thermal conditions that this wicker configuration can be used to provide axial restraint. These physical limits may be exceeded with the higher pressures and temperatures associated with deepwater subsea wells.

[0008] Sill another method that may be used is to provide a separate lockdown sub dedicated to providing axial restraint for the casing hanger seal and casing hanger. However, the installation of a lockdown sub requires an additional trip of the drill string into and out of the well, a considerable expense. In addition, the lockdown sub occupies space, which is limited in a wellhead. Finally, the lockdown sub does not provide the axial restriant immediately upon installation of the casing hanger and casing hanger seal.

[0009] Therefore, an improved technique for preventing axial movement of a casing hanger and casing hanger seal within a wellhead is needed. In particular, a technique is needed to prevent axial movement of a casing hanger or tubing hanger seal within a wellhead immediately upon installation of the casing hanger and casing hanger seal, without interfering with the flow of fluids in the annulus surrounding the casing hanger during cementing operations, without occupying additional space in the wellhead, or requiring additional trips into the well.

BRIEF DESCRIPTION

[0009a] According to one aspect, there is provided a wellhead assembly, comprising: a housing, comprising an inner bore and an inner profile disposed around a portion of the inner bore of the housing; and a seal assembly adapted to form a seal between a tubular member and the housing, the seal assembly, comprising: a seal member; an energizing ring adapted to be driven into the seal member to expand the seal member into sealing engagement with an inner surface of the housing and an outer surface of the tubular member; a latch ring secured to and carried by the seal member and axially movable relative to the seal member and the tubular member, wherein the latch ring is adapted to be driven outward into the inner profile of the housing, whereupon axial movement of the seal assembly is restricted by abutment between the latch ring and the inner profile of the housing; and wherein the tubular member comprises a tapered shoulder and the latch ring comprises a first tapered surface, the tapered shoulder of the tubular member and the first tapered surface of the latch ring being adapted to

cooperate to drive the latch ring outward when the seal assembly and the tubular member abut.

[0009b] According to another aspect, there is provided a wellhead assembly, comprising: a housing, comprising an inner bore and an inner profile disposed around a portion of the inner bore of the housing; a seal assembly adapted to form a seal between a tubular member and the housing, the seal assembly comprising: a seal member; an energizing ring adapted to be driven into the seal member to expand the seal member into sealing engagement with an inner surface of the housing and an outer surface of the tubular member; and a latch ring secured to the seal member and axially movable relative to the seal member, wherein the latch ring is adapted to be driven outward into the inner profile of the housing, whereupon axial movement of the seal assembly is restricted by abutment between the latch ring and the inner profile of the housing; wherein the tubular member comprises a tapered shoulder and the latch ring comprises a first tapered surface, the tapered shoulder of the tubular member and the first tapered surface of the latch ring being adapted to cooperate to drive the latch ring outward when the seal assembly and the tubular member abut; wherein the seal assembly comprises a nose ring having a tapered surface and the latch ring comprises a second tapered surface, the tapered surface of the nose ring and the second tapered surface of the latch ring being adapted to cooperate to drive the latch ring outward when the seal assembly is abutted against the tubular member; and wherein the latch ring comprises a first catch surface and the nose ring comprises a second catch surface, the first catch surface and second catch surface being adapted to cooperate to lift the latch ring when the nose ring is lifted from the housing during removal of the seal assembly.

[0010] Herein disclosed is a~~A~~ wellhead system comprising a seal with a movable restraining member adapted to cooperate with a housing to restrict axial movement of the seal. The seal is adapted to form a seal between the housing, such as a high pressure wellhead, and a tubular member, such as a casing hanger. The restraining member may be a ring that is expanded outward as the seal is installed within the wellhead. The ring may have a split to facilitate the expansion of the ring outward. In addition, the ring may be adapted with a tapered surface that slidingly engages a corresponding tapered surface on the hanger as the seal is installed within the wellhead. The sliding engagement of the tapered surfaces cooperates to urge the restraining member outward. In addition, the corresponding tapered surface may be a shoulder of the tubular member. The seal

CLAIMS:

1. A seal assembly (40) for a wellhead assembly (20), comprising:

a sealing portion (46) having a vertical slot (56);

an energizing ring (48) adapted to be driven into the vertical slot (56) of the sealing portion (46) to expand the sealing portion (46) into sealing engagement with at least one adjacent surface (32, 64); and

an axial restraining member (52, 124) coupled to the sealing portion (46) of the seal assembly (40), the axial restraining member (52, 124) being adapted to be driven outward into a profile (72, 74, 128) surrounding the axial restraining member (52, 124).

2. The seal assembly as recited in claim 1, wherein the axial restraining member (52, 124) comprises a latch ring (52, 124) having at least one protrusion (68, 70, 126) extending circumferentially around the latch ring, the at least one protrusion (68, 70, 126) being adapted to be received into the profile (72, 74, 128) surrounding the axial restraining member (52, 124).

3. The seal assembly as recited in claim 2, wherein the at least one protrusion (126) is adapted to abut the profile when the latch ring (52, 124) is driven outward into the profile (128) surrounding the latch ring.

4. The seal assembly as recited in claim 2, wherein the latch ring (52. 124) comprises a downward-facing tapered surface (84) adapted to slidingly engage a corresponding upward-facing tapered shoulder (86) within the wellhead system (20) to drive the latch ring (52, 124) outward as the seal assembly (40) is disposed within the wellhead assembly.

5. The seal assembly as recited in claim 4, wherein the seal assembly (40) comprises a nose ring (50) secured to the sealing portion (46) of the seal assembly (40), the latch ring (52, 124) being secured to the nose ring (50) and axially moveable relative to the nose ring (50).

6. The seal assembly as recited in claim 5, wherein the latch ring (52, 124) comprises an inward-facing tapered surface (88) adapted to slidingly engage a corresponding outward facing tapered surface (90) on the nose ring (50) to drive the latch ring (52, 124) outward as the seal assembly (40) is disposed within the wellhead assembly (20).

7. The seal assembly as recited in claim 6, wherein the latch ring (52, 124) comprises a first surface (98) and the nose ring (50) comprises a second surface (96), the first surface (98) and the second surface (96) being adapted so that the second surface (96) catches the first surface (98) as the seal assembly (40) is lifted from the wellhead assembly (20).

8. A wellhead assembly (20), comprising:

a housing (24), comprising an inner bore (32) and an inner profile (72, 74, 128) disposed around a portion of the inner bore (32) of the housing (24); and

a seal assembly (40) adapted to form a seal between a tubular member (26) and the housing (24), the seal assembly (40) comprising:

a seal member (46);

an energizing ring (48) adapted to be driven into the seal member (46) to expand the seal member (46) into sealing engagement with an inner surface of the housing (24) and an outer surface of the tubular member; and

a latch ring (52, 124) secured to the seal member and axially movable relative to the seal member, wherein the latch ring (52, 124) is adapted to be driven outward into the inner profile of the housing (24), whereupon axial movement of the seal assembly (40) is restricted by abutment between the latch ring (52, 124) and the inner profile (72, 74, 128) of the housing (24).

9. The wellhead assembly as recited in claim 8, wherein the latch ring (52, 124) is a split ring.

10. The wellhead assembly as recited in claim 8, wherein the tubular member (26) comprises a tapered shoulder (86) and the latch ring (52, 124) comprises a first tapered surface (84) , the tapered shoulder (86) of the tubular member (26) and the first tapered surface (84) of the latch ring (52, 124) being adapted to cooperate to drive the latch ring (52, 124) outward when the seal assembly (40) and the tubular member (26) abut.

11. The wellhead assembly as recited in claim 10, wherein the seal assembly (40) comprises a nose ring (50) having a tapered surface (90) and the latch ring (52, 124) comprises a second tapered surface (88), the tapered surface (90) of the nose ring (50) and the second tapered surface (88) of the latch ring (52, 124) being adapted to cooperate to drive the latch ring (52, 124) outward when the seal assembly (40) is abutted against the tubular member (26).

12. The wellhead assembly as recited in claim 11, wherein the latch ring (52, 124) comprises a first catch surface (98) and the nose ring (50) comprises a second catch surface (96), the first catch surface (98) and second catch surface (96) being adapted to cooperate to lift the latch ring (52, 124) when the nose ring (50) is lifted from the housing (24) during removal of the seal assembly (40).

The invention claimed is:

1. A wellhead assembly, comprising:

a housing, comprising an inner bore and an inner profile disposed around a portion of the inner bore of the housing; and

a seal assembly adapted to form a seal between a tubular member and the housing, the seal assembly, comprising:

a seal member;

an energizing ring adapted to be driven into the seal member to expand the seal member into sealing engagement with an inner surface of the housing and an outer surface of the tubular member;

a latch ring secured to and carried by the seal member and axially movable relative to the seal member and the tubular member, wherein the latch ring is adapted to be driven outward into the inner profile of the housing, whereupon axial movement of the seal assembly is restricted by abutment between the latch ring and the inner profile of the housing; and

wherein the tubular member comprises a tapered shoulder and the latch ring comprises a first tapered surface, the tapered shoulder of the tubular member and the first tapered surface of the latch ring being adapted to cooperate to drive the latch ring outward when the seal assembly and the tubular member abut.

2. The wellhead assembly as recited in claim 1, wherein the latch ring is a split ring.

3. The wellhead assembly as recited in claim 1, wherein the seal assembly comprises a nose ring having a tapered surface and the latch ring comprises a second tapered surface, the tapered surface of the nose ring and the second tapered surface of the latch ring being adapted to cooperate to drive the latch ring outward when the seal assembly is abutted against the tubular member.

4. The wellhead assembly as recited in claim 3, wherein the latch ring comprises a first catch surface and the nose ring comprises a second catch surface, the first catch surface and second catch surface being adapted to cooperate to lift the latch ring when the nose ring is lifted from the housing during removal of the seal assembly.

5. The wellhead assembly as recited in claim 1, wherein the tapered shoulder comprises an upward-facing tapered surface.

6. The wellhead assembly as recited in claim 5, wherein the first tapered surface of the latch ring comprises a downward-facing tapered surface.

7. The wellhead assembly as recited in claim 1, wherein the seal assembly comprises a first series of wickers and the tubular member comprises a second series of wickers, the first series of wickers being urged against the second series of wickers when the seal member engages the tubular member.

8. A wellhead assembly, comprising:

a housing, comprising an inner bore and an inner profile disposed around a portion of the inner bore of the housing;

a seal assembly adapted to form a seal between a tubular member and the housing, the seal assembly comprising:

a seal member;

an energizing ring adapted to be driven into the seal member to expand the seal member into sealing engagement with an inner surface of the housing and an outer surface of the tubular member; and

a latch ring secured to the seal member and axially movable relative to the seal member, wherein the latch ring is adapted to be driven outward into the inner profile of the housing, whereupon axial movement of the seal assembly is restricted by abutment between the latch ring and the inner profile of the housing;

wherein the tubular member comprises a tapered shoulder and the latch ring comprises a first tapered surface, the tapered shoulder of the tubular member and the first tapered surface of the latch ring being adapted to cooperate to drive the latch ring outward when the seal assembly and the tubular member abut;

wherein the seal assembly comprises a nose ring having a tapered surface and the latch ring comprises a second tapered surface, the tapered surface of the nose ring and the second tapered surface of the latch ring being adapted to cooperate to drive the latch ring outward when the seal assembly is abutted against the tubular member; and

wherein the latch ring comprises a first catch surface and the nose ring comprises a second catch surface, the first catch surface and second catch surface being adapted to

cooperate to lift the latch ring when the nose ring is lifted from the housing during removal of the seal assembly.