The arcuate projections on prior art couplings for grooved pipe elements typically have arcuate surfaces with a radius of curvature that is marginally larger than the radius of curvature of the outer surface of the pipe element within the groove that it is intended to engage. For couplings used with grooved pipe elements, the radii of curvature of the arcuate surfaces are smaller than the radii of curvature of the outer surfaces of the pipe elements outside of the grooves so that the projections fit within and engage the grooves.

Methods of securing pipe elements in end to end relation comprise a sequential installation process when mechanical couplings according to the prior art are used. Typically, the coupling is received by the technician with the segments bolted together and the ring gasket captured within the segments' channels. The technician first disassembles the coupling by unbolting it, removes the ring gasket, lubricates it (if not pre-lubricated) and places it around the ends of the pipe elements to be joined. Installation of the ring gasket often requires that it be lubricated and stretched to accommodate the pipe elements. With the ring gasket in place on both pipe elements, the segments are then placed one at a time straddling the ends of the pipe elements and capturing the ring gasket against them. During placement, the segments engage the gasket, the projections are aligned with the grooves, the bolts are inserted through the lugs, the nuts are threaded onto the bolts and tightened, drawing the coupling segments toward one another, compressing the gasket and engaging the projections within the grooves.

As evident from the previous description, installation of mechanical pipe couplings according to the prior art requires that the technician typically handle at least seven individual piece parts (and more when the coupling has more than two segments), and must totally disassemble and reassemble the coupling. Significant time, effort and expense would be saved if the technician could install a mechanical pipe coupling without first totally disassembling it and then reassembling it, piece by piece.

Summary

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

first and second segments attached to one another end to end surrounding a central space for receiving said pipe elements;

a spring assembly joining a first end of said first segment to a first end of said second segment, said spring assembly comprising:

a first boss projecting from said first end of said first segment;

a second boss projecting from said first end of said second segment and positioned adjacent to said first boss;

a first fulcrum positioned on said first boss and contacting said second boss, said segments pivoting about said fulcrum;

a link extending between and attaching said first and second bosses to one another;

said coupling further comprising an adjustable attachment assembly joining a second end of said first segment to a second end of said second segment; wherein

said spring assembly biases said second ends of said segments away from one another when said segments are attached to one another end to end, said adjustable attachment assembly adapted to draw said second ends of said first and second segments toward one another for engaging said segments with said pipe elements.

According to a second aspect of the present invention, there is disclosed, in combination, a pair of pipe elements and a coupling for joining said pipe elements, said coupling comprising:

first and second segments attached to one another end to end surrounding a central space for receiving said pipe elements;

a spring assembly joining a first end of said first segment to a first end of said second segment, said spring assembly comprising:

a first boss projecting from said first end of said first segment;

a second boss projecting from said first end of said second segment and positioned adjacent to said first boss;

a first fulcrum positioned on said first boss and contacting said second boss, said segments pivoting about said first fulcrum;

a link extending between and attaching said first and second bosses to one another;

said combination further comprising an adjustable attachment assembly joining a second end of said first segment to a second end of said second segment; wherein

said spring assembly biases said second ends of said segments away from one another when said

segments are attached to one another end to end, said adjustable attachment assembly adapted to draw said second ends of said first and second segments toward one another for engaging said segments with said pipe elements.

According to a third aspect of the present invention, there is disclosed a method of joining first and second pipe elements to one another using a spring assembly attaching first ends of first and second segments together, in conjunction with an adjustable attachment assembly attaching second ends of said first and second segments together, to hold said second ends of said segments in spaced apart relation sufficient to insert said first and second pipe elements into a central space surrounded by said first and second segments, said spring assembly comprising:

a first boss projecting from said first end of said first segment;

a second boss projecting from said first end of said second segment and positioned adjacent to said first boss;

a fulcrum positioned on said first boss and contacting said second boss, said segments pivoting about said fulcrum;

a link extending between and attaching said first and second bosses to one another;

said method further comprising:

biasing said second ends of said first and second segments away from one another when said segments are attached to one another surrounding said central space; inserting said first pipe element into said central space;

inserting said second pipe element into said central space;

adjusting said adjustable attachment assembly and thereby drawing said second ends of said segments toward one another and engaging said coupling with said pipe elements.

There is disclosed a coupling for joining pipe elements. In one example embodiment the coupling comprises first and second segments positioned end to end surrounding a central space for receiving the pipe elements. A spring assembly joins a first end of the first segment to a first end of the second segment. The spring assembly biases the segments away

are positioned respectively in the first and second channels. Each of the retainers comprises a band having oppositely disposed ends. A plurality of teeth are positioned along one edge of the band. The teeth 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 at least one tab overlies the second floor when the retainers are positioned within the channels. An example may comprise a plurality of tabs.

By way of example, a third channel is positioned between the first and second channels in each of the segments. The third channels extend between the ends of the segments and facing the central space.

In an example embodiment, the teeth are oriented angularly with respect to a line extending radially from an axis arranged coaxially with the central space. In a further example, the at least one tab is oriented perpendicularly to a line extending radially from an axis arranged coaxially with the central space. Further by way of example, the at least one tab is offset from the band toward an axis arranged coaxially with the central space. In a specific example embodiment, the at least one tab projects toward the third channel.

In an example embodiment, a first aperture is positioned in at least one of the segments. The first aperture may be aligned with the first channel and provide a line of sight toward the central space. In an example embodiment the first aperture is positioned between the first and second segments. The first aperture may comprise a trough positioned at an interface between the first and second segments by way of example. A further example comprises a second aperture in at least one of the segments. The second aperture may be aligned with the second channel and provide a line of sight toward the central space. The second aperture may be positioned between the first and second segments and may comprise a trough positioned at an interface between the two segments for example.

In an example embodiment a ring seal is positioned within the third channels. The ring seal has an inner surface sized to receive the pipe elements and an outer surface sized to support the segments in spaced apart relation sufficient to permit insertion of the pipe elements into the central space while the segments are attached to one another. Further by way of example, the

retainer bands may be sized to cooperate with the ring seals to support the housing portions in the spaced apart relation.

In another example embodiment, each of the first and second segments comprises first and second shoulders positioned on opposite sides of each of the segments. The shoulders extend lengthwise along the segments and project toward the central space. The shoulders define a channel therebetween. A first arcuate surface is positioned on the first shoulder, and a second arcuate surface is positioned on the second shoulder. The arcuate surfaces face the central space in this example. A plurality of projections may be positioned on each of the first and second arcuate surfaces. The projections project toward the central space. In an example embodiment, the first arcuate surface may have a first radius of curvature and the second arcuate surface may have a second radius of curvature wherein the second radius of curvature is less than the first radius of curvature.

In an example embodiment a ring seal is positioned within the channel. The ring seal has an inner surface sized to receive the pipe elements and an outer surface sized to support the segments in spaced apart relation sufficient to permit insertion of the pipe elements into the central space while the segments are attached to one another.

In combination, a coupling and a first pipe element. The coupling is for joining a second pipe element to the first pipe element. In an example embodiment, he coupling comprises first and second segments positioned end to end surrounding a central space for receiving the pipe elements. First and second shoulders are positioned on opposite sides of each of the segments. The shoulders extend lengthwise along the segments and project toward the central space. A first arcuate surface is positioned on the first shoulder. A second arcuate surface is positioned on the second shoulder. The arcuate surfaces face the central space. A spring assembly joins a first end of the first segment to a first end of the second segment. The spring assembly biases the segments away from one another. An adjustable attachment assembly joins a second end of the first segment to a second end of the second segment. The adjustable attachment assembly is adapted to draw the first and second segments toward one another and into engagement with the pipe elements. The first pipe element comprises a rim projecting outwardly from the first pipe element and extending

circumferentially. The rim is positioned in spaced relation to an end of the first pipe element. The rim engages the first shoulder and is captured within the central space.

In an example embodiment the rim is defined by a circumferential groove in the first pipe element. In another example embodiment the rim is defined by a circumferential bead which projects radially outwardly from the first pipe element.

In an example embodiment the spring assembly comprises a first boss projecting from the first end of the first segment. A second boss projects from the first end of the second segment and is positioned adjacent to the first boss. A first fulcrum is positioned on the first boss and contacts the second boss. The segments pivot about the first fulcrum. A link extends between and capturing the first and second bosses.

An example embodiment may further comprise a second fulcrum positioned on the second boss. The second fulcrum contacts the first fulcrum. A first land may be positioned contiguous with the first fulcrum on the first boss, and a second land may be positioned contiguous with the second fulcrum on the second boss. The first and second lands are oriented angularly with respect to a plane defining an interface between the first and second segments. In another example embodiment of a combination, a first head projects from the first boss, and a second head projects from the second boss. The link engages the first and second heads for retaining the link to the bosses. In an example embodiment the link comprises a ring encircling the first and second bosses.

In an example embodiment of the combination, the adjustable attachment assembly comprises a first lug attached to the second end of the first segment. A second lug is attached to the second end of the second segment and is positioned in facing relation with the first lug. Each lug defines a respective hole. A fastener extends between the first and second lugs. The fastener is received within the respective holes. The fastener is adjustable for drawing the segments toward one another against the biasing of the spring assembly.

In a further example embodiment the combination comprises a channel positioned between the first and second shoulders in each of the segments. The channels extend between the ends of the segments and face the central space. Further by way of example, a ring seal is

positioned within the channels. The ring seal has an inner surface sized to receive the pipe elements and an outer surface sized to support the segments in spaced apart relation sufficient to permit insertion of the second pipe element into the central space while the segments are attached to one another and the first pipe element is captured within the central space.

A plurality of projections may be positioned on each of the first and second arcuate surfaces in an example embodiment of the combination. The projections project toward the central space. An example embodiment may further comprise at least one aperture in at least one of the segments. The at least one aperture may be positioned between the first and second segments. In an example embodiment, the at least one aperture comprises a trough positioned at an interface between the first and second segments.

There is disclosed a method of assembling the combination coupling and pipe element. In one example embodiment the method comprises:

positioning the first pipe element with the rim engaged with the first shoulder of the first segment;

engaging the first end of the first segment with the first end of the second segment to form the spring assembly;

supporting the first and second segments in spaced apart relation sufficient to permit insertion of the second pipe element into the central space while capturing the first pipe element within the central space;

attaching the second end of the first segment to the second end of the second segment using the adjustable attachment assembly.

Further by way of example, the method may comprise:

engaging the first pipe element with a ring seal;

positioning the ring seal within a channel defined by the first and second shoulders of the first segment.