of lugs which project outwardly from the housings. The lugs are adapted to receive fasteners, such as nuts and bolts, which are adjustably tightenable to draw the segments toward one another.

Some retainers use teeth that are angularly oriented with respect to a line extending radially from an axis coaxial with the central space. The proper angular orientation allows the teeth to be "self-actuating", i.e., the mechanical engagement between the teeth and the pipe elements increases with increasing force on the pipe elements trying to draw or push them out of the coupling. Hence, the force resisting withdrawal increases with the applied force that would otherwise cause withdrawal. However, if such retainers are oriented improperly, for example, if the retainer is reversed within the coupling, then the teeth will not be self-actuating against forces which would draw or push the pipe element out of the coupling. Thus the retainer would not provide sufficient mechanical engagement against withdrawal and the pipe elements will not be securely held within the coupling. For couplings having retainers it is difficult to determine if the retainers are properly oriented once the coupling has been installed. It would be advantageous if pipe couplings could be designed so that the user is alerted if the retainer is not properly oriented during assembly of the joint.

Summary

According to a first aspect of the present invention, there is provided a coupling for joining pipe elements, said coupling comprising:

a plurality of segments attached to one another end to end surrounding a central space for receiving said pipe elements, each of said segments comprising:

first and second channels positioned on opposite sides of said segments, each of said channels extending between said ends of said segments and having a first floor and a second floor facing said central space, said first floor having a greater radius of curvature than said second floor;

first and second retainers positioned respectively in said first and second channels, each of said retainers comprising a band having oppositely disposed ends, a plurality of teeth being positioned along one edge of said band and projecting toward said central space, at least one tab being positioned along an opposite edge of said band, said band overlying said first floor, said at least one tab overlying said second floor when said retainers are positioned within said channels.

According to a second aspect of the present invention, there is provided a coupling for joining pipe elements, said coupling comprising:

a plurality of segments attached to one another end to end surrounding a central space for receiving said pipe elements, each of said segments comprising:

at least a first channel positioned on a first side of said segments, said first channel extending between said ends of said segments;

a first aperture in at least one of said segments, said first aperture providing a line of sight toward said central space,

wherein said first channels have a first floor and a second floor facing said central space, said first floor having a greater radius of curvature than said second floor;

a first retainer positioned in said first channels, said first retainer comprising a band having oppositely disposed ends, a plurality of teeth being positioned along one edge of said band and projecting toward said central space, at least one tab being positioned along an opposite edge of said band, said band overlying said first floor, said tabs overlying said second floor when said retainer is positioned within said channels.

In one example embodiment the coupling comprises a plurality of segments attached to one another end to end surrounding a central space for receiving the pipe elements. By way of example there may be no more than a first and a second segment. Each of the segments comprises first and second channels positioned on opposite sides of the segments. Each of the channels extends between the ends of the segments and has a first floor and a second floor facing the central space. The first floor has a greater radius of curvature than the second floor.

at the interface between the segments. Further by way of example a second aperture is positioned in at least one of the segments. The second aperture provides a line of sight toward the central space and may be aligned with the second channel. In a specific example the second aperture is positioned between two of the segments. The second aperture may comprise a trough at the interface between the segments.

Another example embodiment comprises first and second attachment members positioned at opposite ends of the segments. At least one of the attachment members is adjustably tightenable for drawing the first and second segments toward one another. In one example embodiment the first attachment member comprises first and second lugs positioned respectively on the first and second segments. The first and second lugs are in facing relation. A first fastener extends between the first and second lugs. Tightening of the first fastener draws the segments toward one another. In another example embodiment the second attachment member comprises third and fourth lugs positioned respectively on the first and second segments. The third and fourth lugs are in facing relation. A second fastener extends between the third and fourth lugs. Tightening of the second fastener draws the segments toward one another.

There is also disclosed a coupling for joining pipe elements which, by way of example, comprises a plurality of segments (for example, no more than a first and a second segment) attached to one another end to end surrounding a central space for receiving the pipe elements. In this example embodiment each of the segments comprises at least one channel positioned on one side of the segments. The at least one channel extends between the ends of the segments and has a first floor and a second floor facing the central space. The first floor has a greater radius of curvature than the second floor. A retainer is positioned in the at least one channel. The retainer comprises a band having oppositely disposed ends. A plurality of teeth are positioned along one edge of the band

and project toward the central space. At least one tab is positioned along an opposite edge of the band. The band overlies the first floor, the tab overlies the second floor when the retainer is positioned within the at least one channel. A plurality of tabs is advantageous.

There is also disclosed a method of joining pipe elements. In one example embodiment the method comprises:

inserting at least a first pipe element into a central space defined by a plurality of segments attached to one another end to end in spaced relation sufficient to permit insertion of the pipe elements; and

observing, through a first aperture in at least one of the segments, whether or not the first pipe element is present within the central space.

The example method may further comprise:

inserting at least a second pipe element into the central space; and

observing, through a second aperture in at least one of the segments, whether or not the second pipe element is present within the central space.

Additionally by way of example, the method may further comprise:

adjusting positions of the pipe elements within the central space if the pipe elements are not present within the central space; and

drawing the segments toward the central space and into engagement with the pipe elements once the pipe elements are observed to be present within the central space.

What is claimed is:

1. A coupling for joining pipe elements, said coupling comprising:

a plurality of segments attached to one another end to end surrounding a central space for receiving said pipe elements, each of said segments comprising:

first and second channels positioned on opposite sides of said segments, each of said channels extending between said ends of said segments and having a first floor and a second floor facing said central space, said first floor having a greater radius of curvature than said second floor;

first and second retainers positioned respectively in said first and second channels, each of said retainers comprising a band having oppositely disposed ends, a plurality of teeth being positioned along one edge of said band and projecting toward said central space, at least one tab being positioned along an opposite edge of said band, said band overlying said first floor, said at least one tab overlying said second floor when said retainers are positioned within said channels.

2. The coupling according to claim 1, further comprising a plurality of said tabs.

3. The coupling according to claim 1, further comprising:

a third channel positioned between said first and second channels in each of said segments, said third channels extending between said ends of said segments and facing said central space.

4. The coupling according to claim 3, wherein said at least one tab projects toward said third channel.

5. The coupling according to claim 1, wherein said teeth are oriented angularly with respect to a line extending radially from an axis arranged coaxially with said central space.

6. The coupling according to claim 1, wherein said at least one tab is oriented perpendicularly to a line extending radially from an axis arranged coaxially with said central space.

7. The coupling according to claim 1, wherein said at least one tab is offset from said band toward an axis arranged coaxially with said central space.

8. The coupling according to claim 1, comprising no more than a first and a second of said segments joined end to end surrounding said central space.

9. The coupling according to claim 8, further comprising first and second attachment members positioned at opposite ends of said first and second segments, at least one of said attachment members being adjustably tightenable for drawing said first and second segments toward one another.

10. The coupling according to claim 9, wherein said first attachment member comprises:

first and second lugs positioned respectively on said first and second segments, said first and second lugs being in facing relation;

a first fastener extending between said first and second lugs, tightening of said first fastener drawing said segments toward one another.

11. The coupling according to claim 10, wherein said second attachment member comprises:

third and fourth lugs positioned respectively on said first and second segments, said third and fourth lugs being in facing relation;

a second fastener extending between said third and fourth lugs, tightening of said second fastener drawing said segments toward one another.

12. The coupling according to claim 1, further comprising a first aperture in at least one of said segments, said first aperture providing a line of sight toward said central space.

13. The coupling according to claim 12, wherein said first aperture is aligned with said first channel.

14. The coupling according to claim 12, wherein said first aperture is positioned between two of said segments.

15. The coupling according to claim 14, wherein said first aperture comprises a trough positioned at an interface between said two segments.

16. The coupling according to claim 12, further comprising a second aperture in at least one of said segments, said second aperture providing a line of sight toward said central space.

17. The coupling according to claim 16, wherein said second aperture is aligned with said second channel.

18. The coupling according to claim 16, wherein said second aperture is positioned between two of said segments.

19. The coupling according to claim 18, wherein said second aperture comprises a trough positioned at an interface between said two segments.

20. The coupling according to claim 1, further comprising:

a ring seal positioned within said third channels, said ring seal having an inner surface sized to receive said pipe elements and an outer surface sized to support said segments in spaced apart relation sufficient to permit insertion of said pipe elements into said central space while said segments are attached to one another.

21. The coupling according to claim 20, wherein said retainer bands are sized to cooperate with said ring seal to support said segments in said spaced apart relation.

22. A coupling for joining pipe elements, said coupling comprising:

a plurality of segments attached to one another end to end surrounding a central space for receiving said pipe elements, each of said segments comprising:

at least a first channel positioned on a first side of said segments, said first channel extending between said ends of said segments;

a first aperture in at least one of said segments, said first aperture providing a line of sight toward said central space,

wherein said first channels have a first floor and a second floor facing said central space, said first floor having a greater radius of curvature than said second floor;

a first retainer positioned in said first channels, said first retainer comprising a band having oppositely disposed ends, a plurality of teeth being positioned along one edge of said band and projecting toward said central space, at least one tab being positioned along an opposite edge of said band, said band overlying said first floor, said tabs overlying said second floor when said retainer is positioned within said channels.

23. The coupling according to claim 22, wherein said first aperture is aligned with said first channel.

24. The coupling according to claim 22, wherein said first aperture is positioned between two of said segments.

25. The coupling according to claim 24, wherein said first aperture comprises a trough positioned at an interface between said two segments.

26. The coupling according to claim 25, wherein said second aperture is positioned between two of said segments.

27. The coupling according to claim 26, wherein said second aperture comprises a trough positioned at an interface between said two segments.

28. The coupling according to claim 22, further comprising a second aperture in at least one of said segments, said second aperture providing a line of sight toward said central space.

29. The coupling according to claim 28, wherein said second aperture is aligned with a second channel positioned on a second side of said segments opposite said first side.

30. The coupling according to claim 22 further comprising a plurality of said tabs.

31. The coupling according to claim 22, further comprising:

a third channel positioned adjacent to said first channels in each of said first and second segments, said third channels extending between said ends of said segments and facing said central space.

32. The coupling according to claim 22, wherein said teeth are oriented angularly with respect to a line extending radially from an axis arranged coaxially with said central space.

33. The coupling according to claim 22, wherein said at least one tab is oriented perpendicularly to a line extending radially from an axis arranged coaxially with said central space.

34. The coupling according to claim 22, wherein said at least one tab is offset from said band toward an axis arranged coaxially with said central space.

35. The coupling according to claim 31, wherein said at least one tab projects toward said third channel.

36. The coupling according to claim 22, comprising at most a first and a second of said segments.

37. The coupling according to claim 36, further comprising first and second attachment members positioned at opposite ends of said first and second segments, at least one of said attachment members being adjustably tightenable for drawing said first and second segments toward one another.

38. The coupling according to claim 27, wherein said first attachment member comprises:

first and second lugs positioned respectively on said first and second segments, said first and second lugs being in facing relation;

a first fastener extending between said first and second lugs, tightening of said first fastener drawing said segments toward one another.

39. The coupling according to claim 38, wherein said second attachment member comprises:

third and fourth lugs positioned respectively on said first and second segments, said third and fourth lugs being in facing relation;

a second fastener extending between said third and fourth lugs, tightening of said second fastener drawing said segments toward one another.

40. The coupling according to claim 31, further comprising:

a ring seal positioned within said third channels, said ring seal having an inner surface sized to receive said pipe elements and an outer surface sized to support said segments in spaced apart relation sufficient to permit insertion of said pipe elements into said central space while said segments are attached to one another.

41. The coupling according to claim 40, wherein said retainer bands are sized to cooperate with said ring seal to support said segments in said spaced apart relation.