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RING FASTENER

Abstract

A ring fastener comprising a discontinuous band having first and second axial faces on opposite sides, a first end with a first end face and a groove extending from the first end face and opening to the first axial face; a second end with a second end face and a tongue projecting from the second end face; wherein the groove is u-shaped and the second axial face defines the base of the groove, and the tongue is dimensioned to fit in the groove; such that, when the tongue is received in the groove, the first end is located relative to the second end and a continuous ring is formed. A method of assembling the ring fastener into a circumferential groove in a component comprises the steps of feeding the ring fastener into the groove so that the ends are adjacent to each other; distorting the second end axially out of the plane of the groove; bringing the ends towards each other until the tongue overlies the groove; and inserting the tongue into the groove so that the ends are within groove.

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Background/Summary

FIELD OF INVENTION

[0001] This invention relates to a ring fastener, such as a retaining ring, and methods of assembling the ring fastener into a groove of a component.

BACKGROUND TO THE INVENTION

[0002] Retaining rings can have many different applications, but are often used to secure components together, such as to secure two rotating parts together. For example, a retaining ring can be fitted into a groove on an internal surface of a bore to act as a shoulder to mount or secure a component in the bore.

[0003] One example of a retaining ring is a spiral retaining ring, which comprises a single turn band with a gap in the circumference of the ring. When installed, the ends of the ring are brought together and can be in contact. However, during use, any thermal expansion of the ring can cause the ends of the ring to move apart, thus opening up the gap. This type of retaining ring therefore does not provide reliable full circumference support for the components during use.

[0004] Some retaining rings overcome this problem by providing a two or more turn retaining ring. However, the material used to produce such a ring is much thinner than a single turn ring, and as such each ring does not provide sufficient torsional stiffness. This can result in the ring twisting during use, which can reduce the stability of the ring and its ability to effectively secure components together.

[0005] WO2020/234572 describes a ring fastener comprising a discontinuous band having a first end and a second end. The first end comprises a pair of spaced-apart elongate finger members (having a first finger member and a second finger member), and the second end comprises an elongate tongue member. The finger members and the tongue member are interlockable, such that when interlocked, the band comprises a continuous circumference. The ring fastener further comprises a closed configuration wherein the finger members and the tongue member are substantially aligned with a circumferential surface of the band; and an open configuration wherein the first finger member is radially and/or axially deflected from its substantially aligned position, so that it is angled with respect to the circumferential surface of the band.

[0006] The present invention therefore aims to provide reliable full circumference support during use, whilst also maintaining a stable and effective connection between two components with a relatively simple and robust construction.

SUMMARY OF THE INVENTION

[0007] A first aspect of the invention comprises a ring fastener comprising: [0008] a discontinuous band having first and second axial faces on opposite sides, [0009] a first end with a first end face and a groove extending from the first end face and opening to the first axial face; [0010] a second end with a second end face and a tongue projecting from the second end face [0011] wherein the tongue is dimensioned to fit in the groove; [0012] such that, when the tongue is received in the groove, the first end is located relative to the second end and a continuous ring is formed.

[0013] The tongue and groove arrangement is relatively robust and can be assembled and disassembled by simply distorting the ring to engage or disengage the tongue and groove.

[0014] The groove can be u-shaped and the second axial face defines the base of the groove.

[0015] The axial thickness of the tongue can be substantially the same as the axial depth of the groove. In this way, the surface of the tongue can be substantially flush with the first axial face of

the ring at the first end. This avoids any part projecting in a way that could catch or interfere with other components in use. The tongue can extend from the first axial face of the second end and can be set back from the second axial face of the second end. Thus, the first and second axial faces of the first and second ends can be aligned and flush.
[0016] The tongue can have parallel radial sides and a terminal end face. The tongue can comprise an angled edge between one of the radial sides of the tongue and the terminal end. This can aid in insertion of the tongue into the groove.
[0017] The length of the groove from the first end face can be greater than the length of the tongue extending from the second end face. This can avoid the end face of the tongue contacting the end of the groove and causing distortion or damage of one and/or the other.
[0018] The first and second end faces can be spaced apart when the tongue is received in the groove. This allows some relative movement of the end faces due to thermal expansion or contraction or other forces.
[0019] Another aspect of the invention comprises a method of assembling a ring fastener into a circumferential groove in a component, the method comprising the steps of: [0020] feeding the ring fastener into the circumferential groove so that the first and second ends are adjacent to each other; [0021] distorting the second end axially out of the plane of the circumferential groove; [0022] bringing the first and second ends towards each other until the tongue overlies the groove; and [0023] inserting the tongue into the groove so that the first and second ends are within the circumferential groove of the component.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0024] FIG. **1** shows a portion of an embodiment of a ring fastener in an interlocked position.
[0025] FIG. **2** shows a cross section on the line AA of FIG. **1**.
[0026] FIG. **3** shows a perspective view of the portion shown in FIG. **1**.
DETAILED DESCRIPTION OF EMBODIMENTS
[0027] The ring fastener shown in the drawings is essentially circular in shape. Only part of the ring is shown in the drawings.
[0028] The ring fastener shown in the drawing is typical of such fasteners used in turbines such as gas turbines for securing components, for example within bores. The fasteners will be made from alloys having suitable high temperature strength and oxidation resistance.
[0029] The fastener is formed from a metal strip **10** having a substantially rectangular cross section with rounded corners. The strip has axial faces and radial faces.
[0030] The strip does not form a complete circle, but instead is discontinuous, having opposed end faces **12**, **14**.
[0031] A first end **16** of the strip **10** is formed with a groove **18** which extends from an open end **20** at the first end face **12** and opens onto one of the axial surfaces **22**. The other axial surface **24** defines the base of the groove **18** which is essentially u-shaped, the radial sides of the strip **26**, **28** defining the sides of the groove **18**. The closed end **30** of the groove **18** is radiused.
[0032] The second end **32** of the strip **10** is formed with a tongue **34** projecting from the second end face **14**. The tongue **34** is substantially straight-sided and has a squared-off terminal end face **36**. There is an angled edge **38** between one side **40** and the terminal end face **36**. The tongue **34** is narrower than the width of the strip **10** and is dimensioned so as to be able to fit in the groove **18**.
[0033] The tongue **34** is offset to one side of the second end **32** so that one face **42** of the tongue is flush with the axial face **22** of the strip **10**. The other face **44** of the tongue is set back from the opposite axial face **24** of the strip **10**. The thickness of the tongue **34** is about the same as the dept of the groove **18** so that when the tongue **34** is seated in the groove **18**, its face **42** is substantially

flush with the axial face **22** of the first end **16**.
[0034] In use, one end of the strip **10** will be fed into a groove in a component, such as a circumferential groove (not shown), and the strip **10** fed around the component until the two ends **16**, **32** are close to each other. At this point, the second end **32** with the tongue **34** can be bent away from the plane of the circle and forced to lie over the first end **16** with the groove **18**. The tongue **34** can then be urged into the groove **18**, the angled edge **38** allowing the tongue **34** to clear the side of the groove **18**. At this point, part of the tongue **34** will sit in the groove **18** so that the ring fastener presents a complete circumference but with the end faces **12**, **14** separated by a small distance. The length of the tongue **34** is such that the terminal end face **36** of the tongue **34** will not contact the closed end **30** of the groove **18** even when the tongue **34** is fully inserted into the groove **18** and the end faces **12**, **14** abut each other. The space between the end faces **12**, **14** allows expansion or contraction due to temperature changes to be accommodated without displacing the ring from the groove.
[0035] Holes **46**, **48** are provided in the face **22** of the strip near each end **16**, **32** to allow the use of assembly tools (not shown) to manipulate the ends **16**, **32** of the strip **10** so that the tongue **34** can be instead into or removed from the groove **18**.
[0036] The invention has been described above with reference to one specific embodiment. Various changes or modifications can be made without departing from the scope of the invention.

Claims

1. A ring fastener comprising: a discontinuous band having first and second axial faces on opposite sides, a first end with a first end face and a u-shaped groove extending from the first end face and opening to the first axial face, wherein the second axial face defines the base of the groove; a second end with a second end face and a tongue projecting from the second end face wherein the tongue is dimensioned to fit in the groove; such that, when the tongue is received in the groove, the first end is located relative to the second end and a continuous ring is formed.
2. (canceled)
3. The ring fastener as claimed in claim 1, wherein the axial thickness of the tongue is substantially the same as the axial depth of the groove.
4. The ring fastener as claimed in claim 1, wherein the tongue extends from the first axial face of the second end.
5. The ring fastener as claimed in claim 4, wherein the tongue is set back from the second axial face of the second end.
6. The ring fastener as claimed in claim 1, where the tongue has parallel radial sides and a terminal end face.
7. The ring fastener as claimed in claim 1, wherein the tongue comprises an angled edge between one of the radial sides of the tongue and the terminal end.
8. The ring fastener as claimed in claim 1, wherein the length of the groove from the first end face is greater than the length of the tongue extending from the second end face.
9. The ring fastener as claimed in claim 1, wherein the first and second end faces are spaced apart when the tongue is received in the groove.
10. A method of assembling a ring fastener as claimed in claim 1 into a circumferential groove in a component, the method comprising the steps of: feeding the ring fastener into the circumferential groove so that the first and second ends are adjacent to each other; distorting the second end axially out of the plane of the circumferential groove; bringing the first and second ends towards each other until the tongue overlies the groove; and inserting the tongue into the groove so that the first and second ends are within the circumferential groove of the component.