PISTON CROWN PULLER

The present invention relates to a piston crown puller.

BACKGROUND OF THE INVENTION

The removal of a piston or piston crown from a cylinder is often required for the purposes of maintenance. Large engines such as ship engines normally provide a piston crown fixed to a piston skirt to make up the entire piston assembly. The piston is of a type which moves reciprocally inside a cylinder and utilises annular piston rings to create a seal for the combustion chamber defined by the cylinder and the end face of the piston crown.

The materials that are used for the components of a piston and cylinder assembly can be expensive and during maintenance, damage to the piston crown must be avoided. For maintenance purposes the piston assembly may be required to be removed entirely from the cylinder and skill is required in removing the piston crown from the cylinder. Because of the forces and tolerances between a piston and a cylinder it may be impossible to remove a piston crown from the cylinder by manually pulling on the piston in the axial direction. A means of achieving a mechanical advantage for this task is usually necessary.

Normally the removal of the piston from the cylinder is achieved firstly by removing the cylinder head to expose an open end to the cylinder. With reference to prior art Figure 14, where the cylinder crown is of a kind which provides a plurality of bores in the combustion chamber facing surface of the crown, the removal of the cylinder may be achieved by inserting studs. A lever can in operation rest at one end on the engine block and intermediate of the other end be engaged with the stud. A user can then manually apply force to the other end of the lever to thereby induce an upward force to the piston crown. As mentioned, the tolerances between the piston and cylinder make such prior art methods of removing the piston from the cylinder difficult. The objective of removal is for the axis of the piston during extraction to remain substantially co-axial

with axis of the cylinder so that no or little snagging of the piston occurs as it is advanced out from the cylinder. Any over applied force by the lever can result in the piston crown tilting in the cylinder and cause snagging which may in fact damage the piston crown. In removing the piston crown from the cylinder and in accordance to the prior art, many itterations of force application between two studs is required or two people may need to be used to apply force to two levers substantially simultaneously to achieve an unsnagged extraction of the piston crown from the cylinder. It will hence be appreciated that this present way presents significant disadvantage and can easily lead to damage of the piston crown which may only be avoided by taking time, sufficient care and using a degree of skill.

Accordingly it is an object of the present invention to provide a piston crown puller which overcomes at least some of the abovementioned disadvantages or will at least provide the public with a useful choice.

SUMMARY OF THE INVENTION

Accordingly in the first aspect of the present invention consists in a piston crown puller for longitudinally extracting though an open end of a cylinder in an engine block, a piston crown of the type displaceable in said cylinder in a reciprocating manner in an axial direction, coaxial to the axis of said cylinder, said piston crown having at least one pair of bores provided diametrically opposed and radially outwardly on a pitch circle diameter from said axis in the combustion chamber facing surface of said piston crown, said piston crown puller comprising

an engine block supportable platform comprising (a) a base to, in use be located in a stable manner onto the engine block about the open end of said cylinder and (b) a bridging member supported by said base to in use be located over said piston crown

a piston crown lifting unit comprising (a) at least one pair of bore engaging members, each member of said pair engagble in a manner to, in said axial direction, securely locate each with a diametrically opposed bore, and (b) an interconnection

member extending between and connecting said at least one pair of bore engaging members

a means to apply a linear force to act on said bridging member and said interconnection member at a location on each which is in line with the axis of said cylinder and in a direction which is coaxial thereto to, in use , displace said piston crown engaging unit and the piston crown relative to said platform in a direction to pull the crown out from said cylinder.

Preferably base comprises of at least three legs each to be engaged onto said engine block about said open end.

Preferably said at least three legs of said base are provided at their engine block engaging ends with a shape complementary to the shape of a bore or the engine block into which they are to be located.

Preferably said at least three legs are interconnected to each other by said bridging member

Preferably each leg is threadingly secured to a selected location to said bridging member.

Preferably said bridging member provides a plurality of locations at which each leg is able to become secured thereto.

Preferably said bridging member provides an elongate adjustment slot for each leg to be slidable therein laterally to said axis, and allow a selective positioning and threaded securing of each said leg with said bridging member.

Preferably each said elongate adjustment slot includes a directional component radial to said axis.

Preferably said bridging member is a plate.

Preferably said legs extend from said plate in a direction substantially normal to a major surface of said plate

Preferably said bridging member includes a portion at which said force is applied which is located in use in axial alignment with said piston crown.

Preferably said means to apply a linear force acts to apply a force between said bridging member and said piston crown engaging unit to in use extract said piston crown from said cylinder where the force acts to displace said piston crown engaging unit and said bridging member

a) away from each other where the interconnection member is located that side of said bridging member away from said block or

b) towards each other where the bridging member is located that side of said away interconnection member from said block.

Preferably said means to apply a linear force is a rod which is threadly engaged to a complementary internal thread of the interconnection member or a sleeve being located with said interconnection member , such that said rod is

a) linearly displaceable in said axial direction to said interconnection member and

b)is rotationally but linearly non displaceable to said bridging member.

Preferably said thread providing member is provided interally of a sleeve providing is secured to said interconnection member.

Preferably said means to apply linear force is a rod which is threadly engaged to a complementary internal thread of the bridging member or a sleeve being located with said bridging member , such that said rod is

a) linearly displaceable in said axial direction to said bridging member and

b)is rotationally but linearly non displaceable to said interconnection member.

Preferably said thread providing member is provided internal of a sleeve secured to said bridging member.

Preferably a guiding means is dependent from said bridging member to engage with said interconnecting member in sliding relationship.

Preferably said guiding means provides a pair of planar surfaces parallel to said axis and each with a normal projecting in opposite direction and between which surfaces part of said interconnection member can slidingly move in said axial direction.

Preferably a guiding means is dependent from interconnection member to engage with said bridging member in sliding relationship.

Preferably said guiding means provides a pair of plánar surfaces parallel to said axis and each with a normal projecting in opposite direction and between which surfaces part of said bridging member can slidingly move in said axial direction.

Preferably said interconnection member provides a plurality of locations at which said bore engaging members may be selectively located.

Preferably said interconnection means provides an elongate slot therethough for each bore engaging member, within which the each bore engaging member can slide to be repositionable along said slot as required, and wherein a means is provided to fix each said bore engaging member at least in use with said interconnecting member.

To those skilled in the art to which the invention relates, many changes in construction in widely different embodiments and applications of the invention both suggests themselves without the departing from the scope of the invention as defined in the appending claims. Disclosure in the description herein are purely illustrative and are not intended to be in any sense limiting.

The invention consists of the foregoing and also evisages constructions of which the following give examples.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred forms of the present invention will now be described with reference to the accompanying drawings in which,

Figure 1 is a front view of a piston crown puller of the present invention and wherein in phantom there is shown a cylinder block and a piston on which the piston crown puller is supported,

Figure 2 is an end view of the piston puller as shown in Figure 1,

Figure 3 is a bottom view of the engine block supportable platform,

Figure 4 is a view from direction A of the engine blocks portal platform as shown in Figure 3,

Figure 5 is a front view of means for applying a linear force between the interconnecting member and the bridging member,

Figure 6 is a plan view of the interconnecting member of the piston crown lifting the unit,

Figure 7 is a sectional view through section B-B of Figure 6,

Figure 8 is a front view of the interconnecting member of the crown lifting unit of Figure 6,

Figure 9 is an end view of Figure 6,

Figure 10 is a side view of one of the base members of the engine block supportable platform illustrated in an exploded view,

Figure 11 is a front view of a bore engaging member also illustrated in an exploded view,

Figure 12 is an illustrative diagram of an alternative configuration of the present invention,

Figure 13 illustrates a further alternative configuration,

Figure 14 is a prior art illustration of how previously a piston crown may have been removed from a cylinder,

Figure 15 is a perspective view of one form of the piston crown puller of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to Figure 1 there is shown a piston crown puller (1) which can be supported on a cylinder block (2). The cylinder block comprises of cylinder (3) will normally be lined with a cylinder lining (4). Within the cylinder there is provided the piston assembly which normally consists of piston skirting (29) to which is secured a piston crown (5). The piston crown (5) is that portion of the piston assembly which provides the upper surface of the piston assembly on the combustion chamber side of the cylinder. Figure 1 illustrates the cylinder block assembly where the head of the cylinder has been removed exposing the open end (6) of the cylinder through which the cylinder may be extracted. The piston crown puller of the present invention is able to locate and be supported by the cylinder block in a substantially stable manner. Such support is provided by a base member (7) which is positionable on the cylinder block about the opening (6) of the cylinder (3). The base member (7) consists of at least three and most preferably four legs. These legs are positionable about the opening of the cylinder to provide a stable base for the engine block supportable platform (8) as shown in Figures 3 and 4. In an alternative configuration however the base member may be a single item such as for example a circular section of pipe (not shown) which can be located to surround the opening (6) of the cylinder (3). The base member(s) are engaged to a bridging member (9) of the engine block supportable platform in a stable manner for use. In the most preferred form as shown in Figures 3 and 4 the base members (7) are engaged to the bridging member (9) so as to be laterally displaceable yet by threaded provisions become locked to the bridging member both in the lateral and axial directions. Slots (10) are provided in the bridging member to allow for the base members (7) to be provided in a sliding relationship to the bridging member. In this form, the base members can be adjusted to be accommodated about different sized openings of a cylinder from which the piston crown is to be removed. Each base member (7) includes a threaded clamping

provision (11) which can be tightened and loosened as required to allow for the base members to be fixed or slidable in the slots (10) of the bridging member (9). An alternative configuration may be such that the slots are provided in plates of the base member (5) and threaded lugs by the bridging member. The clamping provisions may be provided with handles (12) to allow tightening and loosening to be achieved by the hand of a user of the puller device. The bridging member and the base member(s) may in an alternative form be made as a single non adjusting unit.

The bridging member in use includes at least one portion or region which is located over the piston crown. In the most preferred form that portion of the bridging member located over the crown is also located above the axis of the piston crown but with vertical clearance above the block sufficient to allow for the crown to be fully removed from the cylinder.

The piston crown puller further provides a crown lifting unit which consists of at least one pair of bore engaging members (13) and an interconnection member (14) from which the bore engaging members (13) are disposed. The interconnection member (14) holds at least one pair of bore engaging members (13) in a secure but preferably moveable relationship. The bore engaging member are preferably rods (13) which at their ends distal from the interconnection member (14) to engage with a bore (30) of the piston crown of the kind as for example shown in Figure 15. The bores of the piston crown are normally a threaded bore and accordingly the ends (15) of the rods (13) are of a thread complimentary to the thread in the bore. Indeed the ends (15) of the rods (13) may be interchangeable to allow for different sized thread to be engaged thereto to accommodate different sized threaded bores of different piston crowns. See for example Figure 11. The bores on the piston crowns are normally provided equi-spaced on a pitch circle diameter from the reciprocal axis of the piston. Provided to extend from the interconnection member (14) may be more than one pair of rods (13) for engagement with more than one diametrically opposed bores on the same pitch circle diameter of the piston crown.

The rods (13) are at least rotatable relative to the interconnection member (14) such that their rotation can engage the threads at the distal ends with the thread in the bore of the piston crowns without needing to move the interconnection member (14). Handle features (16) at the other distal end of the rods (13) may be provided to allow for a user to rotate the rods for engagement of the thread with the thread of the bore of the piston crown.

It is possible that alternatively shaped bores may be provided in a piston crown wherein such threaded engagement is not necessary. Bores may be provided with an undercut into which the ends of the rods (13) may extend and be located relatively to in an axial direction. Hence any suitable and other type of bore engagement feature may be provided to the ends of the rods.

The rods (13) are for use, disposed from the interconnection member so that they run substantially parallel to the axis of the piston cylinder location. The application force to the interconnection member in the axial direction away from the cylinder block induces the displacement of the piston crown within the cylinder for extraction. A force is provided by a linear force application means providing such force between the interconnection member (14) and the bridging member (9). In the configuration as shown in Figure 1 wherein the interconnection member (14) is on that side of the bridging member (9) away from the cylinder block, the force that is applied by the force applier is in a direction to displace the interconnection member (14) away from the bridging member (9) for the purposes of extracting the piston crown. In the alternative configuration as for example shown in Figure 12, where the interconnection member (14) is provided between the bridging member (9) and the cylinder block (2), the force that is applied is to pull the interconnection member (14) towards the bridging member (9).

In the most preferred form the means to apply a linear force between the interconnection member and the bridging member is achieved by a threaded rod which is threadingly engaged to one of the interconnection member (14) and bridging member (9) and acts to press or draw the other away or towards the first. With reference to Figure 1, the threaded rod (17) is threadingly engaged with the

interconnection means (14) and extends through a threaded sleeve (18) to rotatably but non threadingly engage onto the bridging member (9). Rotation of the threaded rod (17) relative to the threaded sleeve (18) will displace the rod relative to the sleeve and thereby displace the interconnection means (14) to the bridging member (9). Rotation in one direction will cause the interconnection means (14) to displace away from the bridging member (9) and simultaneously carry the rods (13) upwardly and displacing the piston crown towards an out of the opening (6) of the cylinder (4). The threaded rod (17) is provided to act between the interconnection member and the bridging member (9) in a location which is in line with the axis of the cylinder and which acts in a direction co-axial with the axis of the cylinder. As can be seen in Figure 1 the axis of the threaded rod (17) extends co-axially with the axis (19) of the piston cylinder. Alternative configurations to apply force between the interconnection member and the bridging member may be employed as for example shown in Figure 12 wherein the threaded rod (17) is threadingly engaged to the bridging member (9) and rotatably engaged to the interconnection member (14) and by the use of a flange (20) is able to lift the interconnection member (14) upwardly and towards the bridging member (9). Furthermore and as for example shown in Figure 13 the threaded sleeve (18) need not be part of the bridging member (9) or interconnection member (14) but may alternatively be rotatably engaged against the bridging member. In the example as shown in Figure 13 the threaded rod (17) extends through the threaded sleeve (18) which is itself rotatable relative to the bridging member (9). Handles (21) may be provided to the threaded sleeve as for example shown in Figure 13 to rotate it relative to the threaded rod (17). In the preferred version as shown in Figure 1, the threaded rod may be provided with handles to rotate the third rod relative to the sleeve (18) and the bridging member (9) or interconnection member (14). Alternatively the rod may merely be adapted to be drivable by a spanner or other separate device.

In a further alternative form the means to apply force may be a hydraulic ram acting between the bridging member (9) and interconnection member (14).

With reference to Figure 8 the interconnection member provides an aperture for each of the rods (13). This aperture (23) is preferably an elongate aperture or slot and

allows for the rods to be slidingly engaged therein. Such a slot engagement allows for the effective displacement between the two rods of each pair to be displaced to thereby accommodate different pitch circle diameter configured bores of different piston crowns. The interconnection member is made of a sufficiently rigid material as a metal such as steel and during the use of the tool wherein a force is applied via the threaded rod between the bridging member and the interconnection member, the interconnection member must withstand the bending moments induced by such a force.

The interconnection member (14) may also include feet (24) which allow for the interconnection member (14) to rest on the bridging member (9) prior to the force being applied for the extraction of the piston crown from the cylinder. Such ability to rest assist during alignment of components of the puller.

With reference to Figure 15 an alternative configuration of the interconnection member (14) is shown wherein the apertures (23) are in fact rebates in the edge of the plate defining the bridging member (14) and wherein the rebates allow for the rod to be engaged with the interconnection member (14) by rotating the interconnection member (14) in a direction so that the rods become located within the rebates.

The base members (7) are preferably provided with cylinder block engagement ends which allow for them to be located in a rebate which may be provided in the cylinder block about the cylinder opening (6). Such rebates may be in the form of threaded holes used for securing the head of the cylinder to the block (2).

The interconnection means may include flanges (22) which are provided to create some stability to the movement of the interconnection member with the platform by being able to move slidingly relative and engaged thereto. The flanges project from the interconnection member to said bridging member in the axial direction. Such flanges or additional flanges may also extend from the bridging member to the interconnection member.

With the application of force along one axis coaxial with the axis of the piston crown and substantially midway between the rods of each pair of rods, the magnitude of the lifting force applied to the crown by the rods is substantially even and in the same direction allowing for a safe and convenient way of extracting the crown from the cylinder.

CLAIMS

1. A piston crown puller for longitudinally extracting though an open end of a cylinder in an engine block, a piston crown of the type displaceable in said cylinder in a reciprocating manner in an axial direction, coaxial to the axis of said cylinder, said piston crown having at least one pair of bores provided diametrically opposed and radially outwardly on a pitch circle diameter from said axis in the combustion chamber facing surface of said piston crown, said piston crown puller comprising

an engine block supportable platform comprising (a) a base to, in use be located in a stable manner onto the engine block about the open end of said cylinder and (b) a bridging member supported by said base to in use be located over said piston crown

a piston crown lifting unit comprising (a) at least one pair of bore engaging members, each member of said pair engagble in a manner to, in said axial direction, securely locate each with a diametrically opposed bore, and (b) an interconnection member extending between and connecting said at least one pair of bore engaging members

a means to apply a linear force to act on said bridging member and said interconnection member at a location on each which is in line with the axis of said cylinder and in a direction which is coaxial thereto to, in use , displace said piston crown engaging unit and the piston crown relative to said platform in a direction to pull the crown out from said cylinder.

2. A piston crown puller as claimed in claim 1 wherein base comprises of at least three legs each to be engaged onto said engine block about said open end.

3. A piston crown puller as claimed in claim 2 wherein said at least three legs of said base are provided at their engine block engaging ends with a shape complementary to the shape of a bore or the engine block into which they are to be located.

4. A piston crown puller as claimed in claims 2 or 3 wherein said at least three legs are interconnected to each other by said bridging member.

5. A piston crown puller as claimed in any one of claim 2 to 4 wherein each leg is threadingly secured to a selected location to said bridging member.

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6. A piston crown puller as claimed in any one of claims 1 to 5 wherein said bridging member provides a plurality of locations at which each leg is able to become secured thereto.

7. A piston crown puller as claimed in any one of claims 1 to 6 wherein said bridging member provides an elongate adjustment slot for each leg to be slidable therein laterally to said axis, and allow a selective positioning and threaded securing of each said leg with said bridging member.

8. A piston crown puller as claimed in claim 7 wherein each said elongate adjustment slot includes a directional component radial to said axis.

9. A piston crown puller as claimed in any one of claims 1 to 8 wherein said bridging member is a plate.

10. A piston crown puller as claimed in claim 9 wherein said legs extend from said plate in a direction substantially normal to a major surface of said plate.

11. A piston crown puller as claimed in any one of claims 1 to 10 wherein said bridging member includes a portion at which said force is applied which is located in use in axial alignment with said piston crown.

12. A piston crown puller as claimed in any one of claims 1 to 11 wherein said means to apply a linear force acts to apply a force between said bridging member and said piston crown engaging unit to in use extract said piston crown from said cylinder where the force acts to displace said piston crown engaging unit and said bridging member

a) away from each other where the interconnection member is located that side of said bridging member away from said block or

c) towards each other where the bridging member is located that side of said away interconnection member from said block.

13. A piston crown puller as claimed in claim 12 wherein said means to apply a linear force is a rod which is threadly engaged to a complementary internal thread of the interconnection member or a sleeve being located with said interconnection member , such that in a piston crown pulling mode said rod is

a) linearly displaceable in said axial direction to said interconnection member and

b)is rotationally but linearly non displaceable to said bridging member.

14. A piston crown puller as claimed in claim 13 wherein said thread providing member is provided interally of a sleeve providing is secured to said interconnection member.

16. A piston crown puller as claimed in claim 12 wherein said means to apply linear force is a rod which is threadly engaged to a complementary internal thread of the bridging member or a sleeve being located with said bridging member , such that in a piston crown pulling mode said rod is

a) linearly displaceable in said axial direction to said bridging member and

b)is rotationally but linearly non displaceable to said interconnection member.

17. A piston crown puller as claimed in claim 16 wherein said thread providing member is provided internal of a sleeve secured to said bridging member.

18. A piston crown puller as claimed in any one of claim 1 to 16 wherein a guiding means is dependent from said bridging member to engage with said interconnecting member in sliding relationship.

19. A piston crown puller as claimed in claim 18 wherein said guiding means provides a pair of planar surfaces parallel to said axis and each with a normal projecting in opposite direction and between which surfaces part of said interconnection member can slidingly move in said axial direction.

20. A piston crown puller as claimed in any one of claim 1 to 16 wherein a guiding means is dependent from interconnection member to engage with said bridging member in sliding relationship.

21. A piston crown puller as claimed in claim 20 wherein said guiding means provides a pair of planar surfaces parallel to said axis and each with a normal projecting in opposite direction and between which surfaces part of said bridging member can slidingly move in said axial direction.



22. A piston crown puller as claimed in any one of claims 1 to 21 wherein said interconnection member provides a plurality of locations at which said bore engaging members may be selectively located.

23. A piston crown puller as claimed in any one of claim 1 to 22 wherein said interconnection member provides an elongate slot therethough for each bore engaging member, within which each bore engaging member can slide to be repositionable along said slot as required, and wherein a means is provided to fix each said bore engaging member at least in use with said interconnecting member.

