A fuel injector 22 may be provided for injecting fuel directly into combustion chamber 20 for combustion of the fuel within combustion chamber 20 which causes piston 16 to reciprocate within combustion chamber 20. A lower end of piston 16 is attached to a crankshaft 24 which rotates about a crankshaft axis 26 as a result of reciprocation of piston 16 within combustion chamber 20. Cylinder head assembly 18 selectively allows air into combustion chamber 20 to support combustion of the fuel and selectively allows exhaust gases out of combustion chamber 20 that result from the combustion of the fuel. Alternatively, but not shown, fuel injector 22 may inject fuel upstream of combustion chamber 20 such that the fuel is introduced into combustion chamber 20 along with air that is supplied by cylinder head assembly 18. A spark plug (not shown) may be provided to initiate combustion of the fuel within combustion chamber 20. Internal combustion engine 10 may be an in-line four cylinder engine as shown; however, it should be understood that a greater or lesser number of cylinders may be included and other cylinder arrangements may be used, for example only, an internal combustion engine having banks of cylinders arranged at an angle to each other which are commonly known as "V" configurations.

[0012] Cylinder head assembly 18 generally includes a cylinder head 28 fastened to engine block 12; an intake valve 30 mounted within cylinder head 28; an exhaust valve 32 mounted within cylinder head 28; an intake camshaft 34 mounted within cylinder head 28; an exhaust camshaft 36 mounted within cylinder head 28; an intake rocker arm 38 engaged with intake camshaft 34 and intake valve 30 and pivotable about an intake lash adjuster 39; an exhaust rocker arm 40 engaged with exhaust camshaft 36 and exhaust valve 32 and pivotable about an exhaust lash adjuster 41; and a valve cover 42 defining a cylinder head assembly compartment 44 with cylinder

head 28 which encloses intake valve 30, exhaust valve 32, intake camshaft 34, exhaust camshaft 36, intake rocker arm 38, intake lash adjuster 39, exhaust rocker arm 40, and exhaust lash adjuster 41. Cylinder head assembly 18 will be described in greater detail in the paragraphs that follow. As illustrated, cylinder 14 includes respective pairs of exhaust valves 32, intake rocker arms 38, intake lash adjusters 39, exhaust rocker arms 40, and exhaust lash adjusters 41; however, it should be understood that each cylinder 14 may include different numbers of each depending on the design of internal combustion engine 10.

[0013] Cylinder head 28 defines an air intake port 46 for selectively communicating air to combustion chamber 20, an exhaust port 48 for selectively discharging exhaust gases from combustion chamber 20, an intake valve seat 50 between air intake port 46 and combustion chamber 20, and an exhaust valve seat 52 between exhaust port 48 and combustion chamber 20. Intake valve 30 is selectively seated (Fig. 2A) and unseated (Fig. 2B) in a cyclic pattern with intake valve seat 50 via input from intake camshaft 34 and intake rocker arm 38 as will be discussed in greater detail below. Similarly, exhaust valve 32 is selectively seated (Fig. 2C) and unseated (Fig. 2D) in a cyclic pattern with exhaust valve seat 52 via input from exhaust camshaft 36 and exhaust rocker arm 40 as will be discussed in greater detail below.

[0014] With continued reference to Figs. 1 and 2 and now with additional reference to Fig. 3, intake camshaft 34 and exhaust camshaft 36 are mounted within cylinder head 28 via a plurality of camshaft bearings 54 which are each defined by a first semicircular recess 56 defined within cylinder head 28 and a second semicircular recess 58 formed in a bearing cap 60 which is secured to cylinder head 28 with fasteners illustrated as bearing cap bolts 62 which pass through bearing cap 60 and threadably engage cylinder head 28 to clamp bearing cap 60 to cylinder head 28. In this way, intake camshaft 34 and exhaust camshaft 36 are captured between respective first semicircular recesses 56 and second semicircular recesses 58 such that intake camshaft 34 and exhaust camshaft 36 define journal bearing interfaces with respective camshaft bearings 54. In this way, intake camshaft 34 rotates about an intake camshaft axis 64 and exhaust camshaft 36 rotates about an exhaust camshaft axis 66 via input from crankshaft 24 through a drive member (not shown), which may be, for example only, a chain, belt, or gear arrangement.

[0015] Again with reference to Figs. 1 and 2, intake camshaft 34 includes a center high lift intake lobe 68 flanked by a pair of outer low lift intake lobes 70. High lift intake lobe 68 selectively transmits a high lift valve opening and closing motion to intake valve 30 through intake rocker arm 38 as will be described in greater detail later while low lift intake lobes 70 selectively transmit a low lift valve opening and closing motion to intake valve 30 through intake rocker arm 38 as will also be described in greater detail later. The high lift valve opening and closing

motion as used herein is meant to be a motion that will open intake valve 30 a greater magnitude from intake valve seat 50 than the low lift valve opening and closing motion.

[0016] Exhaust camshaft 36 includes an exhaust follower 72 which transmits valve opening and closing motion to exhaust valve 32 through exhaust rocker arm 40 as will be described in greater detail later.

[0017] With continued reference to Figs. 1 and 2 and now with additional reference to Fig. 4, intake rocker arm 38 includes an intake rocker arm body 74 within which is mounted a center high lift follower 76 which is selectively pivotable within intake rocker arm body 74 about a pivot shaft 78. High lift follower 76 follows high lift intake lobe 68 of intake camshaft 34 in a sliding interface. A pair of low lift followers 80, illustrated as rollers which flank high lift follower 76, are mounted to intake rocker arm body 74 on a roller shaft 82. Each low lift follower 80 follows a respective low lift intake lobe 70 of intake camshaft 34 in a rolling interface. A first end of intake rocker arm body 74 engages and pivots about intake lash adjuster 39 while a second end engages intake valve 30, thereby causing intake valve 30 to seat and unseat with intake valve seat 50 as intake rocker arm 38 pivots about intake lash adjuster 39.

[0018] A latching mechanism 84 is disposed within intake rocker arm body 74 at the end thereof which engages intake lash adjuster 39. Latching mechanism 84 includes a latch bore 86 in intake rocker arm body 74 within which a latch pin 88 is slidably disposed. Latch pin 88 selectively engages high lift follower 76, thereby preventing relative movement between high lift follower 76 and intake rocker arm body 74. Latch pin 88 also selectively disengages high lift follower 76, thereby allowing high lift follower 76 to pivot relative to intake rocker arm body 74 about pivot shaft 78. A latch spring 90 urges latch pin 88 into engagement with high lift follower 76 when high lift of intake valve 30 is desired. Conversely, pressurized oil is supplied to latch pin 88 through an oil passage 89, thereby compressing latch spring 90 and disengaging latch pin 88 from high lift follower 76 when low lift of intake valve 30 is desired. The supply of pressurized oil to latch pin 88 may be controlled, for example, by an oil control valve 92 which receives oil from an oil supply 94 of internal combustion engine 10.

[0019] A lost motion spring 96, illustrated for example only as a compression coil spring, is disposed operatively between high lift follower 76 and intake rocker arm body 74. When latch pin 88 is disengaged from high lift follower 76, lost motion spring 96 is compressed and uncompressed in a cyclic pattern by high lift intake lobe 68. In this way, lost motion spring 96 maintains contact between high lift follower 76 and high lift intake lobe 68 while not permitting valve lifting motion to be transferred from high lift intake lobe 68 to intake valve 30.

[0020] Further features and characteristics of intake rocker arm 38 are shown in United States Patent Application Publication No. 2009/0078225 to Hendriksma and

United States Patent No. 7,761,217 to Waters et al.

[0021] Again with reference to Figs. 1 and 2, exhaust rocker arm 40 includes an exhaust rocker arm body 98 within which an exhaust rocker arm follower 100 is mounted on roller shaft 101. Exhaust rocker arm follower 100, illustrated as a roller, follows exhaust lobe 72 of exhaust camshaft 36 in a rolling interface. A first end of exhaust rocker arm body 98 engages and pivots about exhaust lash adjuster 41 while a second end engages exhaust valve 32 thereby causing exhaust valve 32 to seat and unseat with exhaust valve seat 52 as exhaust rocker arm 40 pivots about exhaust lash adjuster 41 as a result of exhaust lobe 72.

[0022] With continued reference to Figs. 1 and 2 and now with additional reference to Figs. 5 and 6, cylinder head assembly 18 includes an oil reflector 102 which receives a spray of oil from an oil spray source and directs the spray of oil to high lift follower 76 in order to lubricate the interface between high lift intake lobe 68 and high lift follower 76. Oil reflector 102 includes a mounting portion 104 for attaching oil reflector 102 to cylinder head assembly 18. Mounting portion 104 may be substantially planar and may include mounting holes 106 for receiving bearing cap bolts 62 therethrough which clamp mounting portion 104 between the head of bearing cap bolts 62 and bearing cap 60. Oil reflector 102 also includes at least one directing portion 108 extending from mounting portion 104 in the same direction as intake camshaft axis 64. Directing portion 108 is substantially dome-shaped and includes a concave side 110 which generally faces toward intake rocker arm 38 and a convex side 112 which generally faces toward valve cover 42. At least a portion of the spray of oil from the oil spray source is received by the concave side 110 and is directed by concave side 110 to impinge on high lift follower 76 to lubricate the sliding interface of high lift follower 76 and high lift intake lobe 68. As shown, oil reflector 102 includes two directing portion 108 separated by mounting portion 104 such that oil reflector 102 serves to lubricate high lift followers 76 of two intake rocker arms 38 of cylinder 14. Oil reflector 102 may be made of, for example only, sheet metal which is formed into the desired shape for example only by stamping, punching, and/or bending. While directing portion 108 is illustrated as substantially dome-shaped, it should be understood that directing portion 108 may be other shapes that are tailored to provide the desired lubrication of the interface of high lift follower 76 and high lift intake lobe 68.

[0023] The oil spray source may be camshaft bearing 54. The interface of camshaft bearing 54 and intake camshaft 34 is lubricated by oil from oil supply 94 through an oil gallery 114 (Fig. 3) in cylinder head 28. Oil from oil supply 94 is supplied to oil gallery 114 under pressure, for example, by a pump (not shown). The oil is then forced into the interface of camshaft bearing 54 and intake camshaft 34. Oil from the interface of camshaft bearing 54 and intake camshaft 34 (journal bearing interface) is discharged therefrom to form the spray of oil which is re-

ceived by the concave side 110 and is directed by concave side 110 to impinge on high lift follower 76 to lubricate the sliding interface of high lift follower 76 and high lift intake lobe 68. In this way, the oil that is used to lubricate the interface of camshaft bearing 54 and intake camshaft 34 is also used to lubricate the interface of high lift follower 76 and high lift intake lobe 68. Consequently, the pump used to pressurize oil from oil supply 94 does not need to be increased in size to accommodate an additional oil spray bar that would be used exclusively to lubricate the interface between high lift follower 76 and high lift intake lobe 68. For clarity, Fig. 6 includes arrows 116 to illustrate the spray of oil coming from camshaft bearing 54 and directed by oil reflector 102 to high lift follower 76.

[0024] In order to lubricate high lift follower 76 of each intake rocker arm 38 for each cylinder 14, an oil reflector 102 may be provided at each camshaft bearing 54 of intake camshaft 34. Alternatively, and now with reference to Fig. 7, an oil reflector 102' may be substituted for multiple oil reflectors 102. Oil reflector 102' includes mounting portions 104' corresponding to each camshaft bearing 54 of intake camshaft 34. Each mounting portion 104' includes mounting holes 106' for receiving bearing cap bolts 62 therethrough. Oil reflector 102' also includes directing portions 108' which each correspond to a respective intake rocker arm 38. Oil reflector 102' may perform substantially identical to multiple oil reflectors 102; however, fewer individual parts are needed and assembly of oil reflector 102' may be simplified.

[0025] While exhaust rocker arm 40 has been illustrated as a conventional rocker arm which provides only one magnitude of lift, it should be understood that exhaust rocker arm 40 may be configured to be a two-step rocker arm as has been illustrated by intake rocker arm 38. If exhaust rocker arm 40 is configured to be a two-step rocker arm, oil reflector 102 or oil reflector 102' may be similarly utilized to lubricate exhaust rocker arm 40.

[0026] While intake rocker arm 38 has been illustrated as defaulting to the high lift mode, i.e. high lift follower 76 is prevented from pivoting relative to intake rocker arm body 74, it should now be understood that intake rocker arm 38 may be arranged to default to the low lift mode, i.e. high lift follower 76 is permitted to pivot relative to intake rocker arm body 74. If intake rocker arm 38 is arranged to default to the low lift mode, a spray hole may be provided in intake rocker arm body 74 as disclose in United States Patent Application Publication No. 2009/0078225 to Hendriksma in order to lubricate high lift follower 76. However, oil reflector 102 or oil reflector 102' may still be used in order to provide supplemental lubrication high lift follower 76. For example, high lift intake lobe 68 of intake camshaft 34 may mask a portion of high lift follower 76 from the oil spray provided by the spray hole. Oil reflector 102 may aid in lubricating the portion of high lift follower 76 that is masked by high lift intake lobe 68. Furthermore, intake rocker arm 38 may be a conventional rocker arm which provides only one

magnitude of lift similar to exhaust rocker arm 40 described above. If intake rocker arm 38 is a conventional rocker arm with only one follower, oil reflector 102 or oil reflector 102' may be used in order to provide lubrication to the follower.

[0027] While oil reflector 102 and oil reflector 102' have been illustrated as being mounted to cylinder head assembly 18 by securing oil reflector 102 and oil reflector 102' to camshaft bearings 54, it should be understood that other mounting arrangements may be contemplated. For example only, oil reflector 102 and oil reflector 102' may alternatively be secured to valve cover 42. Consequently, valve cover 42 and oil reflector 102 or oil reflector 102' may be provided as a complete assembly to quicken the assembly process of internal combustion engine 10.

[0028] While high lift follower 76 has been illustrated as being a sliding interface with high lift intake lobe 68, it should now be understood that high lift follower 76 may alternatively be a rolling interface with high lift intake lobe 68. Similarly, while low lift followers 80 have been illustrated as being a rolling interface with low lift intake lobes 70, it should now be understood that low lift followers 80 may alternatively be a sliding interface with low lift intake lobes 70. Consequently, oil reflector 102 or oil reflector 102' may also/alternatively be used to lubricate the interface between low lift followers 80 and low lift intake lobes 70.

[0029] While camshaft bearing 54 has been illustrated as the oil spray source for providing the spray of oil which is received and directed by oil reflector 102 or oil reflector 102', it should now be understood that other oil spray sources may be utilized. For example only, an adjacent exhaust rocker arm 40 may provide a spray of oil which is received and directed by oil reflector 102 or oil reflector 102'.

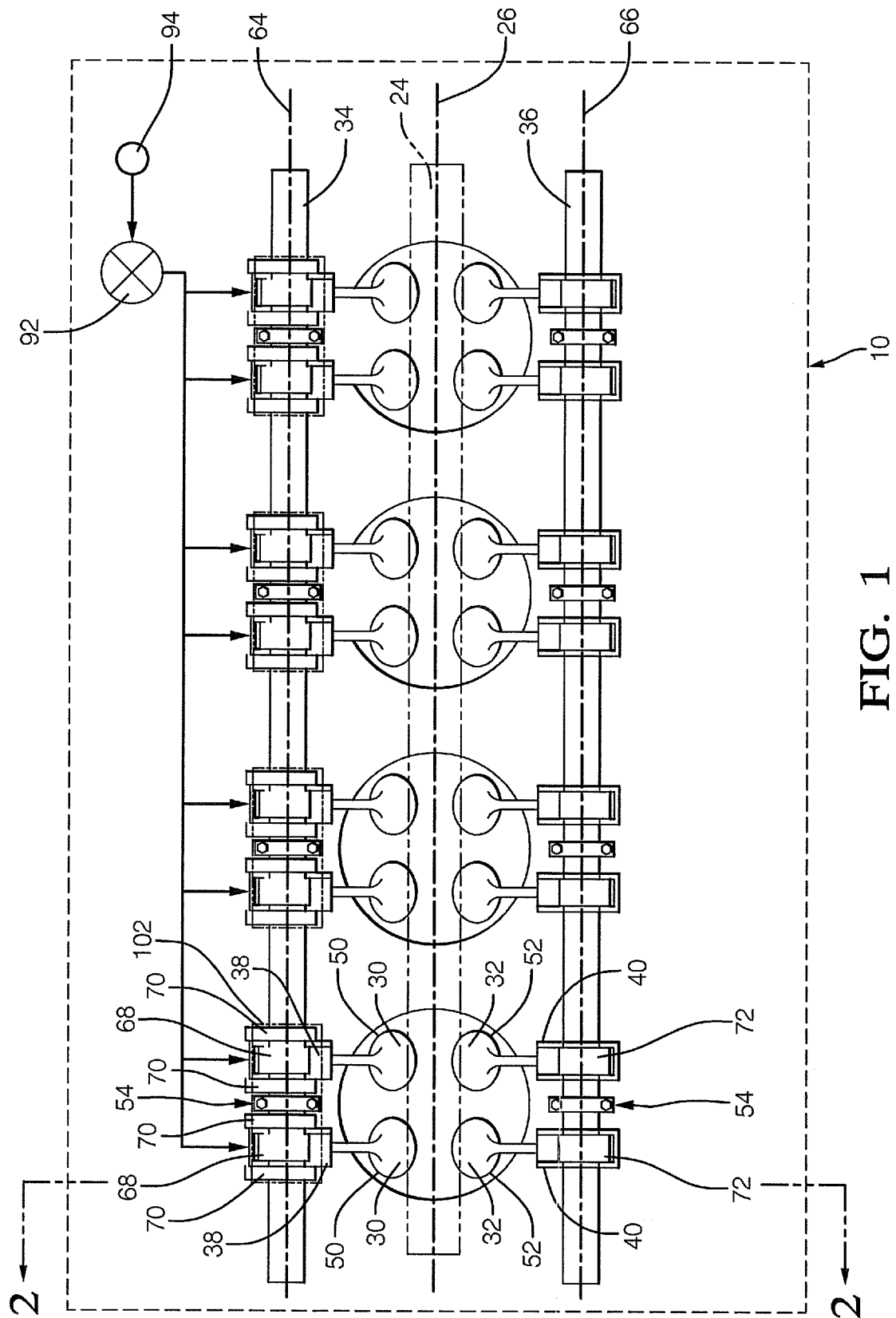
[0030] While this invention has been described in terms of preferred embodiments thereof, it is not intended to be so limited, but rather only to the extent set forth in the claims that follow.

Claims

1. A cylinder head assembly (18) for an internal combustion engine (10) having a piston (16) reciprocable within a cylinder (14), a crankshaft (24) rotated by said piston (16), and a combustion chamber (20) defined between said cylinder head assembly (18) and said piston (16), said cylinder head assembly (18) allowing air into said combustion chamber (20) and allowing exhaust gases out of said combustion chamber (20), said cylinder head assembly (18) comprising:

a cylinder head (28) defining a port (46,48) for selectively communicating said air to said combustion chamber or for selectively discharging said exhaust gases from said combustion cham-

- ber (20) and also defining a valve seat (50,52) between said port (46,48) and said combustion chamber (20); a combustion valve (30,32) mounted in said cylinder head (28) and selectively seated and unseated with said valve seat (50,52);
- a camshaft (34,36) mounted in said cylinder head (28), rotatable about a camshaft axis (64), and having a lobe or, a high lift lobe (68) and a low lift lobe (70);
- a rocker arm (38) engaged with said combustion valve (30,32) and having a high lift follower (76) and a low lift follower (80), said rocker arm (38) being switchable between 1) a high lift mode for receiving high lift valve opening and closing motion from said high lift lobe (68) of said camshaft (34) and 2) a low lift mode for receiving low lift opening and closing motion from said low lift lobe (70) of said camshaft (34), whereby rotation of said camshaft (34) about said camshaft axis (64) causes said rocker arm (38) to pivot, thereby seating and unseating said combustion valve (30) with said valve seat (50) in a cyclic pattern; an oil spray source providing a spray of oil;
- characterized in that** the cylinder head assembly (18) further comprises an oil reflector (102) configured to receive said spray of oil and direct said spray of oil to one of said high lift follower (76) and said low lift follower (80) to provide lubrication between said lobe or one of said high lift follower (76) and said low lift follower (80) and one of said high lift lobe (80) and said low lift lobe (70).
2. A cylinder head assembly (18) as in claim 1 further comprising a camshaft bearing (54) defined by a first semicircular recess (56) in said cylinder head (28) and a second semicircular recess (58) defined in a bearing cap (60), said bearing cap (60) being fastened to said cylinder head (28) and capturing said camshaft (34) between said first semicircular recess (56) and said second semicircular recess (58) to define a journal bearing interface between said camshaft bearing (54) and said camshaft (34); wherein said camshaft (34) bearing is said oil spray source.
3. A cylinder head assembly (18) as in claim 2 further comprising an oil gallery (114) defined within said cylinder head (28) and in fluid communication with said camshaft bearing (54) to supply oil to lubricate said journal bearing interface, whereby said oil supplied to said camshaft bearing (54) is discharged from said journal bearing interface to generate said spray of oil.
4. A cylinder head assembly as in claim 2 wherein said oil reflector (102) comprises:
- a mounting portion (104) for securing said oil reflector (102) to said cylinder head assembly (18); and
- a directing portion (108) extending from said mounting portion (104) to receive and direct said spray of oil.
5. A cylinder head assembly (18) as in claim 4 wherein said mounting portion (104) and said bearing cap (60) are secured to said cylinder head (28) with a fastener (62) such that said bearing cap (60) is captured between said mounting portion (104) and said cylinder head (28).
6. A cylinder head assembly (18) as in claim 5 wherein said mounting portion (104) is planar.
7. A cylinder head assembly (18) as in claim 4 wherein said directing portion (108) has a concave side (110) and a convex side (110) such that said concave side (110) receives and directs said spray of oil.
8. A cylinder head assembly (18) as in claim 7 wherein said directing portion (108) is substantially dome-shaped.



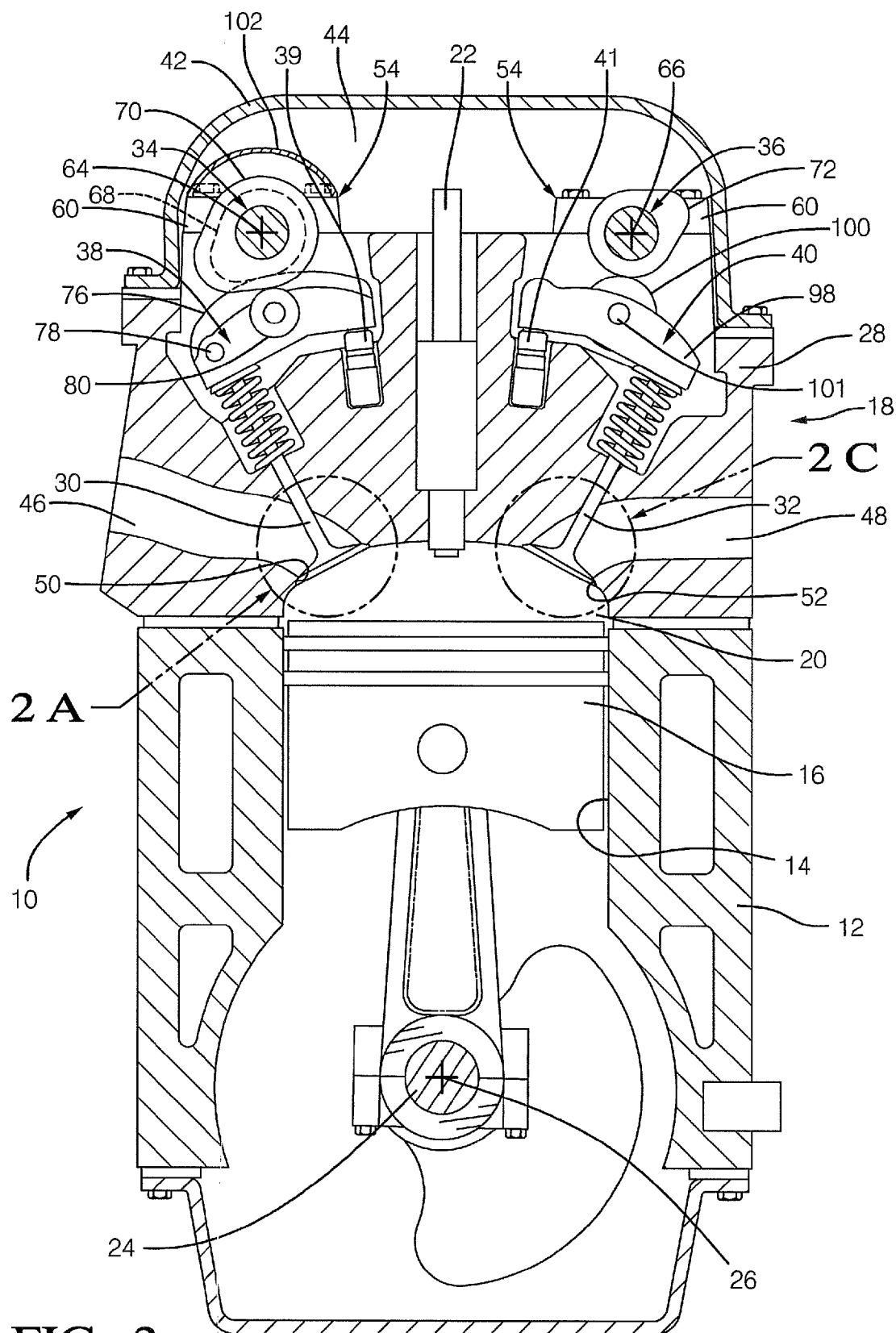


FIG. 2

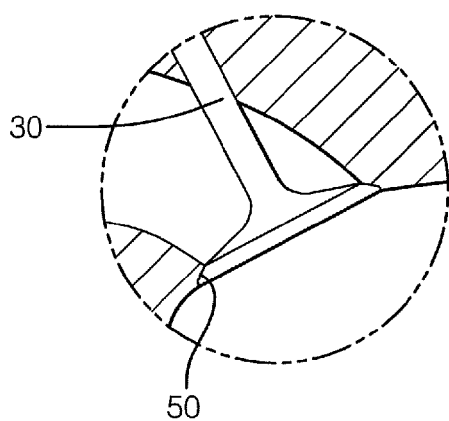


FIG. 2 A

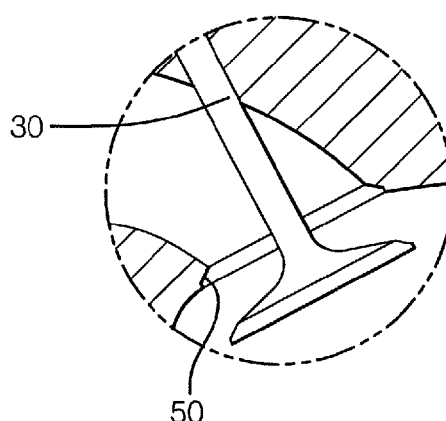


FIG. 2 B

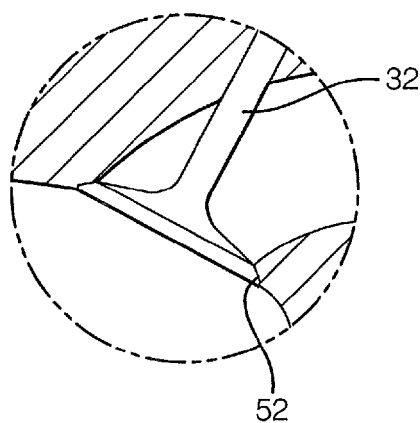


FIG. 2 C

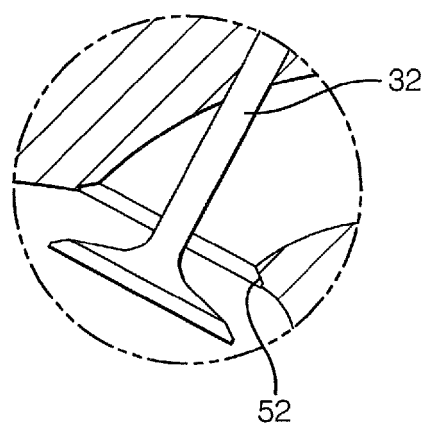


FIG. 2 D

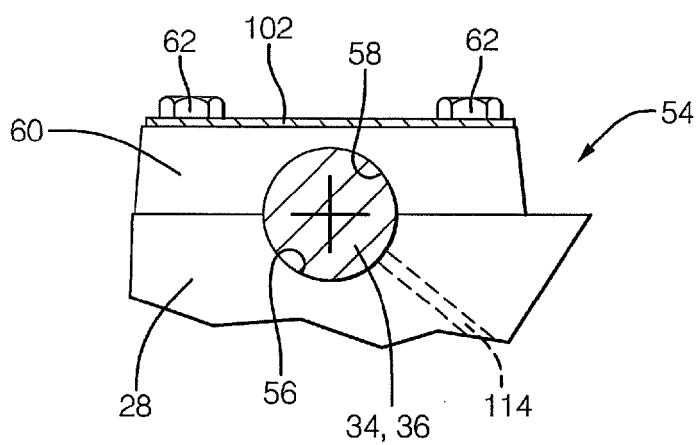


FIG. 3

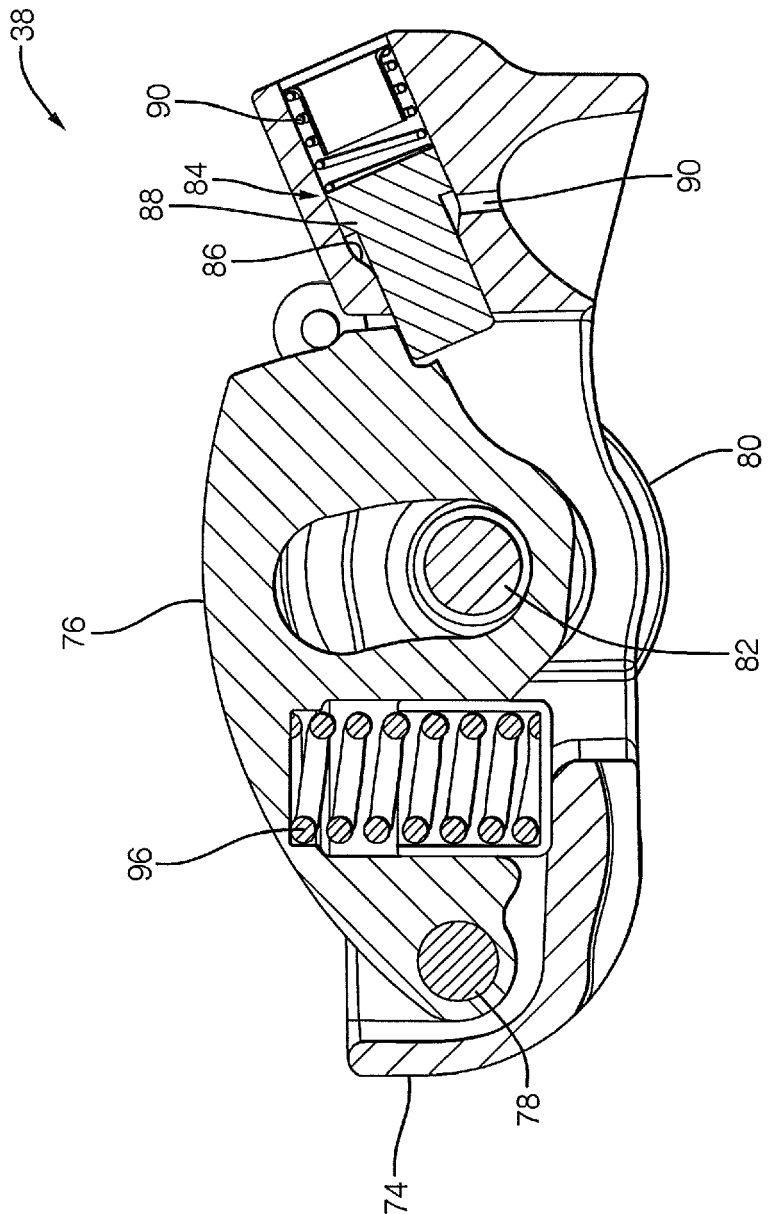


FIG. 4

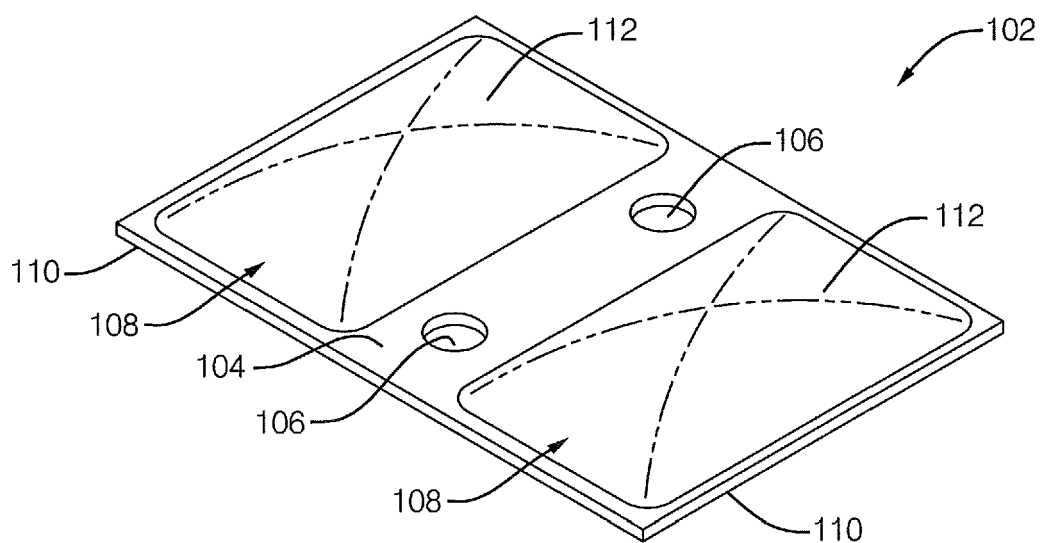


FIG. 5

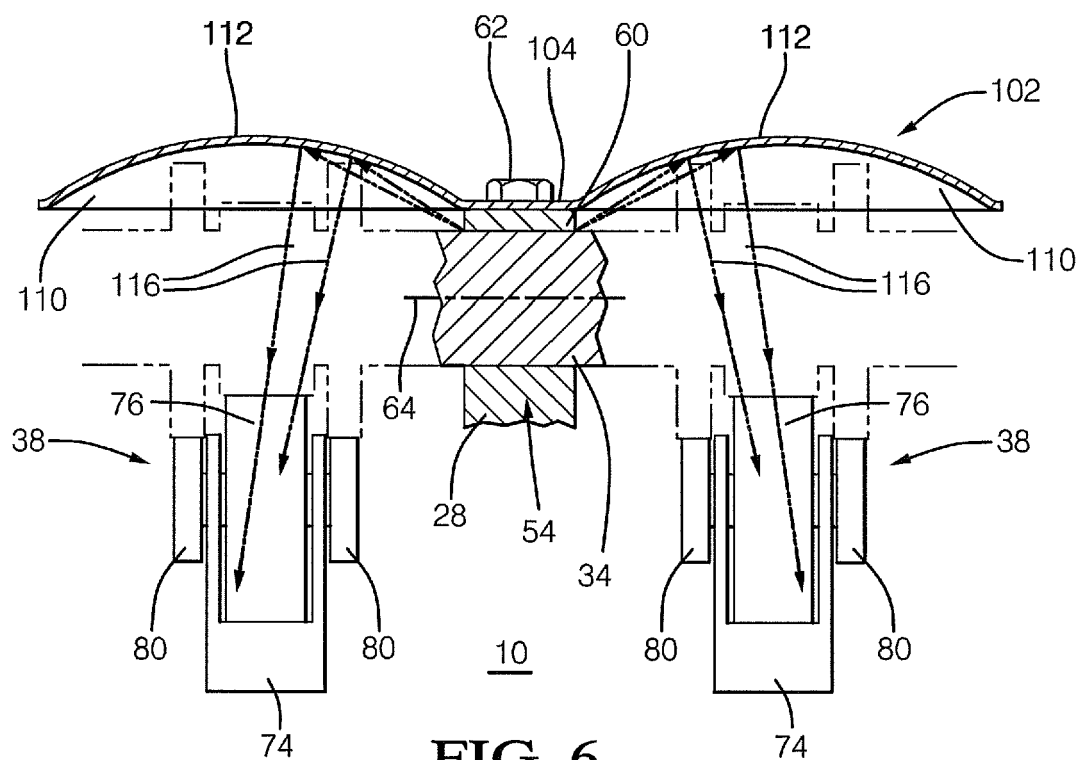


FIG. 6

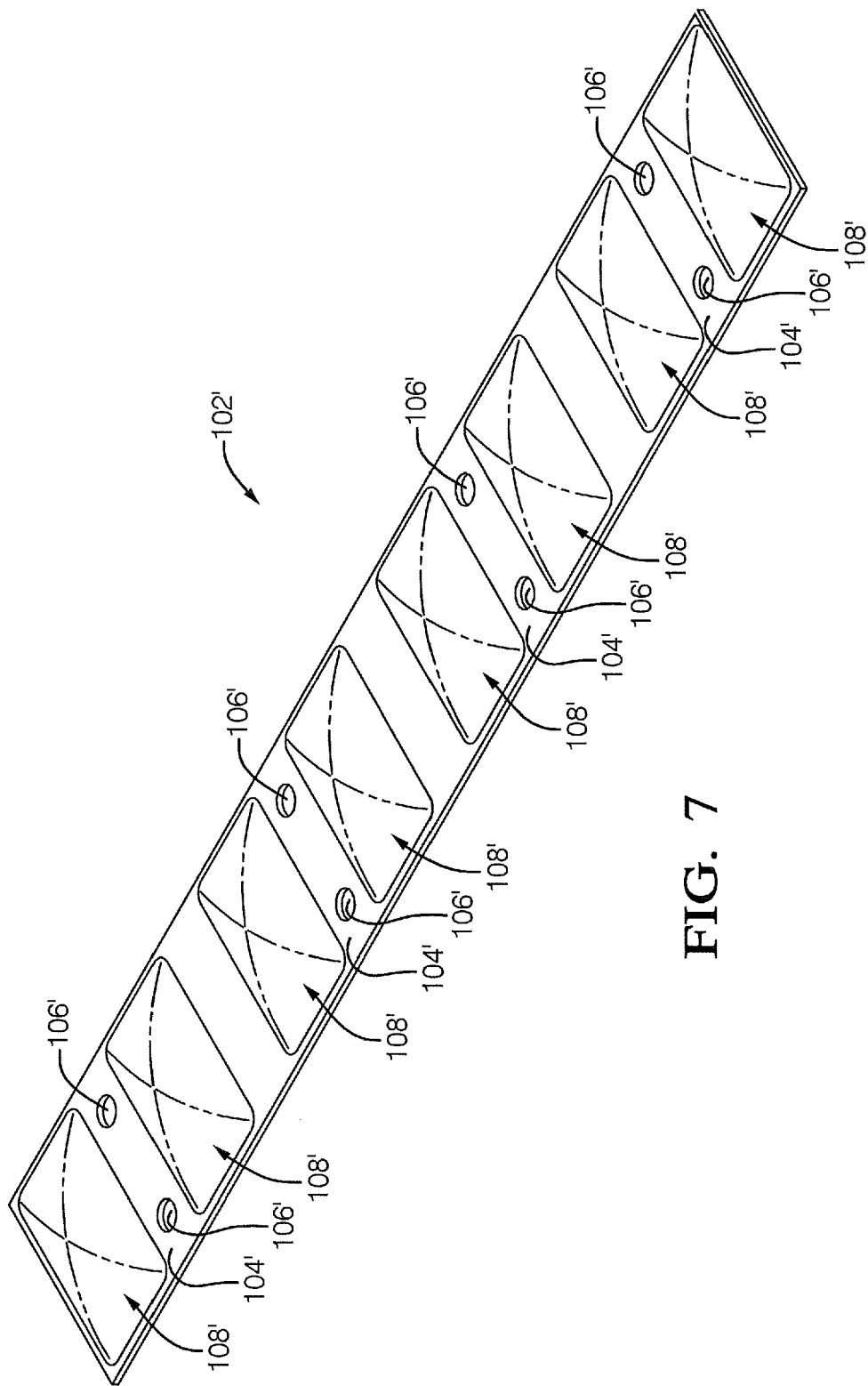


FIG. 7



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Place of search Munich		Date of completion of the search 20 January 2015	Examiner Vedoato, Luca
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