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Dike

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(54) **VARIABLE LIFT VALVE TRAIN**

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F01L 1/18 (2006.01)
F01L 1/344 (2006.01)
F01L 1/047 (2006.01)

(52) **U.S. Cl.**
CPC ***F01L 1/344*** (2013.01); ***F01L 1/047*** (2013.01); *F01L 1/18* (2013.01); *F01L 1/181* (2013.01)

(58) **Field of Classification Search**
CPC F01L 1/18; F01L 1/181
USPC 123/90.39, 90.44, 90.16
See application file for complete search history.

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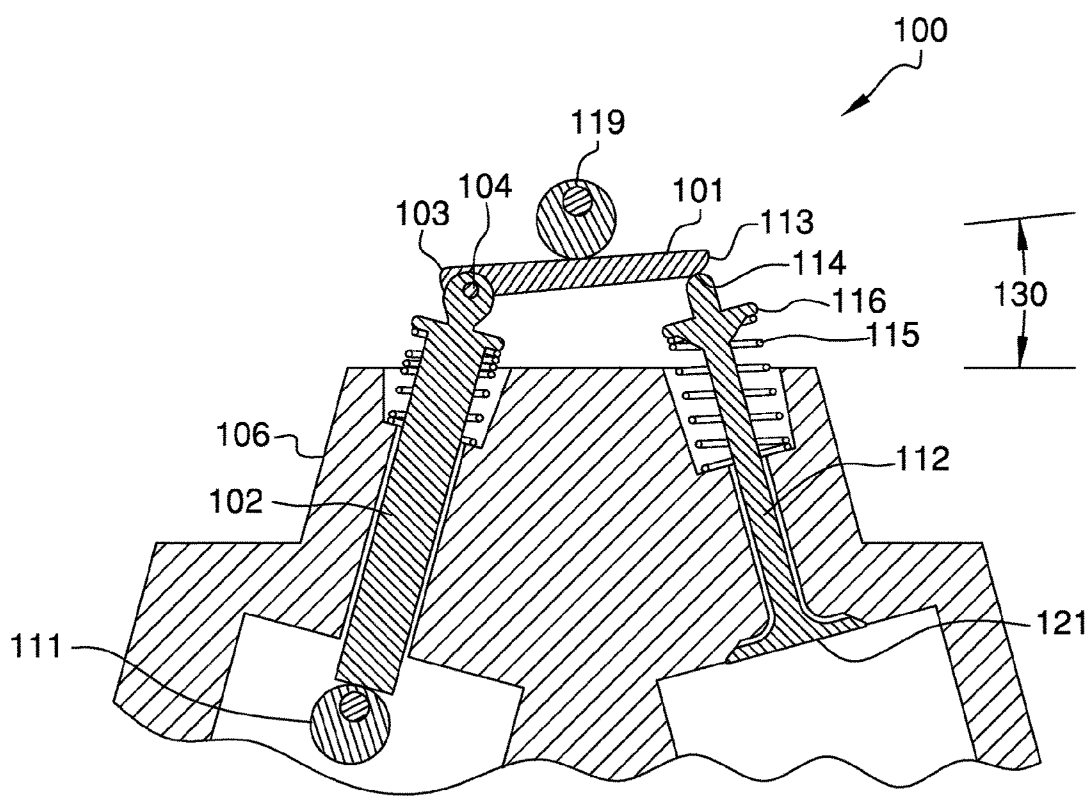
(57) **ABSTRACT**

The variable lift valve train includes a spring-loaded valve that is in mechanical connection with a lever bar. The lever bar is attached to a stroke limiter. The lever bar extends across the spring-loaded valve and the stroke limiter. The lever bar is positioned under a first cam. The angle of the first cam adjusts the angular orientation of the lever bar with respect to the stroke limiter as well as the spring-loaded valve. The stroke limiter is biased via a stroke spring. Moreover, the stroke limiter extends downwardly, and optionally engages against a stroke limiter cam. The stroke limiter cam is optionally able to influence the stroke limiter, and is a secondary influence when compared to the angular orientation of the lever bar. In use, the variable lift valve train is able to adjust the timing and lift of the spring-loaded valve of the engine.

11 Claims, 7 Drawing Sheets



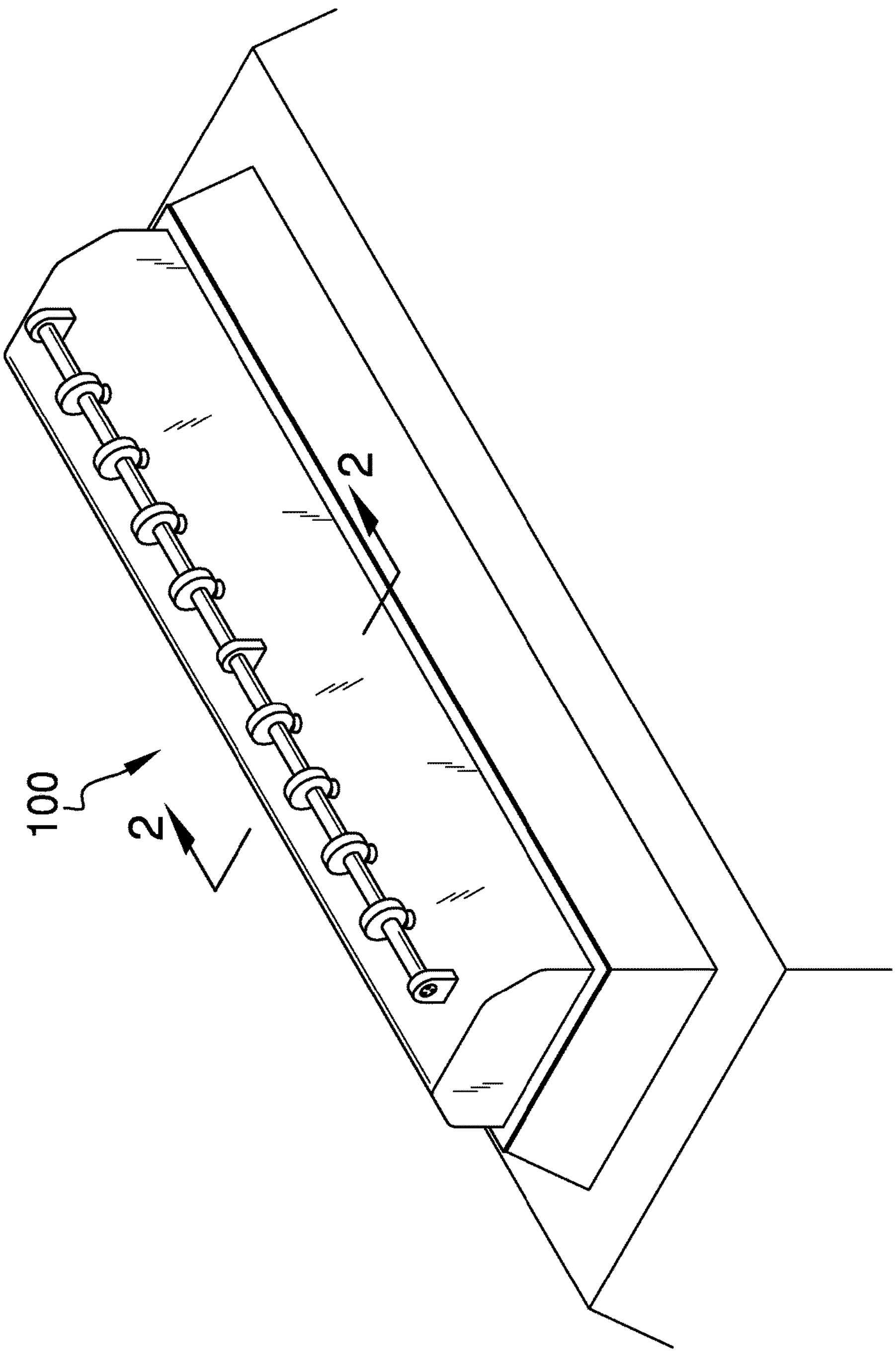


FIG. 1

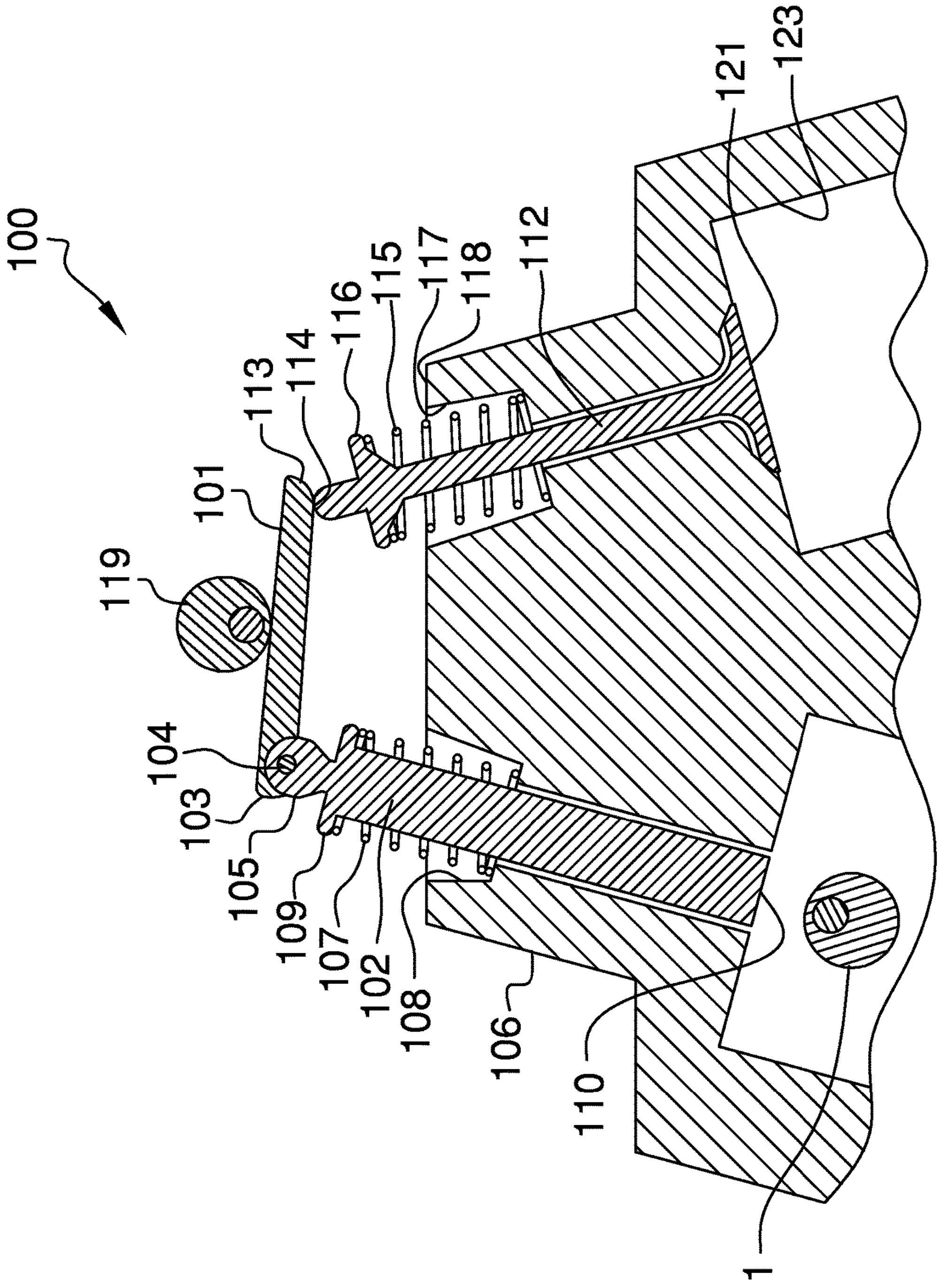

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FIG. 2A

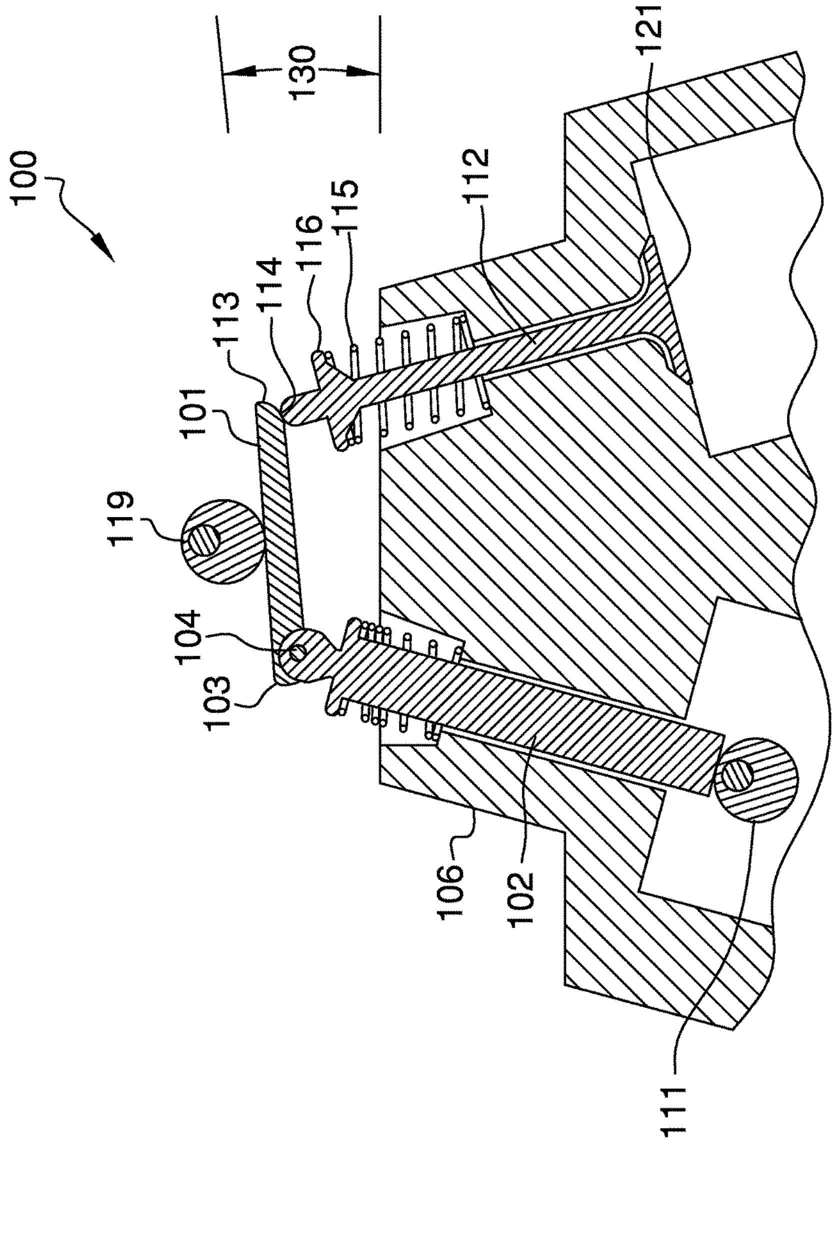

FIG. 2B

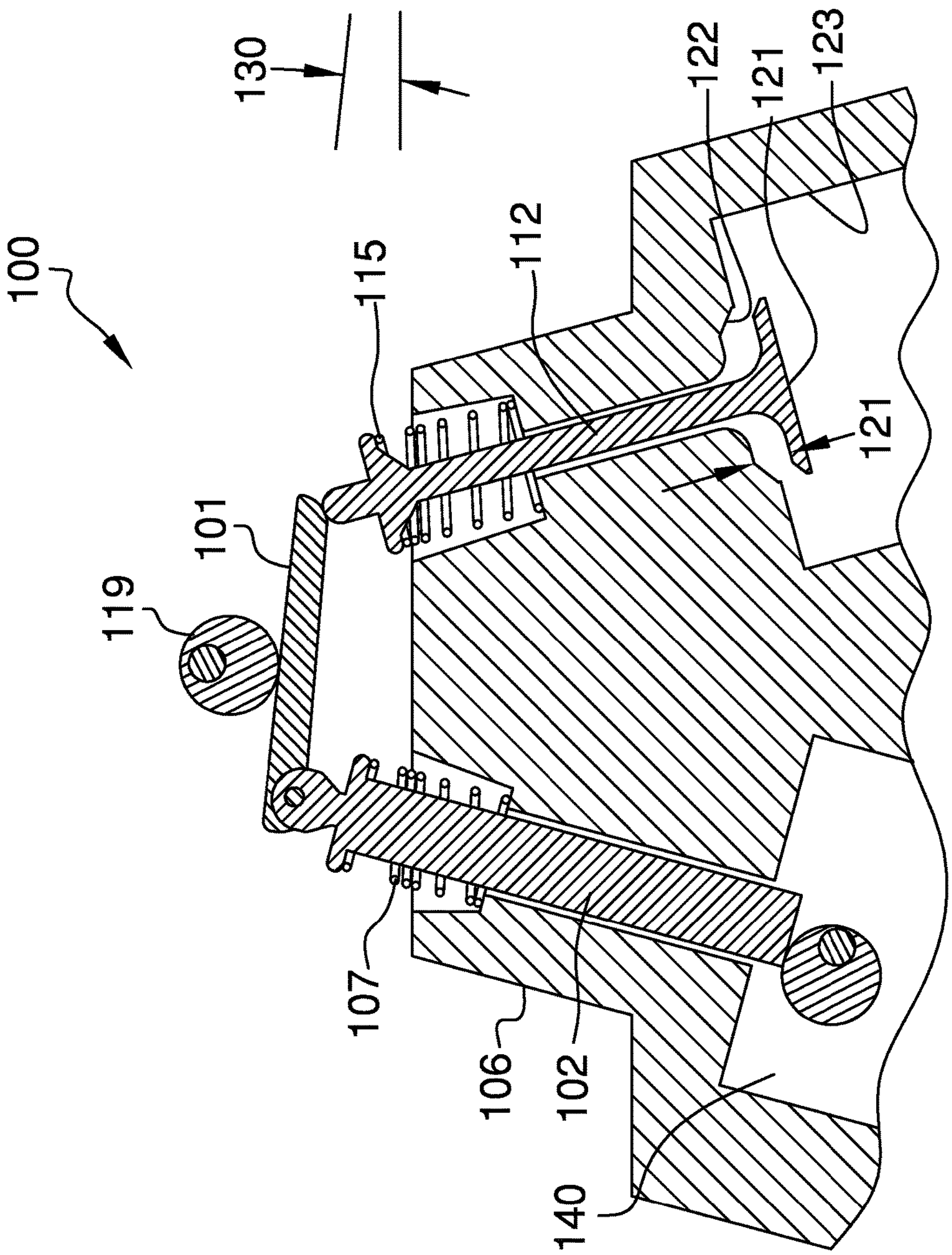

FIG. 2C

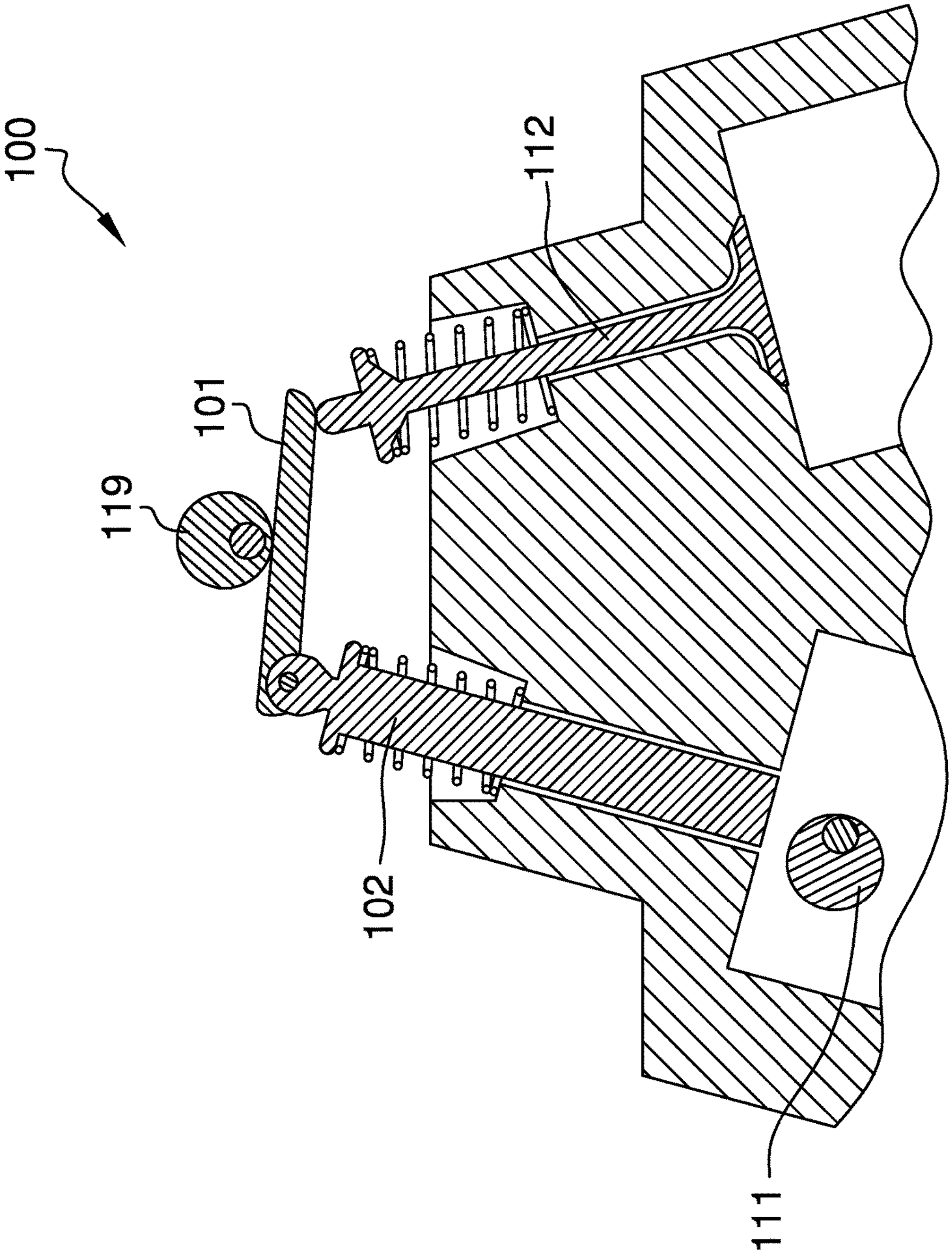

FIG. 2D

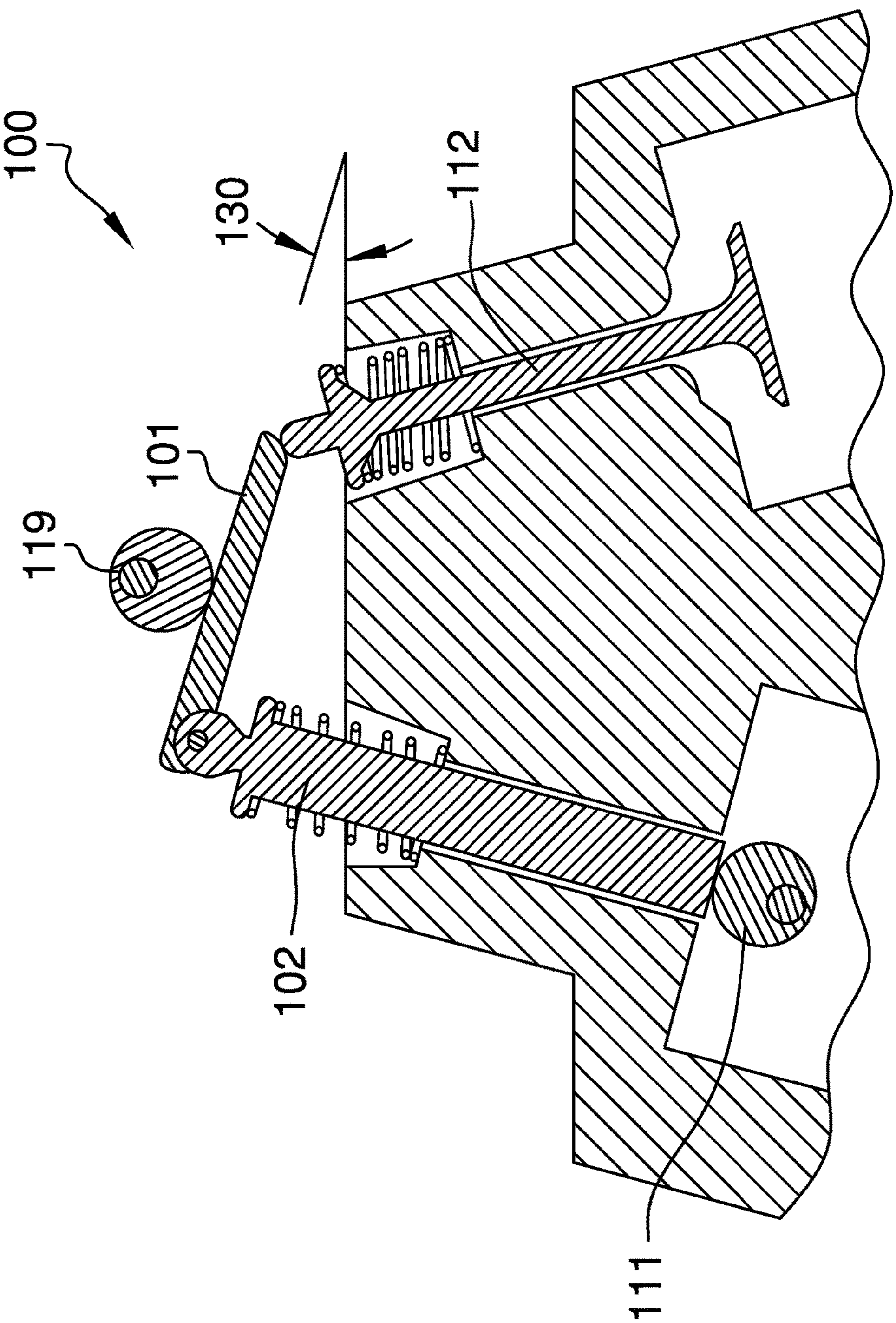

FIG. 2E

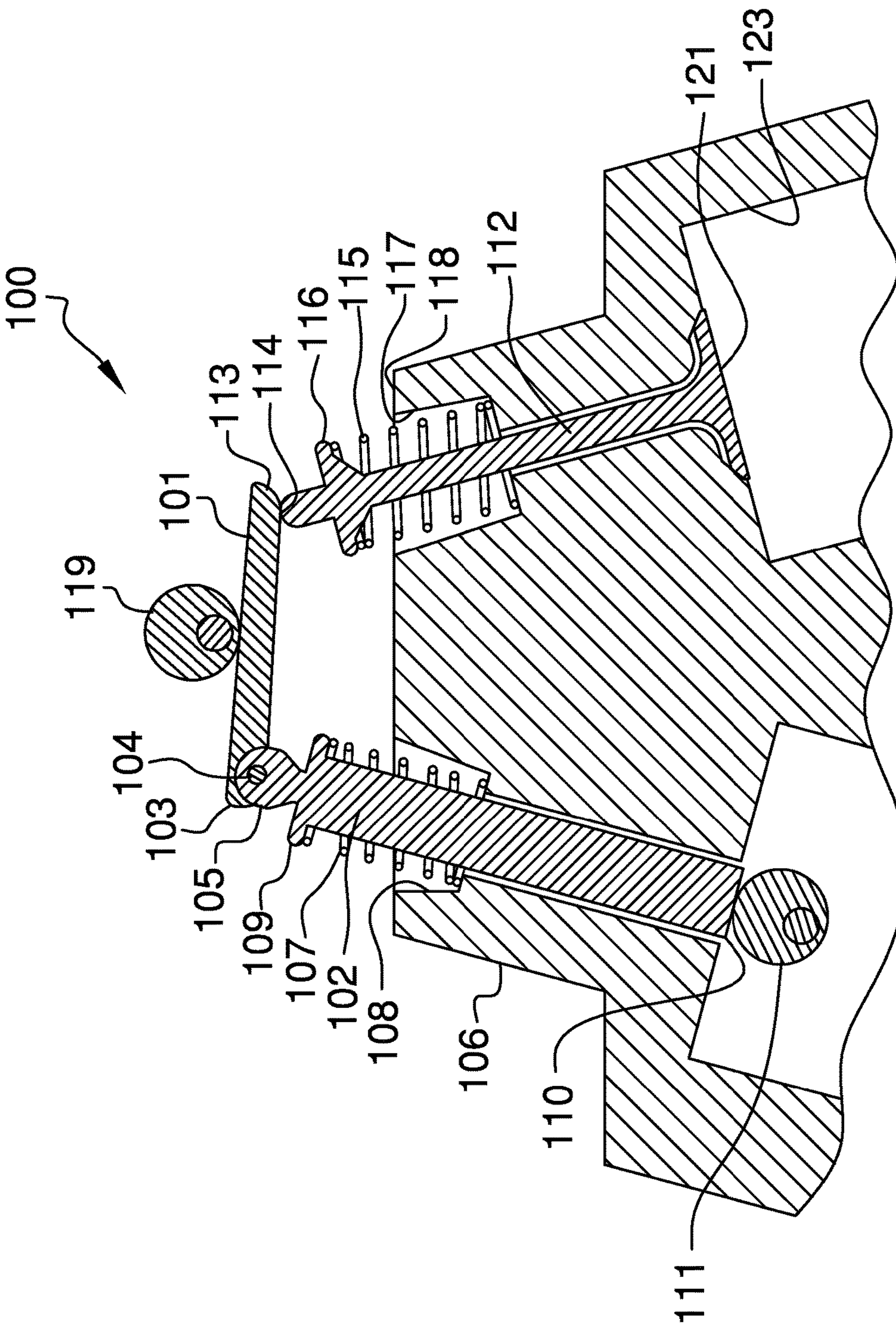
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FIG. 2F

VARIABLE LIFT VALVE TRAIN

CROSS REFERENCES TO RELATED APPLICATIONS

Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

Not Applicable

REFERENCE TO APPENDIX

Not Applicable

BACKGROUND OF THE INVENTION

A. Field of the Invention

The present invention relates to the field of internal combustion engines, more specifically, the rocker arm pivot point.

Internal combustion engines are constantly evolving. Internal combustion engines are always being modified to improve performance or to improve efficiency. This is more important with the ever-increasing cost of gasoline and diesel fuels. One component of a gasoline engine that is in want of increased variability is the valve timing and valve lift of the internal combustion engine. There have been many attempts over the years to provide for variability in the timing of the internal combustion engine and/or to variably adjust the lift of the valve stem.

The device of the present application seeks to address this the timing as well as the lift of the valve.

SUMMARY OF THE INVENTION

The variable lift valve train includes a spring-loaded valve that is in mechanical connection with a lever bar. The lever bar is attached to a stroke limiter. The lever bar extends across the spring-loaded valve and the stroke limiter. The lever bar is positioned under a first cam. The angle of the first cam adjusts the angular orientation of the lever bar with respect to the stroke limiter as well as the spring-loaded valve. The stroke limiter is biased via a stroke spring. Moreover, the stroke limiter extends downwardly, and optionally engages against a stroke limiter cam. The stroke limiter cam is optionally able to influence the stroke limiter, and is a secondary influence when compared to the angular orientation of the lever bar. In use, the variable lift valve train is able to adjust the timing and lift of the spring-loaded valve of the engine.

An object of the invention is to provide a mechanically operated variable timing device for use with an internal combustion engine, which operates independent of the internal combustion engine and also varies the timing and lift of the applicable valve stem.

A further object of the invention is to provide a variable timing device that utilizes few components to vary timing and lift of a valve stem.

These together with additional objects, features and advantages of the variable lift valve train will be readily apparent to those of ordinary skill in the art upon reading the following detailed description of presently preferred, but

nonetheless illustrative, embodiments of the variable lift valve train when taken in conjunction with the accompanying drawings.

In this respect, before explaining the current embodiments of the variable lift valve train in detail, it is to be understood that the variable lift valve train is not limited in its applications to the details of construction and arrangements of the components set forth in the following description or illustration.

Those skilled in the art will appreciate that the concept of this disclosure may be readily utilized as a basis for the design of other structures, methods, and systems for carrying out the several purposes of the variable lift valve train.

It is therefore important that the claims be regarded as including such equivalent construction insofar as they do not depart from the spirit and scope of the variable lift valve train. It is also to be understood that the phraseology and terminology employed herein are for purposes of description and should not be regarded as limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention:

In the drawings:

FIG. **1** illustrates an outer, perspective view of an internal combustion engine whereby the mechanically operable variable timing device is installed thereon.

FIG. **2**A illustrates a cross-sectional view along line **2**-**2** in FIG. **1**.

FIG. **2**B illustrates a cross-sectional view along line **2**-**2** in FIG. **1**.

FIG. **2**C illustrates a cross-sectional view along line **2**-**2** in FIG. **1**.

FIG. **2**D illustrates a cross-sectional view along line **2**-**2** in FIG. **1**.

FIG. **2**E illustrates a cross-sectional view along line **2**-**2** in FIG. **1**.

FIG. **2**F illustrates a cross-sectional view along line **2**-**2** in FIG. **1**.

DETAILED DESCRIPTION OF THE EMBODIMENT

The following detailed description is merely exemplary in nature and is not intended to limit the described embodiments of the application and uses of the described embodiments. As used herein, the word "exemplary" or "illustrative" means "serving as an example, instance, or illustration." Any implementation described herein as "exemplary" or "illustrative" is not necessarily to be construed as preferred or advantageous over other implementations.

All of the implementations described below are exemplary implementations provided to enable persons skilled in the art to practice the disclosure and are not intended to limit the scope of the appended claims. Furthermore, there is no intention to be bound by any expressed or implied theory presented in the preceding technical field, background, brief summary or the following detailed description.

Detailed reference will now be made to the preferred embodiment of the present invention, examples of which are illustrated in FIGS. **1**-**2**F. A variable lift valve train **100** (hereinafter invention) includes a lever bar **101** that is pivotably attached to a stroke limiter **102**. The lever bar **101** is further defined with a first lever end **103**. A pivot pin **104** connects the lever bar **101** to the stroke limiter **102** at the first lever end **103**. The stroke limiter **102** is further defined as a bar-shaped object that includes a bulbous top end **105**. The pivot pin **104** attaches the lever bar **101** to the stroke limiter **102** at the bulbous top end **105**.

The stroke limiter **102** is generally vertically oriented with respect to an cylinder head **106**. The stroke limiter **102** is also biased upwardly via a limiter spring **107**. The limiter spring **107** is positioned between a limiter cavity **108** and a limiter shoulder **109**. The limiter cavity **108** is integrated into the construction of the cylinder head **106**. The stroke limiter **102** is also further defined with a bottom distal end **110** that may come into contact with a stroke limiter cam **111** (see FIGS. **2**A-**2**F).

The lever bar **101** extends from the stroke limiter **102** to a spring-loaded valve **112**. The lever bar **101** is further defined with a second lever end **113** that rests atop of the spring-loaded valve **112**. The second lever end **113** of the lever bar **101** has a curvature, which enables the lever bar **101** to rotate and translate atop of a top valve end **114** of the spring-loaded valve **112**. The spring-loaded valve **112** includes a valve spring **115** that biases the spring-loaded valve **112** upwardly, and which is well known in the art of internal combustion engines.

The valve spring **115** is positioned between a valve collar **116** of the spring-loaded valve **112** and a valve cavity **117** located in the cylinder head **106**. It shall be noted that the valve cavity **117** and the limiter cavity **108** of the cylinder head **106** are recesses formed into a top block surface **118** of the cylinder head **106**.

The lever bar **101** is under the influence of an overhead cam **119**. The overhead cam **119** rotates to adjust the angular orientation of the lever bar **101**. It shall be noted that the valve spring **115** has a higher spring constant than the limiter spring **107**. The FIGS. **2**A-**2**F, depict the various arrangements of the spring-loaded valve **112**, and the interplay of the valve spring **115**, the limiter spring **107**, the stroke limiter cam **111**, and the overhead cam **119**. The invention **100** enables the stroke and timing of the spring-loaded valve **112** to be adjusted independent of engine RPM. Traditional engines have limitations on the timing and lift of the valves in the engine in that the valves open and close in harmony with the RPM of the engine. The engine of the present invention **100** utilizes the stroke limiter cam **111**, which can rotate independent of engine RPM.

It shall be further noted that a lift **120** of the spring-loaded valve **112** is defined as a distance formed between a valve head **121** and a valve opening **122** in a cylinder **123** of the cylinder head **106**. The stroke limiter cam **111** is located in a limiter cavity **140** located inside of the cylinder head **106**. Moreover, the limiter cavity **140** may be adjacent to the cylinder **123** of the cylinder head **106**.

Referring to FIGS. **2**B, **2**C, and **2**E, upon rotation of the overhead cam **119**, the lever bar **101** pushes down on the spring-loaded valve **112** and the stroke limiter **107**. Being that there is more resistance on the spring-loaded valve **112**, the stroke limiter **107** will move downwardly until it encounters the stroke limiter cam **111**. The position of the stroke limiter cam **111** will determine how much valve lift **120** will be diverted to the stroke limiter **107**.

As the stroke limiter **102** lowers vertically, the location of the pivot pin **104** adjusts downwardly, which changes the angular orientation, alpha (a) **130** of the lever bar **101**. Moreover, as the stroke limiter **102** moves downwardly, the lift **120** of the spring-loaded valve **112** decreases. It shall be noted that this example assumes that the overhead cam **117** is in the same position, which is the case for FIGS. **2**B, **2**C, and **2**E. It shall be further noted that the overhead cam **117** rotates dependent upon engine RPM, whereas the stroke limiter cam **111** does not.

With respect to the above description, it is to be realized that the optimum dimensional relationship for the various components of the invention **100**, to include variations in size, materials, shape, form, function, and the manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the invention **100**.

It shall be noted that those skilled in the art will readily recognize numerous adaptations and modifications which can be made to the various embodiments of the present invention which will result in an improved invention, yet all of which will fall within the spirit and scope of the present invention as defined in the following claims. Accordingly, the invention is to be limited only by the scope of the following claims and their equivalents.

The inventor claims:

1. A variable lift valve train comprising:

a lever bar pivotably engaged between a spring-loaded valve and a stroke limiter;

wherein the spring-loaded valve opens and closes with respect to a cylinder of a cylinder head;

wherein the stroke limiter is able to move upwardly or downwardly in order to adjust an angular orientation of said lever bar;

wherein the lever bar is under the influence of an overhead cam, which rotates in proportion to an engine RPM of said cylinder head;

wherein adjustment of the stroke limiter adjusts a timing and lift of the spring-loaded valve with respect to the cylinder of the cylinder head;

wherein the lever bar is pivotably attached to the stroke limiter;

wherein the lever bar is further defined with a first lever end;

wherein a pivot pin connects the lever bar to the stroke limiter at the first lever end;

wherein the stroke limiter is further defined as a bar-shaped object that includes a bulbous top end;

wherein the pivot pin attaches the lever bar to the stroke limiter at the bulbous top end;

wherein the stroke limiter is generally vertically oriented with respect to the cylinder head;

wherein the stroke limiter is also biased upwardly via a limiter spring;

wherein the limiter spring is positioned between a limiter cavity and a limiter shoulder;

wherein the limiter cavity is integrated into the construction of the cylinder head;

wherein the stroke limiter is also further defined with a bottom distal end that optionally contacts with a stroke limiter cam.

2. The mechanically operable variable timing device as described in claim **1** wherein the lever bar extends from the stroke limiter to a spring-loaded valve.

3. The mechanically operable variable timing device as described in claim **2** wherein the lever bar is further defined with a second lever end that rests atop of the spring-loaded valve.

4. The mechanically operable variable timing device as described in claim **3** wherein the second lever end of the lever bar has a curvature, which enables the lever bar to rotate and translate atop of a top valve end of the spring-loaded valve.

5. The mechanically operable variable timing device as described in claim **4** wherein the spring-loaded valve includes a valve spring that biases the spring-loaded valve upwardly.

6. The mechanically operable variable timing device as described in claim **5** wherein the valve spring is positioned between a valve collar of the spring-loaded valve and a valve cavity located in the cylinder head; wherein the valve cavity and the limiter cavity of the cylinder head are recesses formed into a top block surface of the cylinder head.

7. The mechanically operable variable timing device as described in claim **6** wherein the valve spring has a higher spring constant than the limiter spring.

8. The mechanically operable variable timing device as described in claim **7** wherein the lift of the spring-loaded valve is defined as a distance formed between a valve head and a valve opening in said cylinder of the cylinder head.

9. The mechanically operable variable timing device as described in claim **8** wherein the stroke limiter cam is located in the limiter cavity located inside of the cylinder head.

10. The mechanically operable variable timing device as described in claim **9** wherein the limiter cavity is adjacent to the cylinder of the cylinder head.

11. The mechanically operable variable timing device as described in claim **10** wherein upon rotation of the overhead cam, the lever bar pushes down on the spring-loaded valve and the stroke limiter; wherein there is more resistance on the spring-loaded valve, the stroke limiter will move downwardly until it encounters the stroke limiter cam; wherein the position of the stroke limiter cam determines the amount of valve lift that is diverted to the stroke limiter.

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