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[54] **PISTON TOP DEAD CENTER LOCATING TOOL**

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[51] **Int. Cl.**[6] **G01M 17/007**

[52] **U.S. Cl.** **73/116**; 33/600

[58] **Field of Search** 33/601, 600, 602, 33/603, 604, 605, 606, 610, 542.1; 73/116

[56] **References Cited**

U.S. PATENT DOCUMENTS

1,184,154	5/1916	Wilesmith	33/611
1,611,062	5/1925	Peebles	33/605
1,737,726	4/1927	Muzyn	33/601
1,782,142	2/1929	Havens	33/601
2,112,917	5/1936	Linn	33/600
2,426,955	9/1947	Stroup	33/600
2,471,746	5/1949	Hilbert	33/601
3,852,887	12/1974	Hennrick	33/601
3,889,528	6/1975	Grikscheit et al.	73/119 R
4,531,295	7/1985	Saathoff	33/601

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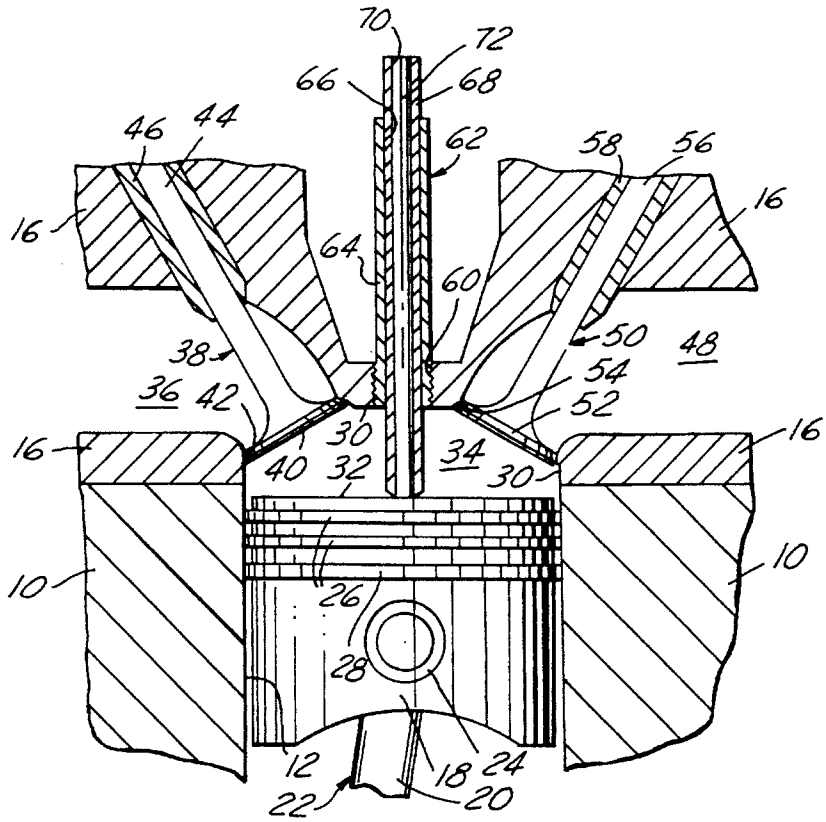
[57] **ABSTRACT**

A tool for visually indicating the relative crankshaft and piston position at top dead center for an internal combustion engine of the type having a threaded opening for a spark plug positioned above the piston's top surface. The tool consists of a base which has threads for attachment in the spark plug opening, an outer tubular member supported by the base to allow it to slide upward through the base in response to urging of the top of the piston moving toward the base but otherwise being frictionally secured to the base, and an inner member equal in the length dimension to the outer member and supported by the outer member in a manner allowing it to initially move upward with the outer tubular member as urged by the piston but also allowing it to move with the piston away from the base and the outer member whereby changes in the alignment of the exterior ends of the members indicates piston movement past top dead center.

3 Claims, 1 Drawing Sheet



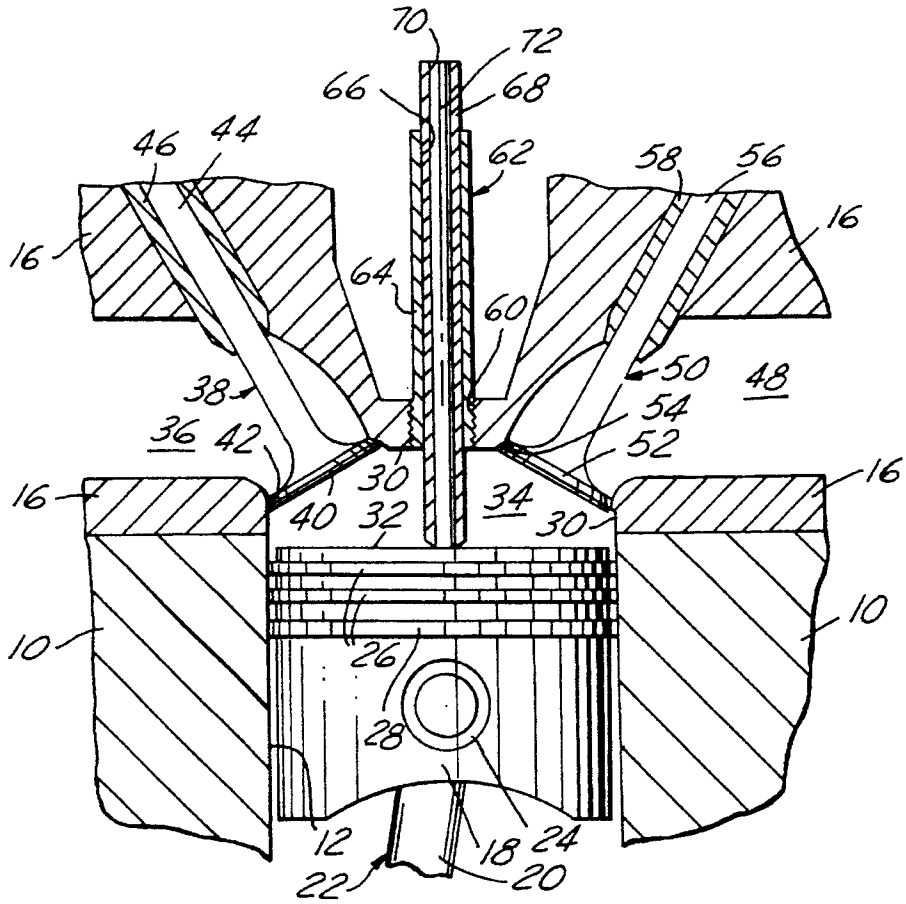


FIG. 1

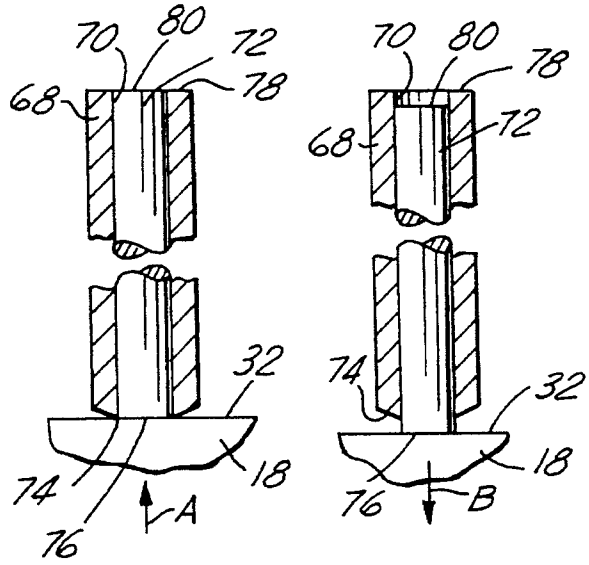


FIG. 2 FIG. 3

PISTON TOP DEAD CENTER LOCATING TOOL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an apparatus or assembly for use in finding and indicating the top dead center position of a piston in an internal combustion engine.

2. Description of Related Art

There are several devices known to find and indicate the top dead center position of a piston in an engine. The subject device accomplishes this purpose and is simpler, easier to use, and less costly than previously know devices.

In U.S. Pat. No. 1,184,154 issued to Wilesmith, a device to indicate a pistons's position is disclosed which uses a movable rod **1** supported in a housing with a graduated face **2**. The exterior end of the rod is visible relative to the graduated face to indicate relative piston location. Similar devices are disclosed in U.S. Pat. Nos. 1,782,142 and 2,426,955 issued to Havens and to Stroup respectively.

In U.S. Pat. No. 1,737,726 issued to Muzyn, a device to indicate a piston's position for the purpose of checking valve timing is disclosed which uses a tubular gauge rod or calibrated tube **10** movable in a housing **1**. A rod **16** is threadably supported in the tube **10**. Once set for a top or bottom dead center piston position, both the tube **10** and rod **16** move together.

SUMMARY OF THE INVENTION

This invention is directed to a new and improved device for providing a visual indication of a piston's position and the corresponding crankshaft position when the piston is at top dead center. The device is particularly devised for an internal combustion engine of the type having a threaded opening for a spark plug which is located above and in-line with a top surface of a piston. The device consists of a base which has threads for attachment in the spark plug opening, an outer tubular member supported by the base to allow it to slide upwardly through the base in response to upward piston movement toward the base but otherwise being frictionally secured within the base, and an inner member equal in the length dimension to the outer member and supported by the outer member in a manner allowing it to initially move upward with the outer tubular member as urged by the piston but also allowing it to move downwardly with the piston away from the base and the outer member whereby changes in the alignment of the exterior ends of the members indicates piston movement past top dead center.

An advantage and an object of the subject device is to provide a simple to use but accurate tool for determining the top dead center position of a piston in an internal combustion engine.

Other features and advantages will become more apparent from the following:

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial elevational sectioned view of an engine combustion chamber with a piston at the top dead center position and with the subject locating tool; and

FIG. **2** is an enlarged elevational view of a portion of the piston just as it attains its top dead center position and showing the lower and upper portions of the subject locating tool; and

FIG. **3** is an enlarged elevational view of a portion of the piston after it passes its top dead center position and showing the lower and upper portions of the subject locating tool.

DETAILED DESCRIPTION

Turning now in greater detail to the drawings and particularly FIG. **1** in which an embodiment of the invention as illustrated, a portion of an engine block **10** is shown which defines a cylinder **12**. The upper end or deck surface of the engine block as well as the cylinder is covered by a cylinder head **16**. The cylinder head **16** is attached to the engine block by a plurality of fasteners (not shown) in a conventional manner. A piston **18** is supported within cylinder **12** in a manner permitting reciprocal movements as is well known in the engine art. Piston **18** is attached to an upper end portion **20** of a connecting rod **22** by a piston pin **24**. The lower end portion (not shown) of the connecting rod **22** is attached to an engine crankshaft (not shown) in a manner well know in the engine art.

Piston **18** includes piston rings **26** and an oil control ring **28** which slide against the surface of cylinder **12**. The cylinder **12**, surfaces **30** of the cylinder head **16**, and the top surface **32** of piston **18** define a variable volume combustion chamber **34**. An air/fuel mixture is passed into the combustion chamber **34** through an intake passage **36**. The flow of air/fuel is controlled by opening and closing of an intake valve **38**. Valve **38** has an enlarged valve head **40** which is shown seated against a valve seat **42** in the closed operative position. A stem portion **44** of the intake valve **38** is supported in the cylinder head **16** by a valve guide **46** which permits an axially downward movements of the valve **38** to a more opened operative position.

After combustion of the air/fuel mixture in the combustion chamber **34**, the exhaust products are discharged through an exhaust passage **48** in the cylinder head. The flow of exhaust products from the combustion chamber **34** is controlled by opening and closing of an outlet or exhaust valve **50**. Exhaust valve **50** has an enlarged valve head **52** which is shown seated against a valve seat **54** in the closed operative position. A stem portion **56** of the exhaust valve **50** is supported in the cylinder head **16** by a valve guide **58** which permits an axially downward movements of the valve **50** to a more opened operative position.

The engine illustrated in FIG. **1** is of a common type in which a threaded spark plug aperture **60** is provided above the top surface **32** of the piston **18**. Instead of a spark plug, aperture **60** is utilized to mount the subject piston position locating tool assembly **62** when the location of the top dead center position of the piston and crankshaft is desired. Specifically, position locating tool **62** includes base or mount housing **64** with a threaded lower end adapted and configured to be screwed into aperture **60** of cylinder head **16**. The base **64** has an internal bore **66** into which a tubular outer member **68** is supported. In turn, an internal bore **70** of outer member **68** supports an inner member **72**.

The base **64** of the locating tool assembly **62** supports the outer member **68** to permit axial movement of the member **68** relative to base **64**. However, the dimension of bore **66** and member **68** are configured to create a sufficiently tight sliding fit so that friction restrains axial movement and thus a small but significant axial force is needed to slide outer member **68** in bore **66**. In contrast, the bore **70** and inner member **72** are configured so that there is not a substantial force caused by friction to restrain relative axial movements between members **68** and **72**.

As shown in FIG. **2**, the lower end portion of outer member **68** is beveled so as to present an inner edge portion **74** which is contacted by top surface **32** of the piston **18** as the piston moves upward in direction A toward its top dead center position. The lower end portion of inner member **72** is formed with a flat surface **76** which is also contacted by the top surface **32** of piston **18**. When the piston is moving upward in direction A, both outer and inner members **68, 72** are forced upward through bore **66** of base **64**.

The outer and inner members **68, 72** are exactly equal in length so that during this upward piston movement, the upper end surfaces **78** and **80** of members **68** and **72** are aligned or flush with one another which is easily determined by visual examination as well as by touch. This aligned relationship of end surfaces **78, 80** continues until the piston **18** passes its top dead center position and begins to move downward in cylinder **12**. The downward movement is indicated in FIG. **3** by arrow B.

When the piston **18** begins to move downward in direction B, there is no longer a significant axial force exerted by piston **18** on outer member **68** and therefore a frictional force between member **68** and base **64** retains member **68** in its uppermost axial position. Unlike member **68**, the inner member is free of significant friction between it and outer member **68** so that inner member follows top surface **32** of piston **18** in its downward movement. This produces an ever increasing non-alignment between end surfaces **78** and **80** which is both immediately visible and immediately detectable by touch.

Thus, the subject piston position locating tool assembly readily and simply indicates by visual examination or by touch a crankshaft position at which a particular piston has attained its top dead center position. While a preferred embodiment of the invention has been shown and described, other embodiments will now become apparent to those skilled in the art. Accordingly, this invention is not to be limited to what is shown and described but by the following claims.

What is claimed is:

1. For an internal combustion engine having an axially aligned cylinder and spark plug aperture in a cylinder head, a top dead center position indicator for a piston in the cylinder, comprising: a base member with a threaded end portion adapted to be attached to the engine within the spark plug aperture to provide a stationary support, said base member having a bore therethrough with an axis generally aligned with the axis of the cylinder; a tubular outer member extending through said bore in said base member; an inner member supported within said tubular outer member, said inner member being capable of reciprocal movements within said outer member; said outer member being sized relative to said bore in said base member to permit reciprocal movement of said outer member relative to said base member only in response to a significant axially applied force upon the outer member, as by upward movements of the piston toward the base member; said inner member being sized relative to said tubular outer member to permit free reciprocal movements within said outer member; said tubular outer member and said inner member having exactly the same length dimension so that as the ends nearest the piston of said outer and inner members are contacted by a piston as it moves in the cylinder toward said base member, the opposite externally exposed end surfaces of both members are arranged to form a common unbroken plane and subsequently as the piston moves oppositely away from the base member, only the inner member follows the movement of the piston thereby producing a visual axial dislocation of said end surfaces to visually present the ends in two different planes.

2. A piston position indicating tool for revealing the top dead center position of a piston in a combustion chamber of an internal combustion engine of the type having a cylinder bore and a cylinder head with a threaded spark plug opening, the spark plug opening and the cylinder being generally axially aligned with direction of travel taken by a piston in the cylinder, comprising: a base member having an end portion with external thread means configured and sized to attach into the spark plug opening for temporarily attachment to the engine, said base member having a bore therethrough with its axis extending generally parallel to the movement of the piston in the cylinder; a tubular outer member extending through said bore in said base member and defining an interior end portion adapted to project into the combustion chamber of the associated engine and having an opposite exterior end portion; an inner member supported by and extending through said tubular outer member, said inner member having an interior end portion within the combustion chamber of the associated engine and having an opposite exterior end portion; said outer member being sized and configured relative to said bore in said base member to permit axial movement of said outer member relative to said base member only in response to a significant axially applied force upon said outer member such as by upward movement of the piston toward said base member; said inner member being sized and configured relative to said supporting tubular outer member to freely allow axial movement relative to said outer member and said base member without significant axially applied forces other than gravitational force; said tubular outer member and said inner member having equal lengths so that when the interior ends of both members are engaged by a piston moving upward toward said base member, said opposite external ends of both members are arranged to form a common unbroken plane but when the piston moves past its top dead center position and withdraws from said base member, said outer member retains its uppermost position relative to the base member while the inner member follows the piston's downward movement thereby producing an axial dislocation of said external end surfaces to visually present the outer and inner ends in two different planes.

3. The piston position indicating tool as set forth in claim **2** in which the internal end portion of said outer member is furnished with a beveled end configuration so as to contact the top surface of an associated piston immediately adjacent the end surface of the inner member.

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