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(54) VALVE ASSEMBLY.

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Description

The present invention relates to the assembly of poppet valves in an internal combustion engine, and seeks to facilitate automation of valve assembly.

A poppet valve as used in the cylinder head of an engine has a valve stem which passes through a valve guide in the cylinder head and its protruding end is surrounded by a valve spring which acts on the stem in a direction to close the valve. A spring retainer is secured to the valve stem by means of tapered valve collets which engage a circumferential groove in the valve stem and the valve spring acts between the spring retainer and a spring seat which rests on the cylinder head. The spring seat is required because the material of the cylinder head would be damaged by the sharp edge of the valve spring and at least a washer is required between these two surfaces.

It is further required to provide, at a suitable place, an oil seal to prevent oil from running down the valve stem into the ports. This oil seal may be in the form of a cap fitting over the end of the valve guide though it has also been proposed to include the oil seal in the spring seat.

The assembly of a spring on a valve involves first fitting the oil seal to the valve stem, then placing the spring seat, spring and retainer, in that order, over the valve stem. Next the spring is compressed by pushing the retainer below the level of the groove in the valve stem, the valve collets are placed in the groove and finally the spring is released. Upon release of the retainer, the valve collets are held captive in the groove by the retainer and they in turn prevent the retainer from sliding up the length of the valve stem.

Because of the large number of individual parts involved and because of the complexity in handling some of these parts, the task of assembly of a valve spring was hitherto been considered too complex to automate and has instead been carried out manually. This, of course, adds to the cost of manufacture and the present invention seeks to mitigate the foregoing problem.

In accordance with a first aspect of the present invention, there is provided a method of assembling a poppet valve which includes the steps of fitting a spring seat, a helical spring and a spring retainer over the stem of the valve, compressing the spring, fitting collets to the stem of the poppet valve and releasing the compression force on the spring to trap the collets between the valve stem and the spring retainer, characterised in that the spring seat, the helical spring and the spring retainer are secured to one another before being fitted over the valve stem to form a sub-assembly in which the spring is not compressed, and in that the sub-assembly is fitted as a single component over the valve stem.

The components of the sub-assembly may be secured to one another by means of an adhesive or by virtue of their form being a locking fit in one another. For example, the retainer and the valve seat may have cylindrical extensions resiliently engaged by the coils of the spring and capable of holding the components together for later assembly without the use of an adhesive.

Because all three components are held together, they reduce the number of parts that have to be fed to, and manipulated by, an automated assembly line or robot.

Conveniently, a stack of such sub-assemblies may be contained in a cylindrical magazine and in a single operation a sub-assembly can be removed from the magazine and fitted over the valve stem.

In the prior art (e.g. GB 179,111 and GB 317,580) attempts have been made to simplify dismantling and reassembly of a poppet valve by fitting a cage or clamp over the compressed spring prior to its removal so as to maintain the spring compressed. The compressed spring, the seat and the retainer are then removed and later re-fitted as one component. Though during re-fitting, the spring, seat and retainer are pre-assembled, such pre-assembly does not meet the objective of reducing manufacturing costs by assisting mass production since an additional clamp is required to compress the spring and an additional manufacturing step is required to remove the clamp and dispose of it.

It is preferred that the spring seat be provided with an oil seal sealing against the valve stem so that the only operation required after the fitting of the sub-assembly over the valve stem is the mounting of the valve collets.

In accordance with a second aspect of the invention, there is provided a sub-assembly for facilitating automated assembly of valve springs onto poppet valves, the sub-assembly comprising an uncompressed helical valve spring secured at one end to a spring seat and at the other end to a spring retainer, whereby all three components may be mounted simultaneously over the stem of a poppet valve.

Preferably, the spring seat is provided with a seal for sealing against the stem of the poppet valve.

The spring seats in conventional engines are hat shaped and are centred on the valve step by being fitted over a boss surrounding the valve stem and protruding from the surface of the cylinder head. The presence of a boss prevents the oil which lubricates the valves from running down the stem into the combustion chamber but it interferes with the machining of the cylinder head, as it is difficult to work around the bosses.

According to a preferred feature of the invention, the spring seat is adapted to fit in a recess in the cylinder head surrounding the valve stem and is provided with two oil seals, the first operative to seal against the stem of the poppet valve and the second against the surface of the cylinder head.

Preferably, the spring seat is hat shaped and has an axial seal resting on the surface of the cylinder head and a radial seal for engaging the surface of the valve stem. The cylindrical portion of the seat now acts to centre the valve spring and the force of the spring urges the axial seal against the cylinder head.

Because of the provision of two seals on the spring seat, there is no need for a boss on the cylinder head and this simplifies manufacture without creating any problems in containing the oil in the valve chamber.

In a further aspect of the invention, there is provided a plurality of sub-assemblies as set out above stacked vertically one above the other in a magazine whereby to facilitate the supply of the sub-assemblies to an automated assembly line.

The invention will now be described further, by way of example, with reference to the accompanying drawing which is a section through a sub-assembly of a spring seat, a valve spring and a retainer placed above a cylinder head.

In the drawing, a cylinder head 10 is provided with a flat upper surface 12 and with a valve guide 14. A recess 16 is formed in the cylinder head 10 surrounding the upper end of the valve guide dimensioned to receive a spring seat 18.

The spring seat 18 forms part of a sub-assembly of three components which are secured to one another by means of an adhesive. The other two components are a spring 20 and a spring retainer 22 which is engaged by the valve collets in the usual manner when the valve is fully assembled and acts to transfer the force of the spring to the valve stem. The poppet valve and the valve collets are not shown in the drawing.

The spring seat 18 is hat shaped having a rim 24 against which the spring 20 rests. The lower surface of the rim 24 is formed with an elastomeric oil seal 26 which in use is held in sealing contact with the surface of the cylinder head by the force of the valve spring 20.

The top of the spring seat 18 has a central aperture through which the valve stem passes and in which there is provided a second oil seal 28. The design of the latter seal may be conventional and is shown as fitted with a resilient collar 30 which urges the inwardly projecting lip of the seal 28 into radial contact with the surface of the valve stem.

The spring seat has been described as having two separate seals and this is illustrated on the left half of the section shown in the drawing. It is alternatively possible to use a single elastomeric layer adhering to the metal of the spring seat, as shown to the right in the drawing.

In the assembly of cylinder heads in an automated line, sub-assemblies of springs, as illustrated, are provided in a magazine to an assembly robot which removes sub-assemblies from the magazine, one at a time, and places them over the valve stems in the cylinder head. The springs are then compressed by pressing down on the retainers 22 and the valve collets are placed about the grooves in the upper ends of the valve stems before releasing the pressure on the spring retainers 22.

It should be mentioned that in the prior art, valve springs have not been packaged in magazines and tended to become entangled with one another making unpacking alone a time consuming task. When assembled into sub-assemblies as proposed in the present invention, the springs are prevented from becoming entangled even when not packed in magazines ready for dispensing one at a time.

It can thus be seen that the preferred embodiment of the invention facilitates automation of assembly and also enables manufacturing costs to be reduced by simplifying the machining of the cylinder head.

Claims

1. A method of assembling a poppet valve which includes the steps of fitting a spring seat (18), a helical spring (20) and a spring retainer (22) over the stem of the valve, compressing the spring (20), fitting collets to the stem of the poppet valve and releasing the compression force on the spring (20) to trap the collets between the valve stem and the spring retainer, characterised in that the spring seat (18), the helical spring (20) and the spring retainer (22) are secured to one another before being fitted over the valve stem to form a sub-assembly in which the spring (20) is not compressed, and in that the sub-assembly is fitted as a single component over the valve stem.

2. A method of assembly as claimed in claim 1, wherein the components of the sub-assembly are secured to one another by means of an adhesive.

3. A method of assembly as claimed in claim 1, wherein the components of the sub-assembly are secured to one another by virtue of their being a form locking fit in one another.

4. A method as claimed in any preceding claim, wherein a stack of such sub-assemblies is contained in a cylindrical magazine.

5. A sub-assembly for facilitating automated assembly of valve springs onto poppet valves, the sub-assembly comprising an uncompressed helical valve spring (20) secured at one end to a spring seat (18) and at the other end to a spring retainer (22), whereby all three components may be mounted simultaneously over the stem of a poppet valve.

6. A sub-assembly as claimed in claim 5, wherein the spring seat (18) is provided with a seal (28) for sealing against the stem of the poppet valve.

7. A sub-assembly as claimed in claim 5 or 6, wherein the spring seat (18) is adapted to fit in a recess (16) in the cylinder head surrounding the valve

stem, and wherein the spring seat (18) is provided with two oil seals, the first (28) operative to seal against the stem of the poppet valve and the second (26) against the surface of the cylinder head.

8. A sub-assembly as claimed in claim 7, wherein the spring seat (18) is hat shaped and has an axial seal (26) resting on the surface of the cylinder head and a radial seal (28) for engaging the surface of the valve stem.

9. A plurality of sub-assemblies as claimed in any of claims 5 to 8 in a magazine in which the sub-assemblies are stacked vertically one above the other.

Patentansprüche

1. Verfahren zum Zusammenbau eines Tellerventils, das folgende Schritte einschließt : Anbringen eines Federsitzes (18), einer Schraubenfeder (20) und einer Federhalterung (22) über dem Ventilschaft, Zusammendrücken der Feder (20), Anbringen der Klemmringe am Tellerventilschaft und Lösen der auf die Feder (20) ausgeübten Druckkraft zum Betestigen der Klemmringe zwischen dem Ventilschaft und der Federhalterung, dadurch gekennzeichnet, daß der Federsitz (18), die Schraubenfeder (20) und die Federhalterung (22) aneinander befestigt werden, bevor sie über dem Ventilschaft angebracht werden und dann eine Unterbaugruppe bilden, in der die Feder (20) nicht zusammengedrückt ist, und daß die Unterbaugruppe als ein Einzelbauteil über dem Ventilschaft angebracht wird.

2. Zusammenbauverfahren nach Anspruch 1, bei dem die Bauteile der Unterbaugruppe durch einen Klebstoff aneinander befestigt werden.

3. Zusammenbauverfahren nach Anspruch 1, bei dem die Bauteile der Unterbaugruppe dadurch aneinander befestigt sind, daß sie genau ineinander passen.

4. Verfahren nach einem der vorhergehenden Ansprüche, bei dem ein Zylindermagazin einen Stapel solcher Unterbaugruppen enthält.

5. Unterbaugruppe zur Erleichterung des automatisierten Zusammenbaus von Ventilfedern und Tellerventilen, wobei die Unterbaugruppe eine Schraubenventilfeder (20) umfaßt, die nicht zusammengedrückt ist und an einem Ende an einem Federsitz (18) und am anderen Ende an einer Federhalterung (22) befestigt ist, wodurch alle drei Bauteile gleichzeitig über den Tellerventilschaft montiert werden können.

6. Unterbaugruppe nach Anspruch 5, bei der der Federsitz (18) eine Dichtung (28) zur Abdichtung gegenüber dem Tellerventilschaft aufweist.

7. Unterbaugruppe nach Anspruch 5 oder 6, bei der der Federsitz (18) in eine Vertiefung (16) im den Ventilschaft umgebenden Zylinderkopf paßt, und bei der der Federsitz (18) zwei Öldichtungen aufweist, wobei die erste (28) zur Abdichtung gegenüber dem Tellerventilschaft und die zweite (26) zur Abdichtung gegenüber der Zylinderkopfoberfläche dient.

8. Unterbaugruppe nach Anspruch 7, bei der der Federsitz (18) hutförmig ist und eine auf der Zylinderkopfoberfläche aufliegende Axialdichtung (26) und eine Radialdichtung (28) zur Ineingriffnahme der Ventilschaftoberfläche aufweist.

9. Mehrzahl von Unterbaugruppen nach einem der Ansprüche 5 bis 8 in einem magazin, in dem die Unterbaugruppen senkrecht übereinander gestapelt sind.

Revendications

1. Procédé pour assembler une soupape à champignon qui comprend les étapes selon lesquelles on ajuste un siège de ressort (18), un ressort hélicoïdal (20) et un organe de retenue du ressort (22) sur la tige de la soupape, on comprime le ressort (20), on ajuste des bagues sur la tige de la soupape à champignon et on relâche la force de compression sur le ressort (20) pour bloquer les bagues entre la tige de la soupape et l'organe de retenue du ressort, caractérisé par le fait que le siège de ressort (18), le ressort hélicoïdal (20) et l'organe de retenue du ressort (22) sont fixés l'un à l'autre avant d'être ajustés sur la tige de la soupape pour former un sous-ensemble dans lequel le ressort (20) n'est pas comprimé, et par le fait que le sous-ensemble est ajusté comme un composant unique sur la tige de la soupape.

2. Procédé d'assemblage selon la revendication 1, dans lequel les composants du sous-ensemble sont fixés l'un à l'autre au moyen d'un adhésif.

3. Procédé d'assemblage selon la revendication 1, dans lequel les composants du sous-ensemble sont fixés l'un à l'autre grâce au fait qu'ils constituent un ajustement qui les bloque l'un dans l'autre par conjugaison des formes.

4. Procédé selon l'une quelconque des revendications précédentes, dans lequel une pile de tels sous-ensembles est contenue dans un magasin cylindrique.

5. Sous-ensemble pour faciliter l'assemblage automatique de ressorts de soupapes sur des soupapes à champignon, le sous-ensemble comprenant un ressort de soupape hélicoïdal non comprimé (20) fixé à une extrémité à un siège de ressort (18) et à l'autre extrémité à un organe de retenue du ressort (22), ces composants pouvant être montés simultanément tous les trois sur la tige d'une soupape à champignon.

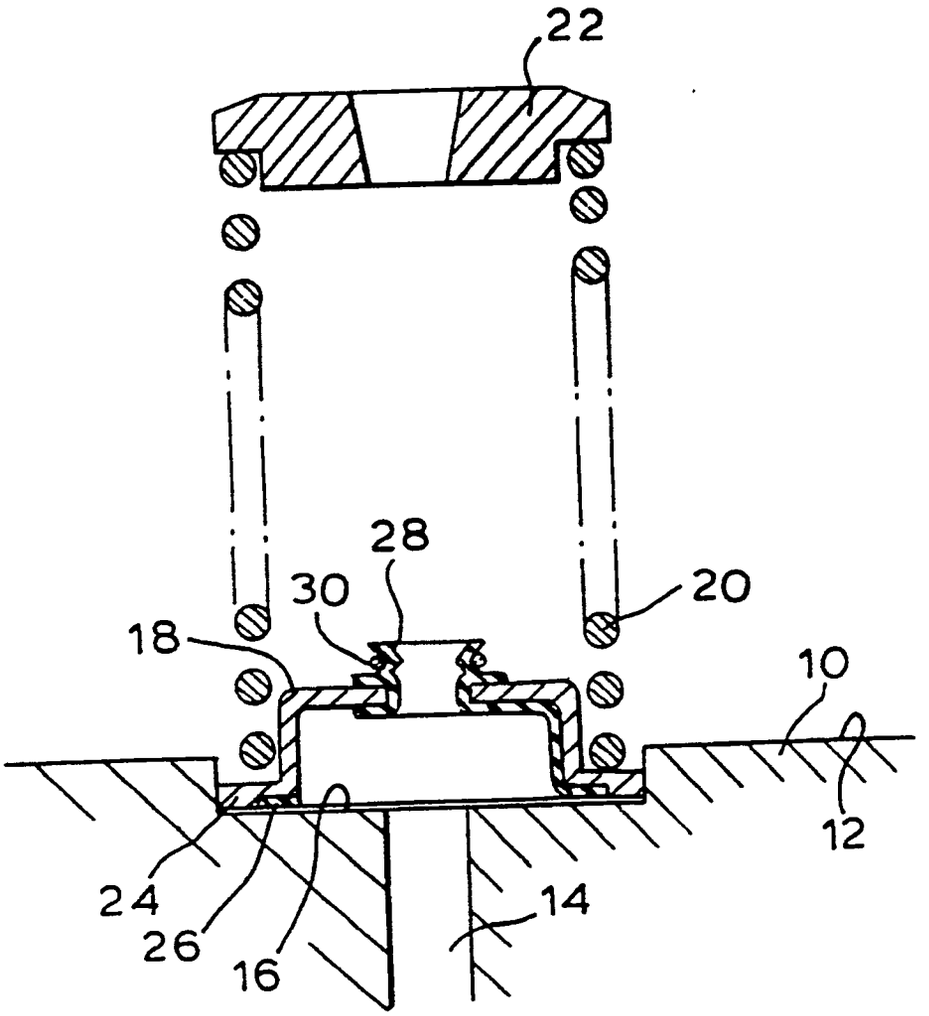
6. Sous-ensemble selon la revendication 5, dans lequel le siège de ressort (18) est muni d'un joint (28) pour le rendre étanche par rapport à la tige de la soupape à champignon.

7. Sous-ensemble selon la revendication 5 ou 6, dans lequel le siège de ressort (18) est susceptible de

s'ajuster dans un évidement (16) ménagé dans la tête du cylindre qui entoure la tige de la soupape, et dans lequel le siège de ressort (18) est muni de deux joints étanches à l'huile et aptes à créer l'étanchéité par rapport à la tige de la soupape à champignon pour le premier (28) et par rapport à la surface de la tête de cylindre pour le second (26).

8. Sous-ensemble selon la revendication 7, dans lequel le siège de ressort (18) présente la forme d'un chapeau et comporte un joint axial (26) qui repose sur la surface de la tête de cylindre et un joint radial (28) destiné à venir en contact avec la surface de la tige de la soupape.

9. Pluralité de sous-ensembles selon l'une quelconque des revendications 5 à 8 dans un magasin dans lequel les sous-ensembles sont empilés verticalement les uns au-dessus des autres.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