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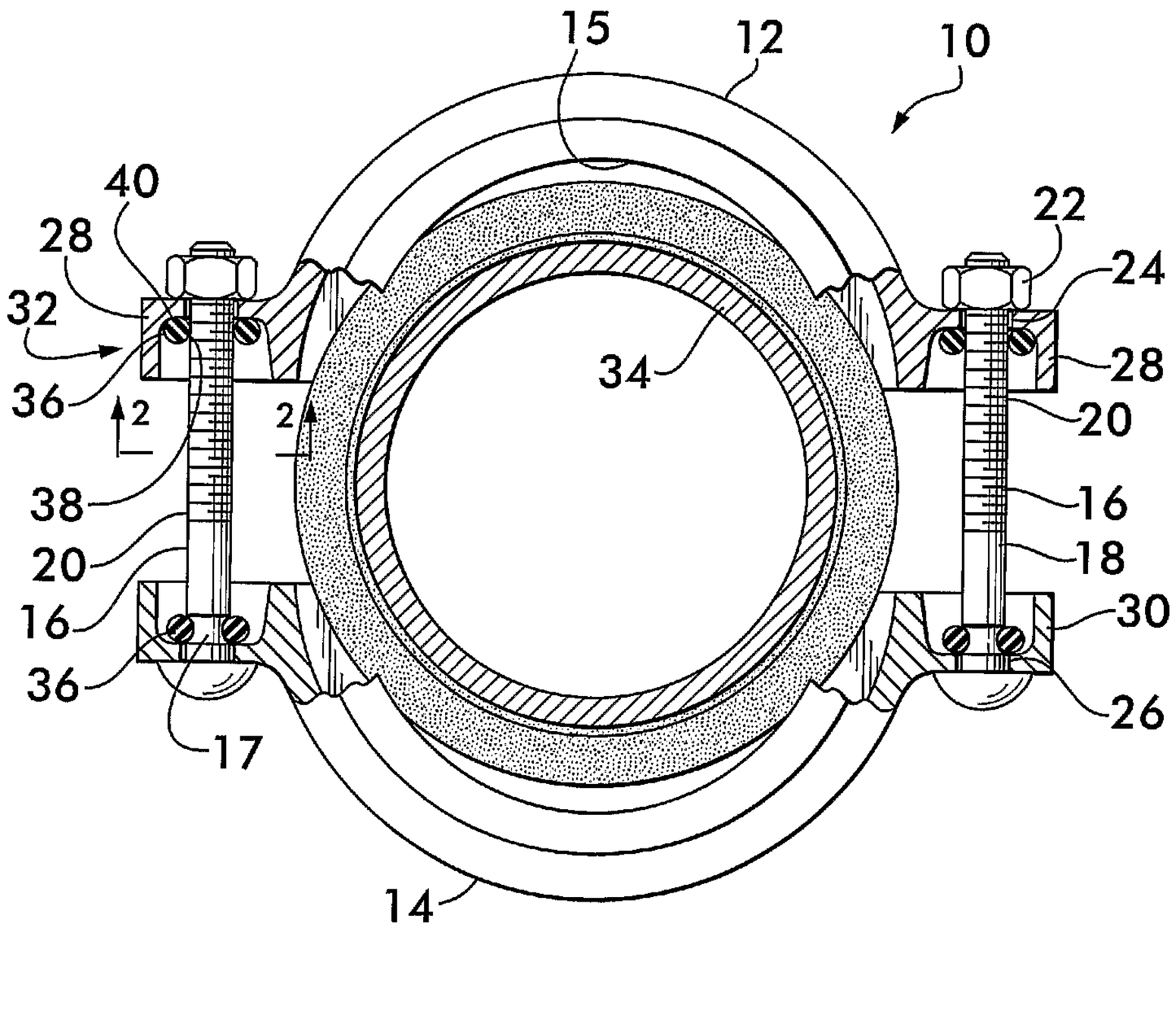

(57) Abrégé/Abstract:
A stop assembly for limiting motion of a shank of a fastener through an opening in a body is disclosed. The stop assembly has a retention element that is positionable on the shank. The retention element has a first surface that engages the shank for holding it at a predetermined position on the shank. A second surface on the retention element engages the body, and limits the motion of the shank relative to the body. Application of sufficient force to the body or removal of the retention element from the shank will allow the body and the fastener to move relatively to one another.

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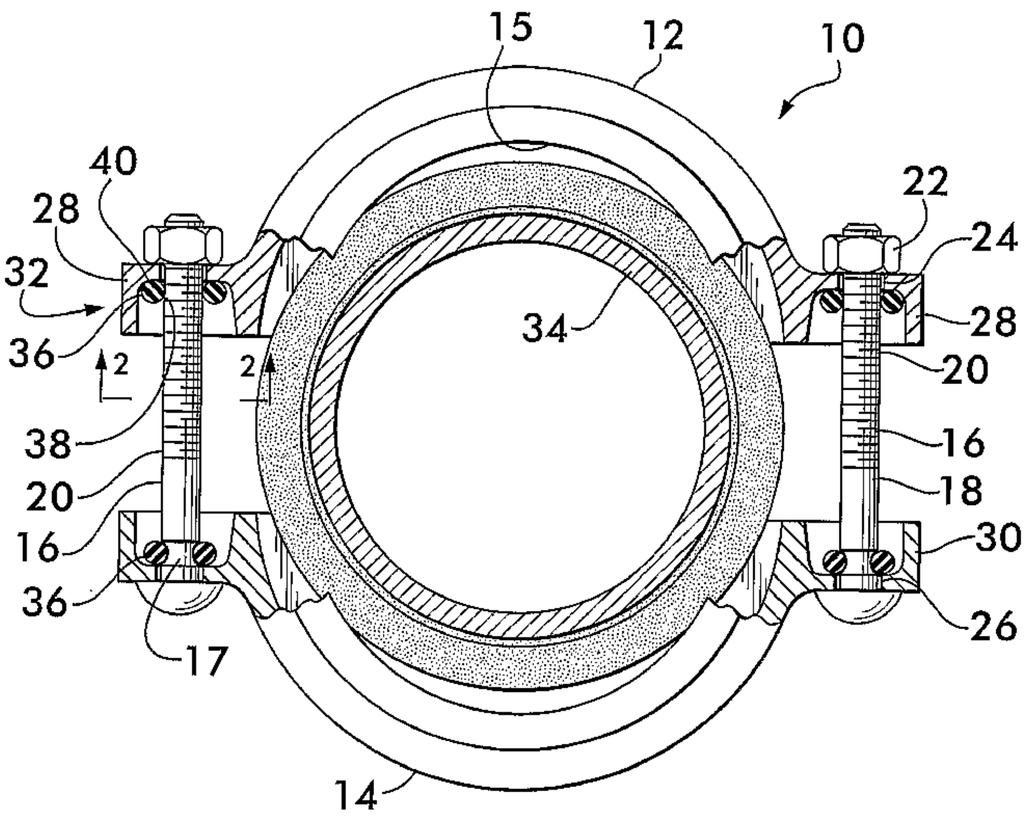
(54) **Title:** STOP ASSEMBLY FOR PIPE COUPLINGS



(57) **Abstract:** A stop assembly for limiting motion of a shank of a fastener through an opening in a body is disclosed. The stop assembly has a retention element that is positionable on the shank. The retention element has a first surface that engages the shank for holding it at a predetermined position on the shank. A second surface on the retention element engages the body, and limits the motion of the shank relative to the body. Application of sufficient force to the body or removal of the retention element from the shank will allow the body and the fastener to move relatively to one another.

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STOP ASSEMBLY FOR PIPE COUPLINGS

Field of the Invention

This invention relates to stop assemblies usable with pipe coupling segments for maintaining the coupling segments in spaced apart relation during assembly of a pipe joint.

Background of the Invention

Mechanical couplings for joining pipe elements in end to end relation find widespread use throughout industry for creating piping networks, used for example, in fire suppression sprinkler systems in warehouses, office buildings and the like.

Such couplings comprise two or more interconnectable segments that are positionable circumferentially surrounding the end portions of the co-axially aligned pipe elements. The term "pipe element" is used herein to describe any pipe-like item or component having a pipe like form. Pipe elements include pipe stock, pipe fittings such as elbows, caps and tees as well as fluid control components such as valves, reducers, strainers, restrictors, pressure regulators and the like.

Each mechanical coupling segment comprises a housing having arcuate surfaces which project radially inwardly from the housing and engage plain end pipe elements, pipe elements having radially extending shoulders or circumferential grooves that extend around each of the pipe elements to be joined. Engagement between the arcuate surfaces and the pipe elements provides mechanical restraint to the joint and ensures that the pipe elements remain coupled even under high internal pressure and external forces. The housings define

an annular channel that receives a gasket or seal, typically an elastomeric ring which engages the ends of each pipe element and cooperates with the segments to provide a fluid tight seal. The segments have connection members, typically in the form 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.

Installation of a coupling to form a pipe joint can be a tedious and time consuming process when mechanical couplings are used. The installation process described below is based upon a coupling that engages pipes having circumferential grooves, it being understood that the description applies substantially to other types of pipes as well. Typically, the coupling is received by the technician with the segments bolted together and the ring seal captured within the segments' channels. The technician first disassembles the coupling by unbolting it, removes the ring seal, lubricates it (if not pre-lubricated) and places it around the ends of the pipe elements to be joined. Installation of the ring seal requires that it be lubricated and stretched to accommodate the pipe elements, an often difficult and messy task, as the ring seal is usually stiff and the lubrication makes manual manipulation of the seal difficult. With the ring seal 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 seal against them. During placement, the segments engage the seal, the arcuate surfaces 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 seal and engaging the arcuate surface 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 of the Invention

The invention concerns a stop assembly for limiting the motion of a shank of a fastener extended through an opening in a body, such as a pipe coupling. The stop assembly comprises a retention element positionable on the fastener at a predetermined position along the shank. The retention element has a first surface portion engageable with the shank for holding the retention element at the predetermined position. The retention element further has a second surface portion engageable with the body. Engagement of the second surface portion with the body limits and motion of the shank through the opening.

Preferably, the assembly also includes a second retention element positionable on the fastener at a second predetermined position along the shank. The second retention element has a first surface portion engageable with the shank for holding the second retention element at the second predetermined position. The second retention element further has a second surface portion engageable with a second body, such as a cooperating coupling segment. The second body has a second opening therein. Engagement of the second surface portion with the second body limits motion of the shank through the second opening.

The invention also includes a pipe coupling positionable straddling facing end portions of a pair of pipe elements for securing the pipe elements together in end-to-end relationship. The pipe coupling comprises a plurality of coupling segments engageable with the pipe elements for holding them in the end to end relationship. The coupling segments are positioned in facing relation and have paired aligned openings extending therethrough.

A fastener for joining the coupling segments together has an elongated shank that extends through a pair of the aligned openings. A retention element has a first surface portion engaged with the shank. The retention element also has a second surface portion engaged with one of the coupling segments for limiting motion of the fastener relative to the one coupling segment.

Preferably, the coupling includes a second retention element having a first surface portion engaged with the shank. The second retention element has a second surface portion engaged with the other of the coupling segments for limiting motion of the fastener relative to the other coupling segment. The first and second retention elements cooperate to maintain the coupling segments in spaced apart relation.

Brief Description of the Drawings

Figure 1 is a partial sectional axial view of a pipe coupling having coupling segments maintained in spaced apart relation by a stop assembly according to the invention;

Figure 2 is a view taken at line 2-2 of Figure 1;

Figure 3 is an axial view of the pipe coupling of Figure 1 wherein the coupling segments are moved into engagement with a pair of pipe ends;

Figure 4 is a partial sectional axial view of a pipe coupling having another embodiment of a stop assembly according to the invention;

Figure 5 is a view taken at line 5-5 of Figure 4;

Figure 6 is a partial sectional axial view of a pipe coupling having another embodiment of a stop assembly according to the invention;

Figure 7 is a view taken at line 7-7 of Figure 6;

Figure 8 is a partial sectional axial view of a pipe coupling having another embodiment of a stop assembly according to the invention;

Figure 9 is a view taken at line 9-9 of Figure 8;

Figure 10 is a partial sectional axial view of a pipe coupling having another embodiment of a stop assembly according to the invention;

Figure 11 is a view taken at line 11-11 of Figure 10;

Figure 12 is a partial sectional axial view of a pipe coupling having another embodiment of a stop assembly according to the invention;

Figure 13 is a partial sectional axial view of a pipe coupling having another embodiment of a stop assembly according to the invention;

Figure 14 is a view taken at line 14-14 of Figure 13;

Figure 15 is a partial sectional axial view of a pipe coupling having another embodiment of a stop assembly according to the invention;

Figure 16 is a view taken at line 16-16 of Figure 15; and

Figure 17 is a partial sectional axial view of a pipe coupling having a stop assembly according to the invention.

Detailed Description of the Embodiments

Figure 1 shows a pipe coupling 10 having coupling segments 12 and 14 positioned in facing relation with one another. The segments have arcuate surfaces 15 that engage the ends of pipe elements for securing them in end to end relationship. Segments 12 and 14 are joined to one another by fasteners 16, typically comprising a bolt 18 having a threaded shank 20 that engages a nut 22.

The bolts 18 extend through openings 24 and 26 in the body of the segments, the body often including lugs 28 and 30 designed to receive and engage the nut and bolt. Lugs 28 and 30 are configured so as to align the openings 24 and 26 to receive the shank 20 of the bolt 18.

Coupling 10 includes a stop assembly 32 that limits the motion of the shank 20 through the openings in a body such as 24 and 26. This is useful for efficient assembly of the pipe joint as it allows the coupling 10 to be pre-assembled at the factory with the coupling segments 12 and 14 maintained in

spaced apart relation by the stop assembly. The spaced apart relation allows the coupling to receive the pipe elements without disassembly, thereby reducing the number of loose parts which a technician must handle when assembling the joint and decreasing the labor and time required. Figure 1 shows the coupling 10 with the segments 12 and 14 in spaced apart relation ready to receive pipe elements, and Figure 3 illustrates the pipe coupling engaging pipe elements 34 to form a pipe joint, the pipe elements having been inserted between the coupling segments 12 and 14 while in the spaced apart configuration. It may be advantageous to modify the coupling segments to facilitate insertion of the pipe elements between them. Such modifications may include, for example, forming notches in the arcuate surfaces adjacent to the lugs to provide clearance for the pipe elements, or providing arcuate surfaces that do not extend completely around the segment.

Various embodiments of stop assemblies are described below. All of the embodiments include a retention element that is positionable on the fastener shank. The retention element has a surface portion that engages the shank to hold it in a predetermined position on the shank. The retention element further includes another surface portion that is engageable with the body having the openings (in these examples, the bodies being the coupling segments). Engagement between the other surface portion and the body limits the motion of the shank through the opening and supports the body, for example, in spaced apart relation to another body.

Figures 1 and 2 show a stop assembly 32 having a retention element in the form of an O-ring 36. O-ring 36 has an inwardly facing circumferential surface 38 that engages the shank 20 and a flank surface 40 that engages the lug 28 of the coupling segment 12. The O-ring is formed from elastomeric material and is sized so that its inner diameter is smaller than the outer diameter of shank 20, resulting in

a tight interference fit between the O-ring and the fastener 16. The elasticity of the O-ring allows it to hold tightly to the shank, and when used as a pair on one or both fasteners 16, the O-rings support the coupling segments in spaced apart relation as shown in Figure 1. The grip of the O-rings with the fastener is such as to maintain the coupling segments 12 and 14 in spaced relation for shipping, handling and installation on pipe elements, but upon application of sufficient force to the coupling segments, the O-rings are movable along the fastener or fasteners to allow the coupling segments to move toward one another and engage the pipe elements 34 as shown in Figure 3. Movement of the O-rings may be effected manually, for example, by pushing the coupling segments toward each other, or by tightening the fasteners and using screw action between the nut 22 and bolt 18 to draw the coupling segments into engagement with the pipe elements.

The force required to move the O-rings may be augmented by incorporating an undercut 17 on the shank 20 at a point along the shank where the O-ring is to be positioned in order to maintain the segments 12 and 14 in spaced apart relation. Undercut 17 is preferably positioned on a non-threaded section of the shank 20, and provides purchase for the O-ring, increasing the force necessary to dislodge and move it when it is desired to bring the segments toward one another.

Figures 4 and 5 show another stop assembly embodiment 42 having retention elements in the form of one or more collars 44. The collars are preferably cylindrical in shape and have an axially extending bore 46 therethrough. Bore 46 provides an inwardly facing surface 48 that engages the shank 20 of fasteners 16. The bore has a diameter smaller than the diameter of the shank so as to create an interference fit between the collar and the fastener which allows the collar to grip the fastener and maintain the coupling segments 12 and 14 in spaced relation until sufficient force is applied to move the segments toward one another for engagement with

pipe elements. It is advantageous to have shank 20 threaded over its entire length to increase the force necessary to move to the collars relatively to the fasteners, as the threads tend to dig into the surface 48. (This is also true for other stop assembly embodiments disclosed herein.) The annular surfaces 50 at the ends of the collars engage the segments and, being larger than the opening through the couplings, limit the motion of the shank relatively to the couplings.

Preferably the collars are formed from an elastic material allowing them to be biased into gripping engagement with the fasteners, yet expandable so as to slide over the fasteners when the coupling segments are moved into engagement with the pipe elements. The degree of force required to move the collars 44, or the aforementioned O-rings 36 is largely a function of the degree of interference, the coefficient of friction between the surfaces in contact, and the elastic modulus of the material forming the collars or the O-rings.

Figures 6 and 7 illustrate another embodiment of a retention element comprising a flexible elastic plate 52 having an opening 54 therein that receives the shank 20 of fastener 16. Plate 52 is preferably thin and sufficiently flexible and elastic so as to be slidable along shank 20, but maintain its position on the shank in the absence of sufficient applied force. The plate is preferably made from a polymer material, such as engineering plastics, but could also be made of cardboard or metal. The opening 50 defines an inwardly facing edge 56 that engages the shank. The plate surface 58 engages the couplings to limit their motion relatively to the shank.

The retention element shown in Figures 8 and 9 comprises a frangible material 60 applied to both the shank 20 and the coupling segments 12 and 14. The frangible material preferably has the characteristics of a fillet, with a first

surface 62 engaged with the shank and a second surface 64 engaged with the couplings, preferably the lugs. The frangible material adheres to both the coupling segments and the fasteners to maintain the segments in spaced relation, but the frangible material is weaker than the material which it bonds together so that, upon the application of force, the bond between the frangible material and either or both the fastener and the coupling segments are broken allowing the segments to move relatively to the fasteners. The frangible material is preferably an adhesive, but could also comprise solder, caulk or paint.

In Figures 10 and 11, the retention element comprises a washer 66 having a plurality of flexible, resilient teeth 68 that face inwardly and define an inner diameter of the washer that is smaller than the diameter of the shank. The edges 70 of teeth 68 engage the shank and the annular surface 72 of the washer engages the coupling segments, thereby limiting relative motion of the two components. The teeth are resiliently flexible, however, and will bend to allow the washer to move along the shank upon the application of sufficient force. The washers may comprise metal or polymeric material.

Figure 12 illustrates a stop assembly embodiment wherein the shank 20 is attached to one of the coupling elements 12. In this example the shank is threadedly engaged in a tapped opening 74 in the coupling segment 12, but it could alternately comprise a stud integrally formed with the coupling segment. A retention element 76 is mounted on the shank 20 and engages the other coupling segment 14 to maintain it in spaced relation until force is applied to engage the segments with pipe elements as described above. Although a collar 44 is illustrated as comprising the retention element, any of the examples of retention elements could also be used with this embodiment.

Figures 13 and 14 show a retention element comprising a clip 78 having legs 80 and 82 defining an aperture therebetween to receive the shank. The legs are flexible and resiliently biased to engage the shank 20 on opposite sides from one another. The clips also engage the coupling segments 12 and 14 to limit their motion relatively to the shank. Motion of the segments is permitted by removing the clip transversely from the shank. This may be effected manually or with hand tools such as a pair of pliers. Alternately, the clip may slide along the shank to permit the segments to engage the pipe elements. Preferably the clip is formed from a wire 84 made of spring steel. Wire 84 has a reverse curve 86 that defines legs 80 and 82. Preferably the legs themselves have a curvature 88 that accommodates the shank and thereby increases the hold of the clip thereto.

Figures 15 and 16 show another clip-type retention element embodiment comprising a plate 90 having a slot 92 therein defining legs 94 and 96. The shank 20 is received within slot 92. Grip of the plate on the shank may be increased by including teeth 98 projecting inwardly into slot 92. The clip may be removed from the shank by sliding it transversely to the shank so that the shank passes through the slot, thereby permitting motion of the shank relatively to the coupling segments. Alternatively, it could also slide along the shank. Preferably the plate 90 is formed of metal and is resilient and flexible.

Figure 17 shows a coupling embodiment 100 wherein the segments 102 and 104 are joined at one end by a hinge 109. The opposite ends 106 and 108 are held in spaced relation by retention elements 110 engaged with shank 20 of fastener 16 that is used to draw the coupling segments 102 and 104 together for engagement with pipe elements to form a pipe joint. Retention elements 110 may comprise any of the embodiments described herein.

The stop assemblies disclosed herein may be used in conjunction with couplings modified to allow them to be positioned in closer proximity to one another when in spaced apart relation. Such modifications including positioning notches or cut-outs adjacent to the lugs to provide clearance between the coupling and the pipe elements allowing them to be inserted into the couplings. Alternatively, the couplings could be flexible and have arcuate surfaces that do not extend the entire length of the coupling, i.e., they subtend an angle of less than 180°.

Stop assemblies according to the invention allow pipe couplings to be held in spaced relation until force is applied to bring them toward one another for engagement with pipe elements. This allows the couplings to be preassembled at the factory and handled in the field as a single unit, thereby facilitating rapid and convenient assembly of pipe joints by inserting the pipe elements between the coupling segments while they are in spaced apart relation and then forcing the coupling elements into engagement with the pipe elements by, for example, removing the retention elements from the shanks or sliding the retention elements along the shanks to permit relative motion between the coupling segments and the shanks.

CLAIMS

What is claimed is:

1. A stop assembly for limiting the motion of a shank of a fastener extended through an opening in a body, said stop assembly comprising:

a retention element positionable on said fastener at a predetermined position along the shank, said retention element having a first surface portion engageable with said shank for holding said retention element at said predetermined position; and

said retention element further having a second surface portion engageable with said body, engagement of said second surface portion with said body limiting motion of said shank through said opening.

2. A stop assembly according to Claim 1, further comprising:

a second retention element positionable on said fastener at a second predetermined position along said shank, said second retention element having a first surface portion engageable with said shank for holding said second retention element at said second predetermined position;

said second retention element further having a second surface portion engageable with a second body having a second opening therein, engagement of said second surface portion with said second body limiting motion of said shank through said second opening.

3. A stop assembly according to Claim 1, wherein said retention element has an aperture oriented transversely to said shank and permitting removal of said retention element

from said shank by movement of said retention element transversely thereto, removal of said retention element allowing relative motion between said shank and said body.

4. A stop assembly according to Claim 3, wherein said retention element comprises a clip having first and second legs positioned adjacent to one another defining said aperture, said legs being flexible and resiliently biased to engage said shank, said clip being positionable on said shank by deforming said legs to receive said shank therebetween.

5. A stop assembly according to Claim 4, wherein said clip comprises a wire, said wire having a reverse curve defining said legs, said legs having a curvature sized and shaped to receive said shank therebetween.

6. A stop assembly according to Claim 3, wherein said clip comprises a plate having a slot therein defining said aperture, said shank being movable through said slot for removal of said clip from said shank.

7. A stop assembly according to Claim 1, wherein said retention element has an aperture therethrough for receiving said shank, said aperture having a diameter less than the diameter of said shank, said body engaging said shank with an interference fit, said retention element being movable lengthwise along said shank for positioning said retention element at said predetermined position.

8. A stop assembly according to Claim 7, wherein said retention element comprises an o-ring.

9. A stop assembly according to Claim 8, wherein said shank has an undercut that receives said O-ring.

10. A stop assembly according to Claim 7, wherein said retention element comprises a collar formed from an elastic material.

11. A stop assembly according to Claim 7, wherein said retention element comprises a flexible, elastic plate.

12. A stop assembly according to Claim 7, wherein said retention element comprises:

a washer having an inner diameter defined by a plurality of flexible teeth extending radially inwardly, said teeth being engageable with said shank for holding said washer at said predetermined position, said teeth being flexibly deformable and allowing relative motion between said washer and said shank.

13. A stop assembly according to Claim 1, wherein said retention element comprises a frangible material engaging said body and said fastener, said frangible material being separable from one of said retention element and said body upon the application of force to said shank to permit relative motion between said body and said shank.

14. A stop assembly according to Claim 13, wherein said frangible material is selected from the group consisting of adhesive, solder, caulk and paint.

15. A pipe coupling positionable straddling facing end portions of a pair of pipe elements for securing said pipe elements together in end-to-end relationship, said pipe coupling comprising:

a plurality of coupling segments engageable with said pipe elements for holding them in said end to end

relationship, said coupling segments being positioned in facing relation and having paired aligned openings extending therethrough;

a fastener having an elongated shank extending through a pair of said aligned openings for joining said coupling segments together;

a retention element having a first surface portion engaged with said shank, said retention element having a second surface portion engaged with one of said coupling segments for limiting motion of said fastener relative to said one coupling segment.

16. A pipe coupling according to Claim 15, further comprising:

a second retention element having a first surface portion engaged with said shank, said second retention element having a second surface portion engaged with the other of said coupling segments for limiting motion of said fastener relative to said other coupling segment, said first and second retention elements cooperating to maintain said coupling segments in spaced apart relation.

17. A pipe coupling according to Claim 16, wherein one of said retention elements has an aperture oriented transversely to said shank and permitting removal of said one retention element from said shank by movement of said retention element transversely thereto, removal of said one retention element allowing relative motion between said fastener and one of said coupling segments.

18. A pipe coupling according to Claim 17, wherein said one retention element comprises a clip having first and second legs positioned adjacent to one another defining said aperture, said legs being flexible and resiliently biased into

engagement with said shank, said clip being positioned on said shank by deforming said legs to receive said shank therebetween.

19. A pipe coupling according to Claim 18, wherein said clip comprises a wire, said wire having a reverse curve defining said legs, said legs having a curvature sized and shaped to receive said shank therebetween.

20. A pipe coupling according to Claim 17, wherein said clip comprises a plate having a slot therein defining said aperture, said shank being movable through said slot for removal of said clip from said shank.

21. A pipe coupling according to Claim 16, wherein one of said retention elements has an aperture therethrough for receiving said shank, said aperture having a diameter less than the diameter of said shank, said one retention element engaging said shank with an interference fit, said one retention element being movable along said shank for permitting relative motion between said fastener and one of said coupling segments.

22. A pipe coupling according to Claim 21, wherein said one retention element comprises an o-ring.

23. A pipe coupling according to Claim 21, wherein said one retention element comprises a collar formed from an elastic material.

24. A pipe coupling according to Claim 21, wherein said one retention element comprises a flexible, elastic plate.

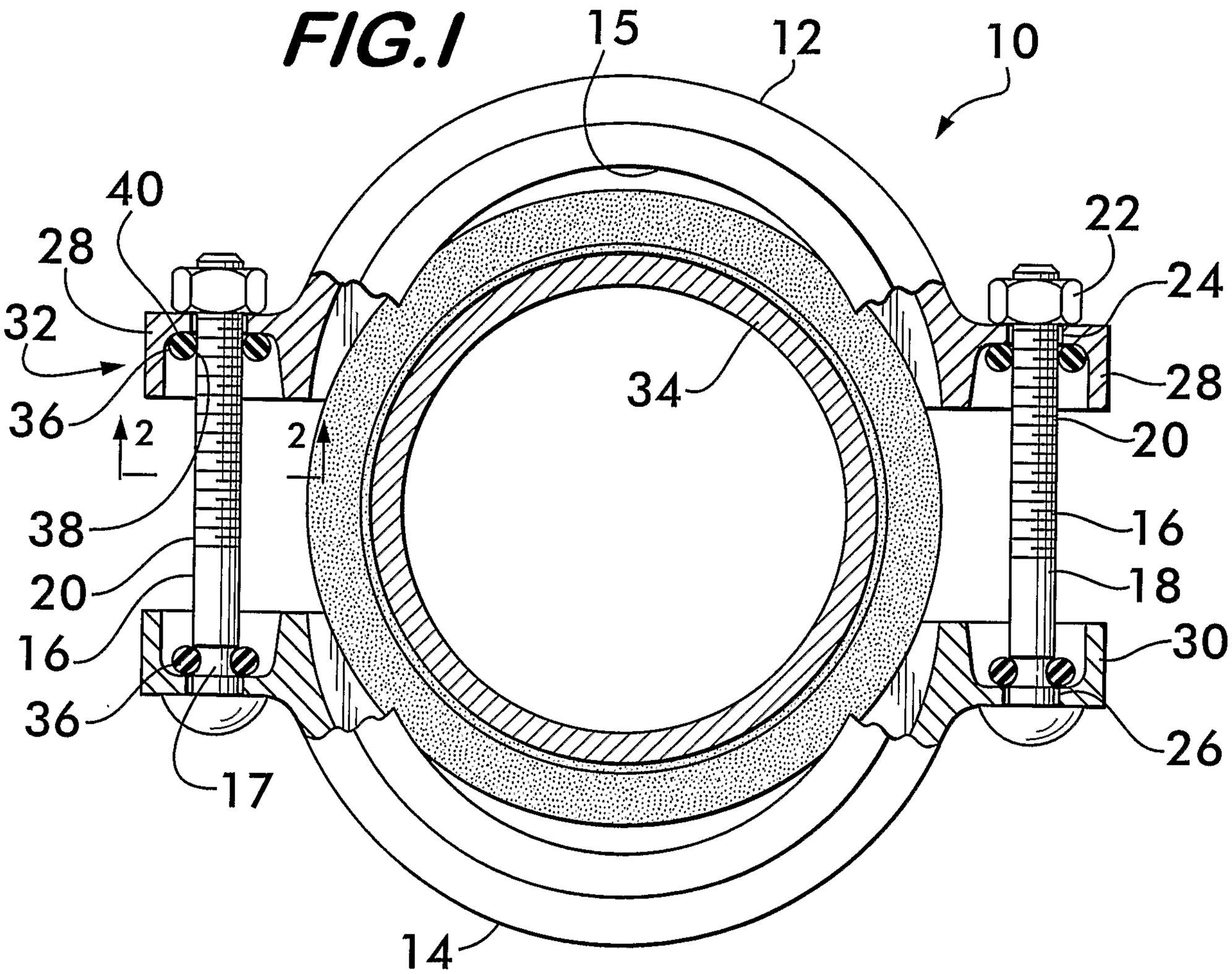
25. A pipe coupling according to Claim 21, wherein said one retention element comprises:

a washer having an inner diameter defined by a plurality of flexible teeth extending radially inwardly, said teeth being engageable with said shank, said teeth being flexibly deformable and allowing relative motion between said washer and said fastener.

26. A pipe coupling according to Claim 15, wherein said retention element comprises a frangible material engaging said one of said coupling segments and said shank, said frangible material being separable from one of said shank and said one coupling segment upon the application of force to said fastener to permit relative motion between said one coupling segment and said fastener.

27. A pipe coupling according to Claim 15, wherein said shank is attached to said one of said coupling segments, said retention element cooperating with said other coupling segment to hold said coupling segments in spaced apart relation.

FIG.1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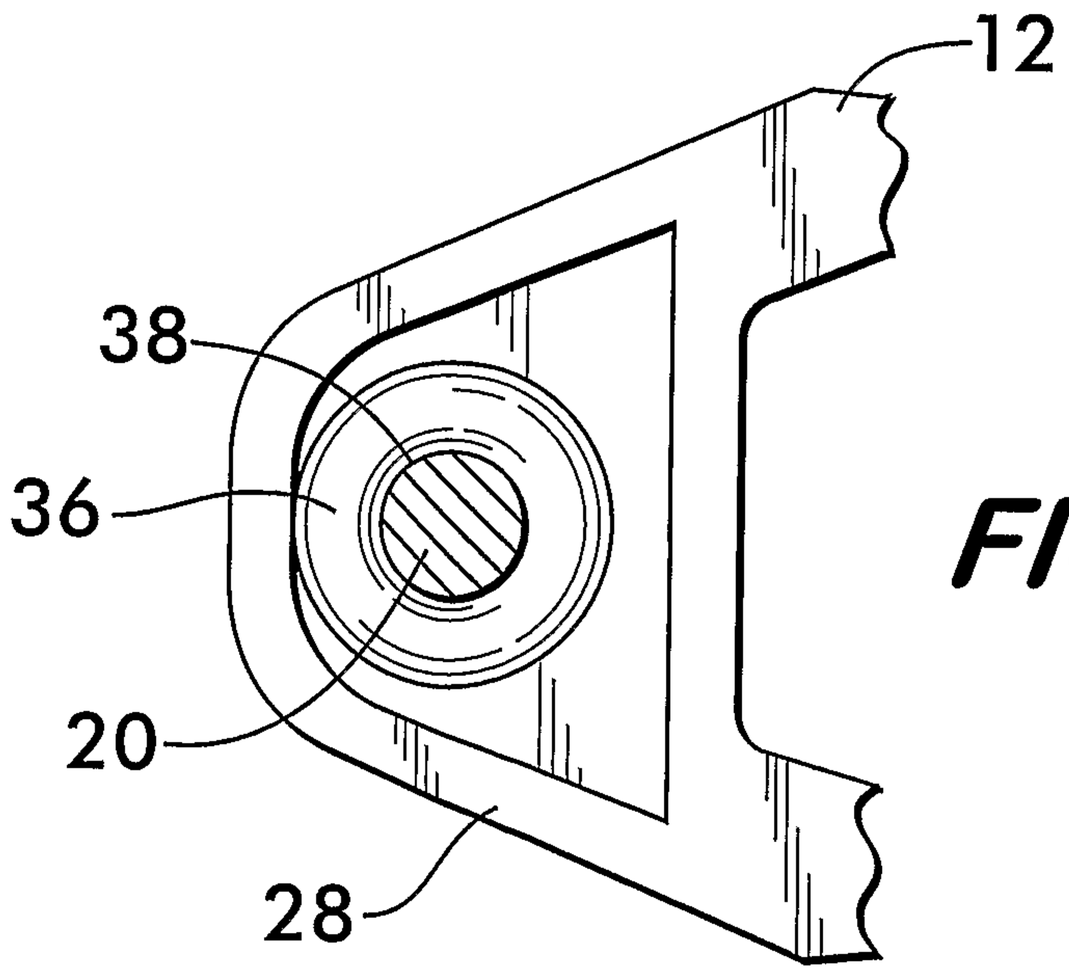
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FIG.2

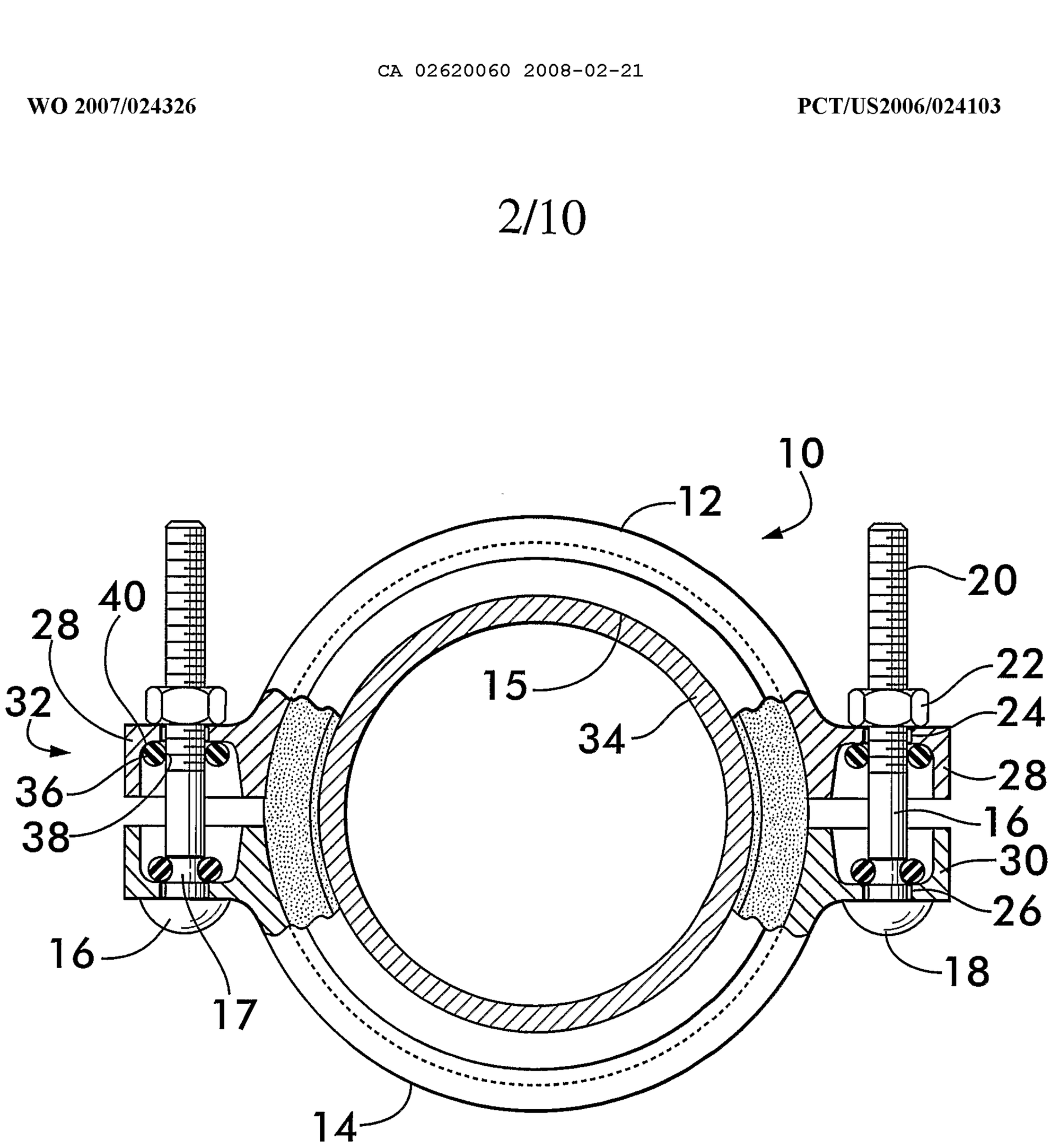
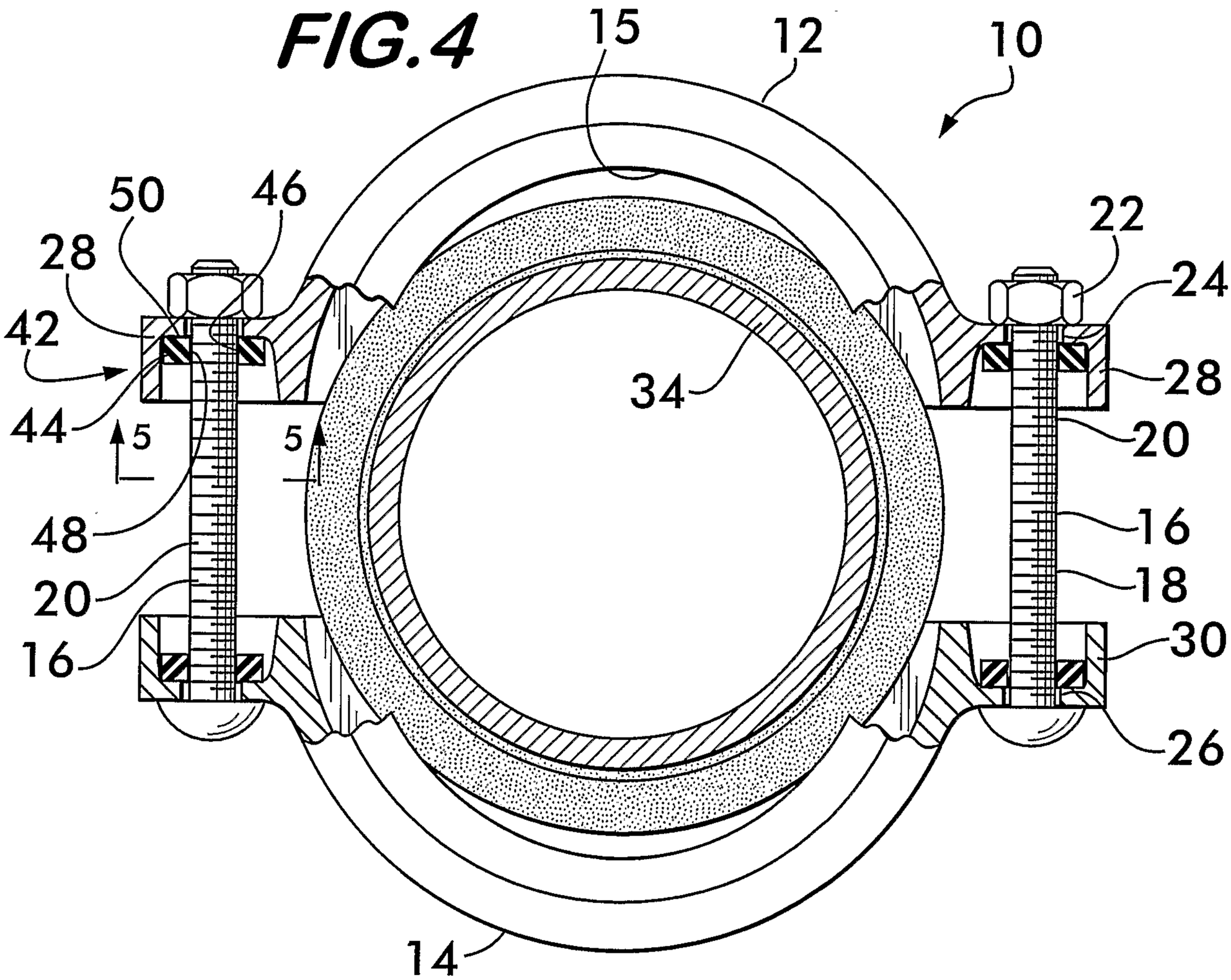


FIG.3

FIG.4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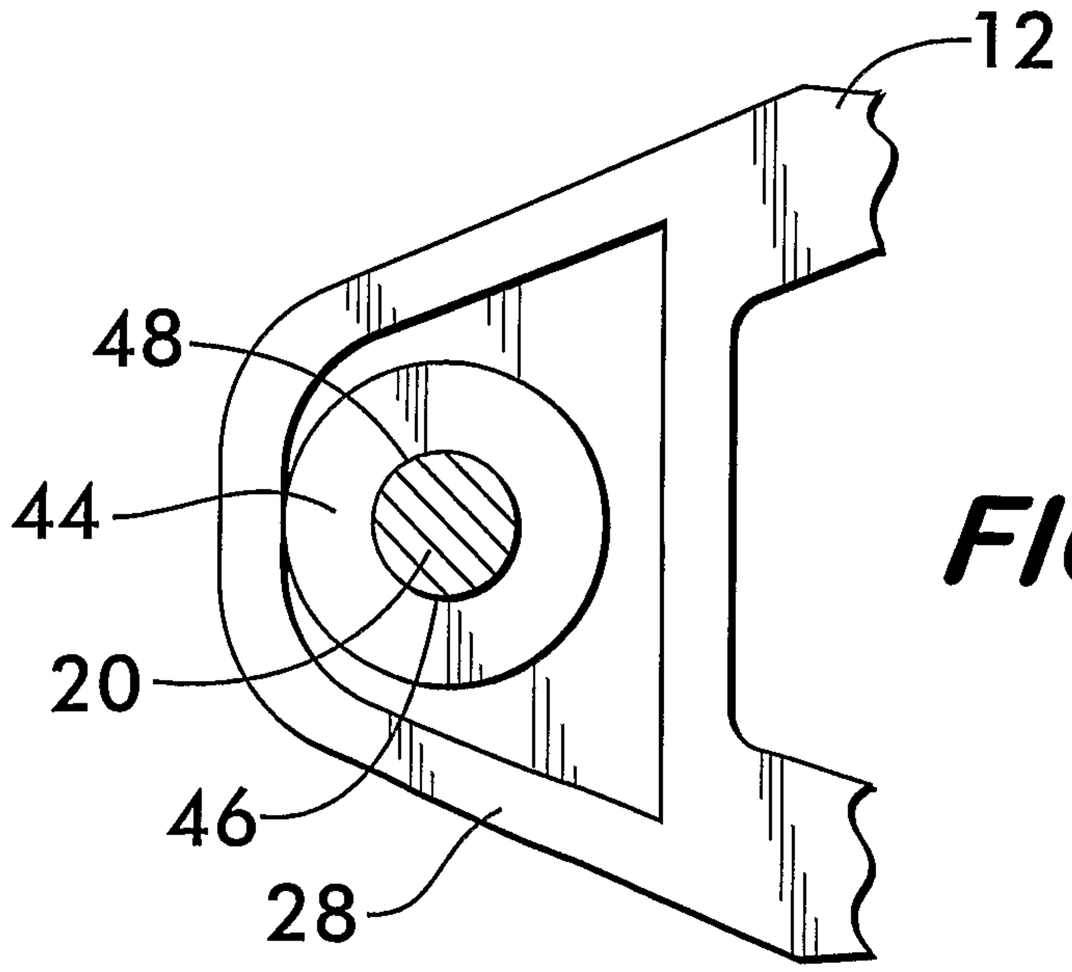
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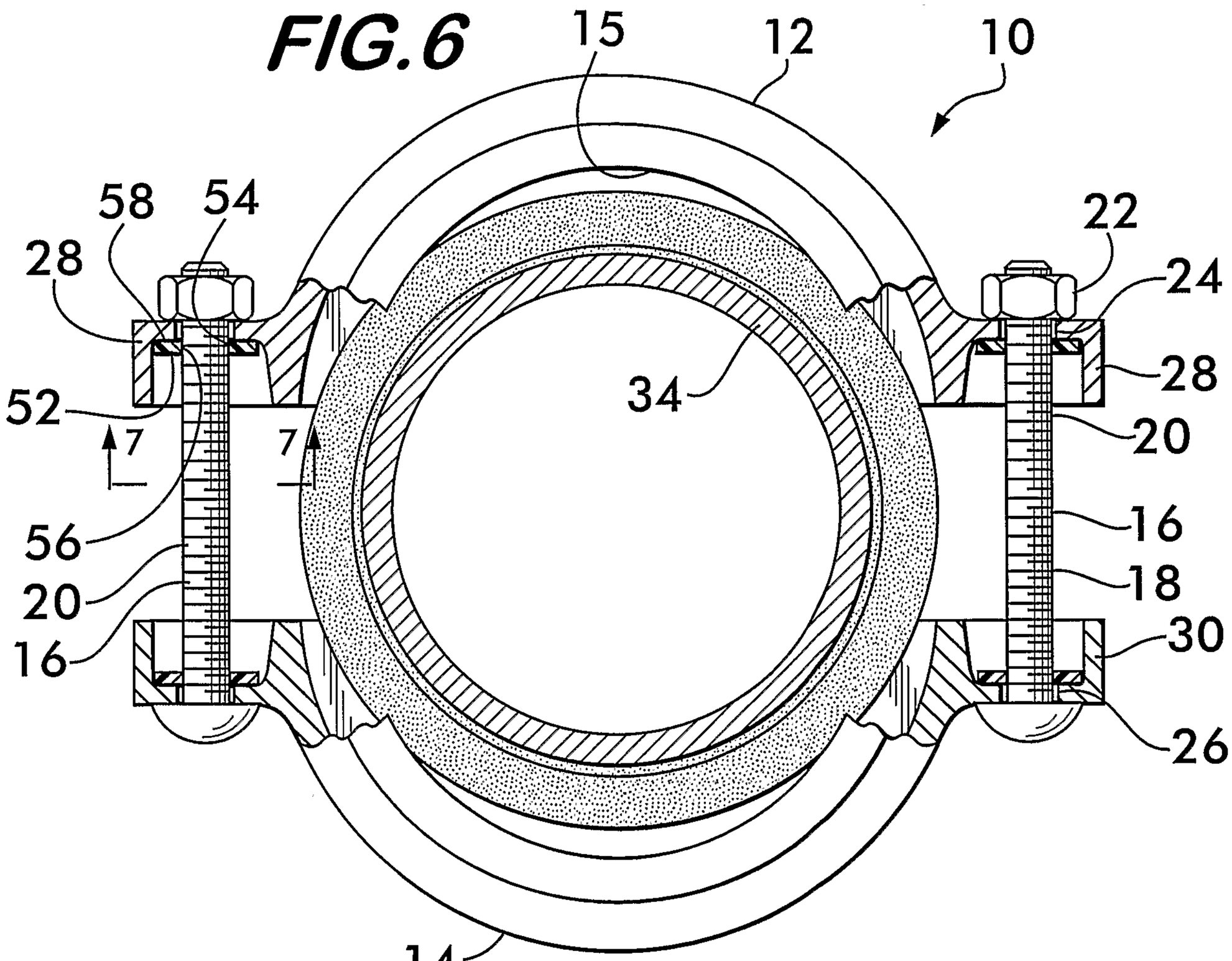
FIG.5

FIG.6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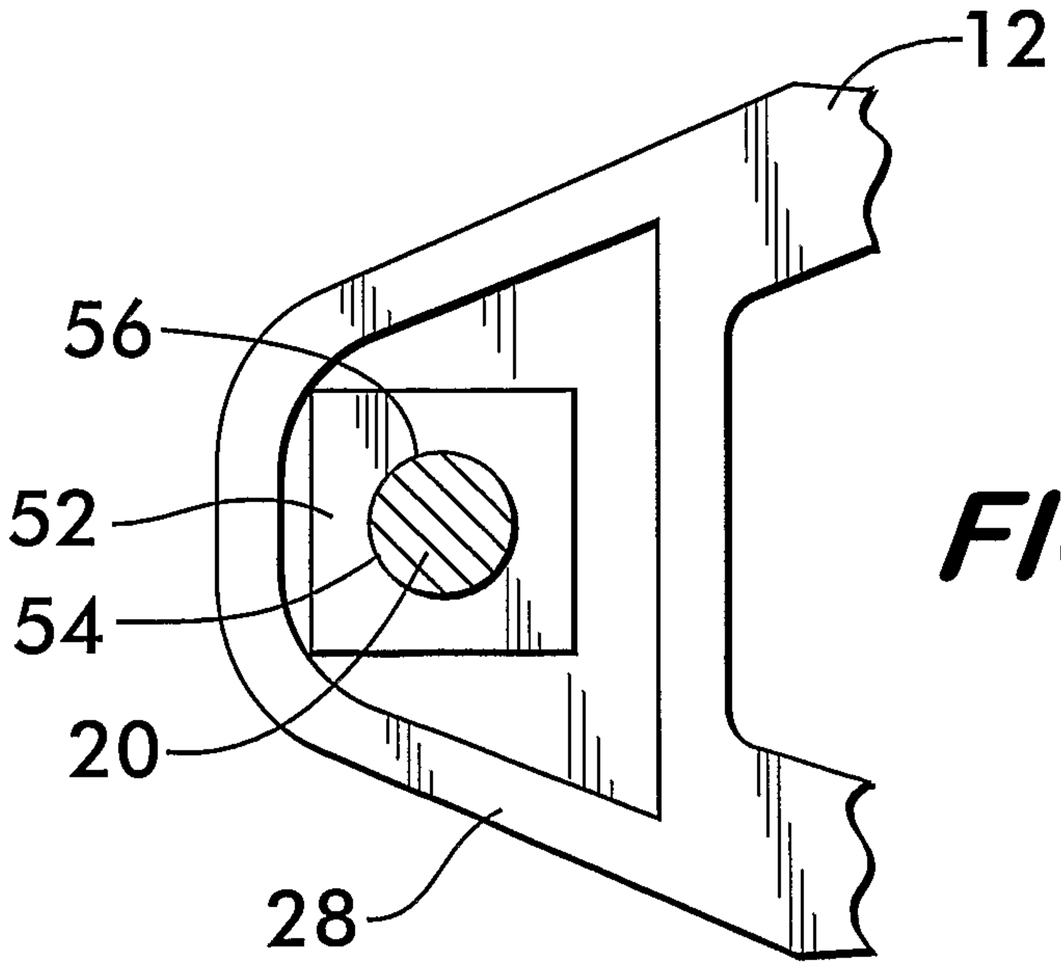
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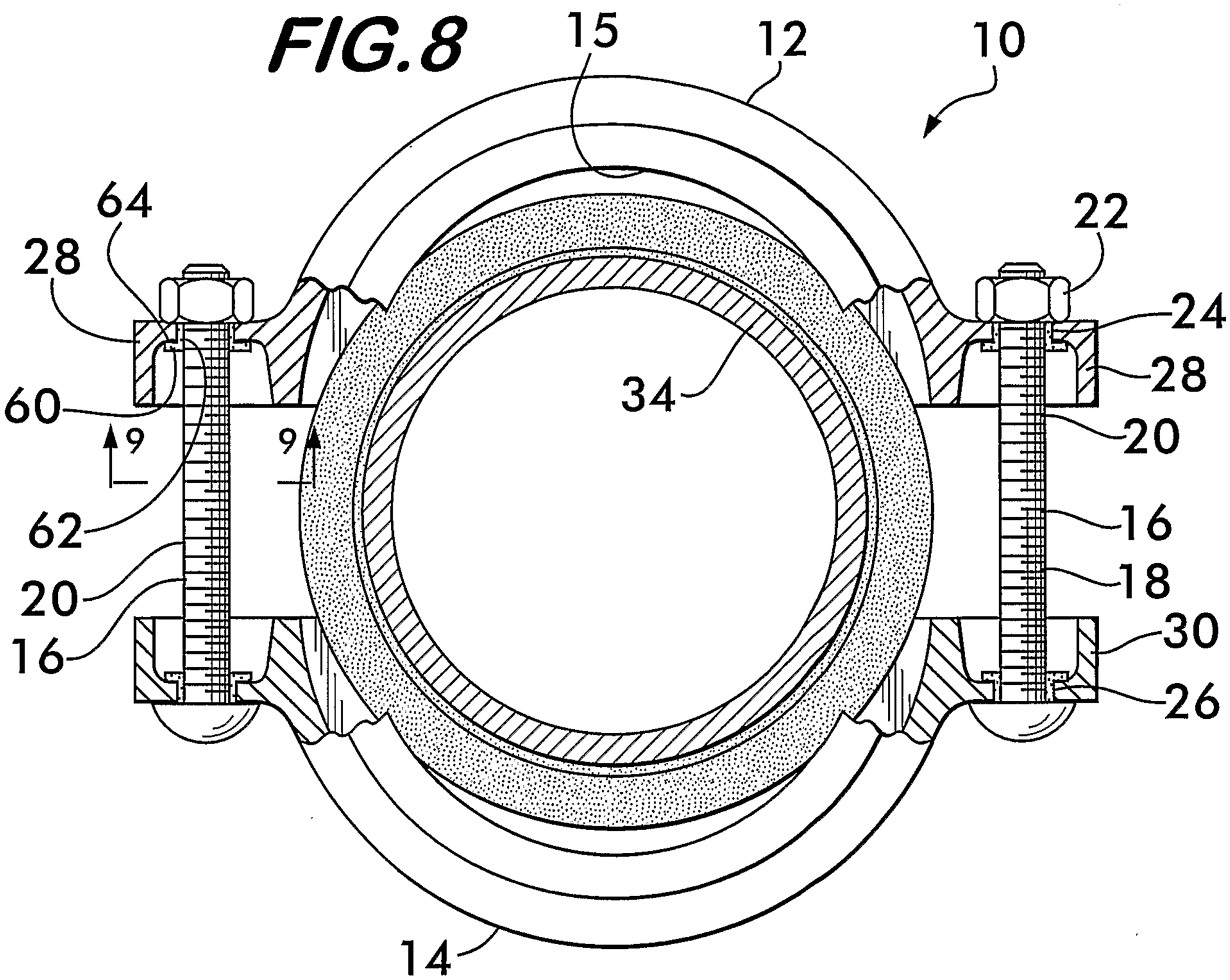
FIG.7

FIG.8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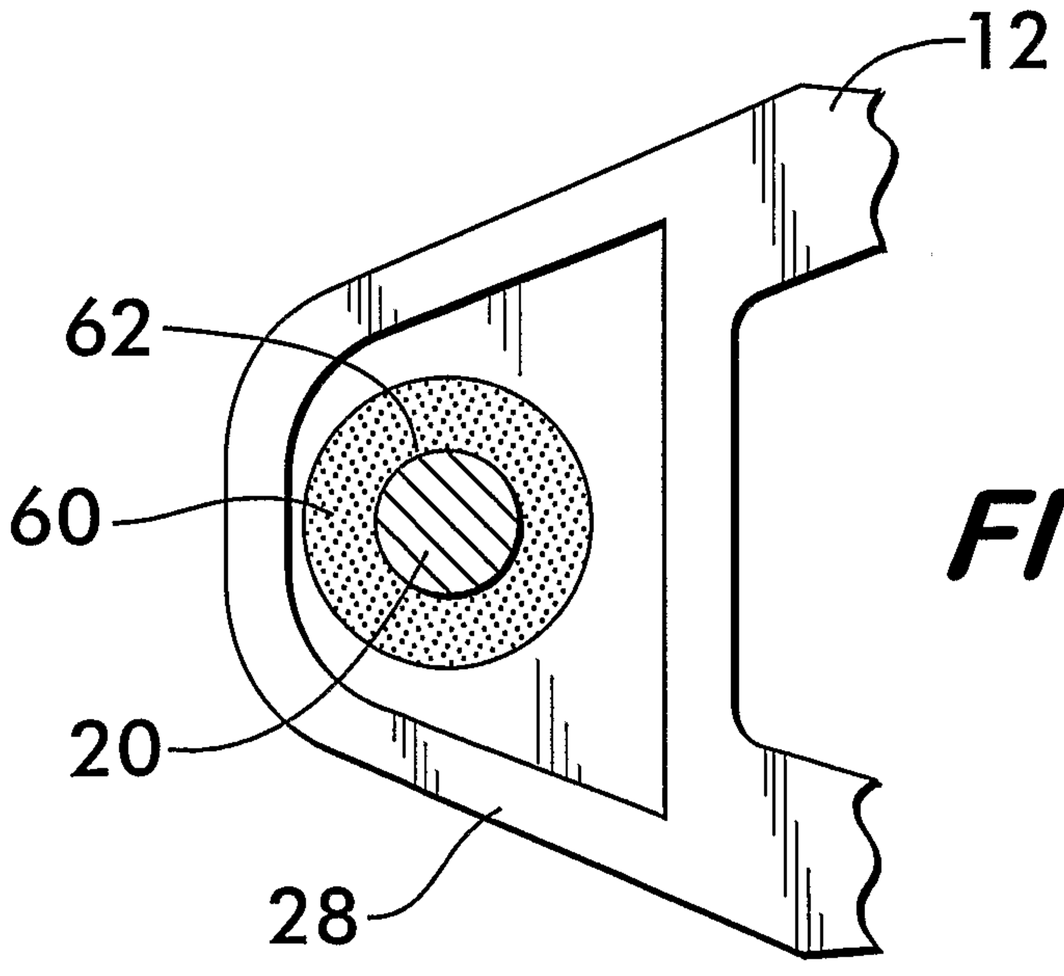
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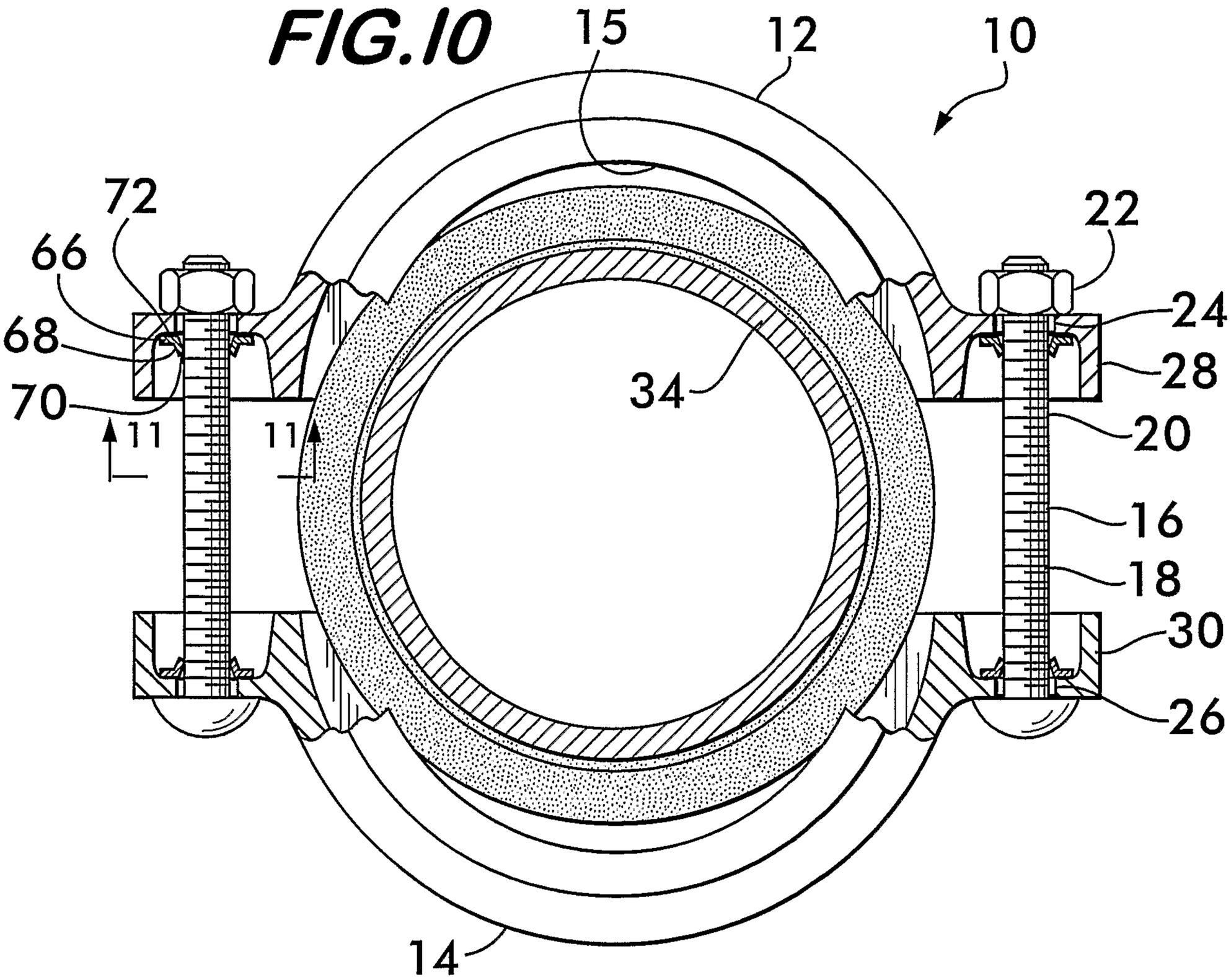
FIG.9

FIG.10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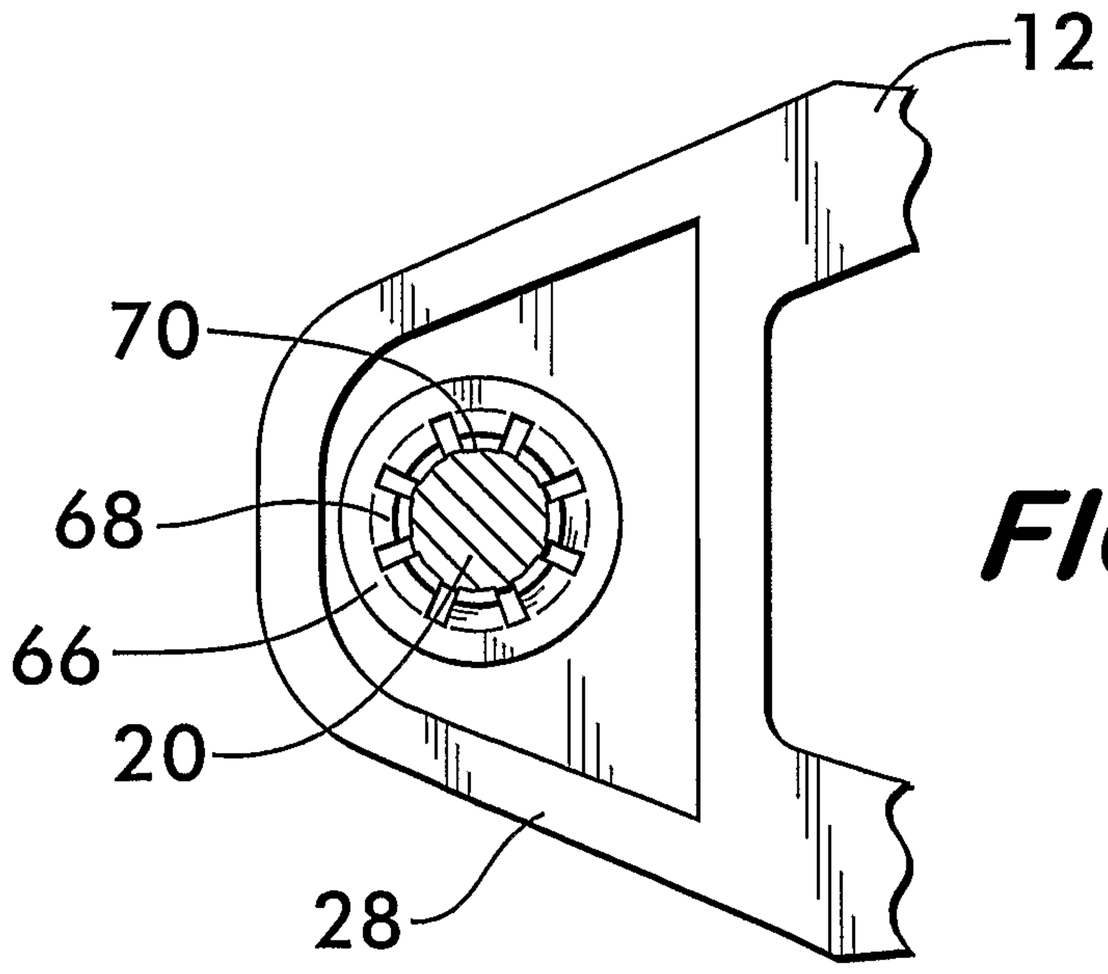
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FIG.11

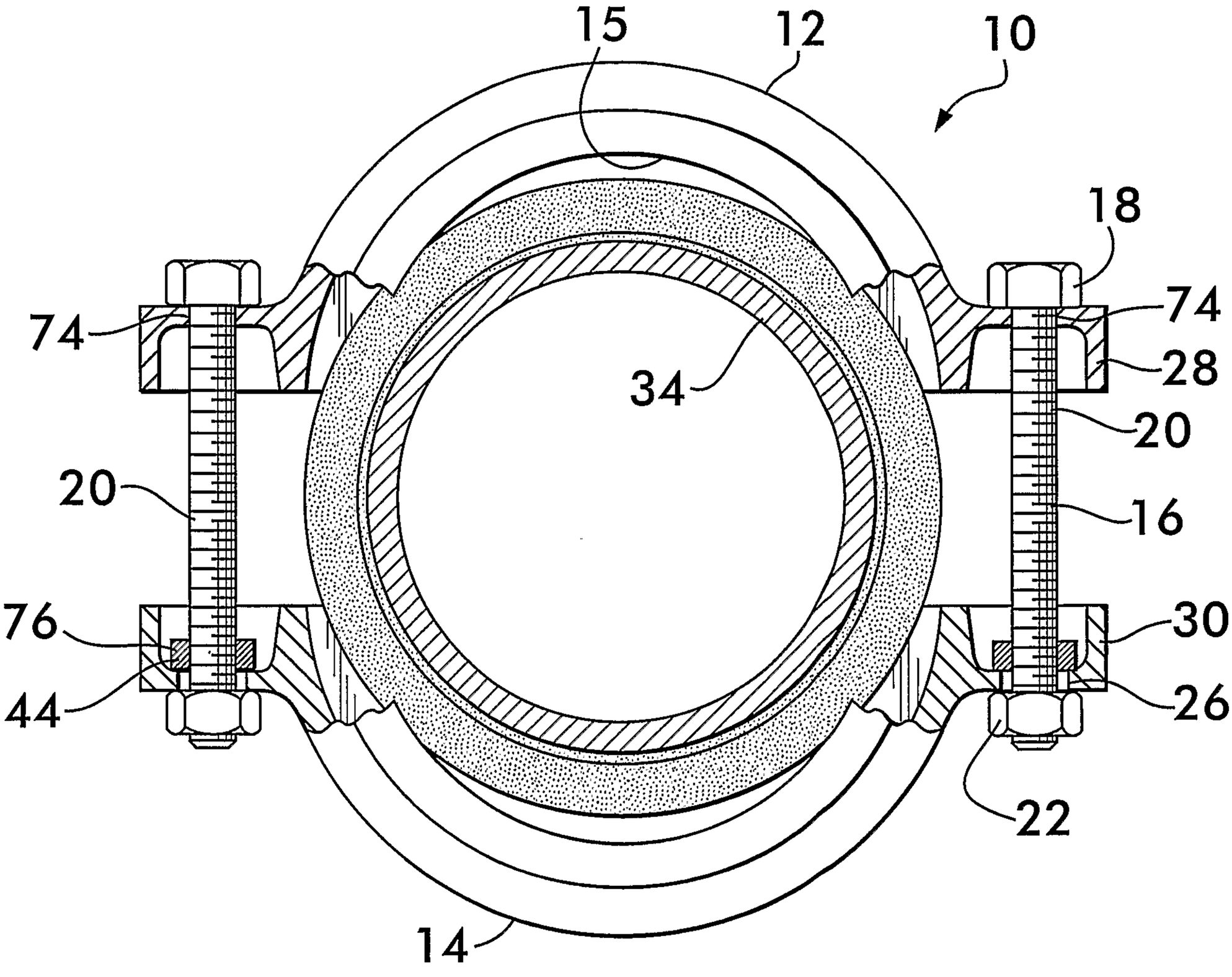
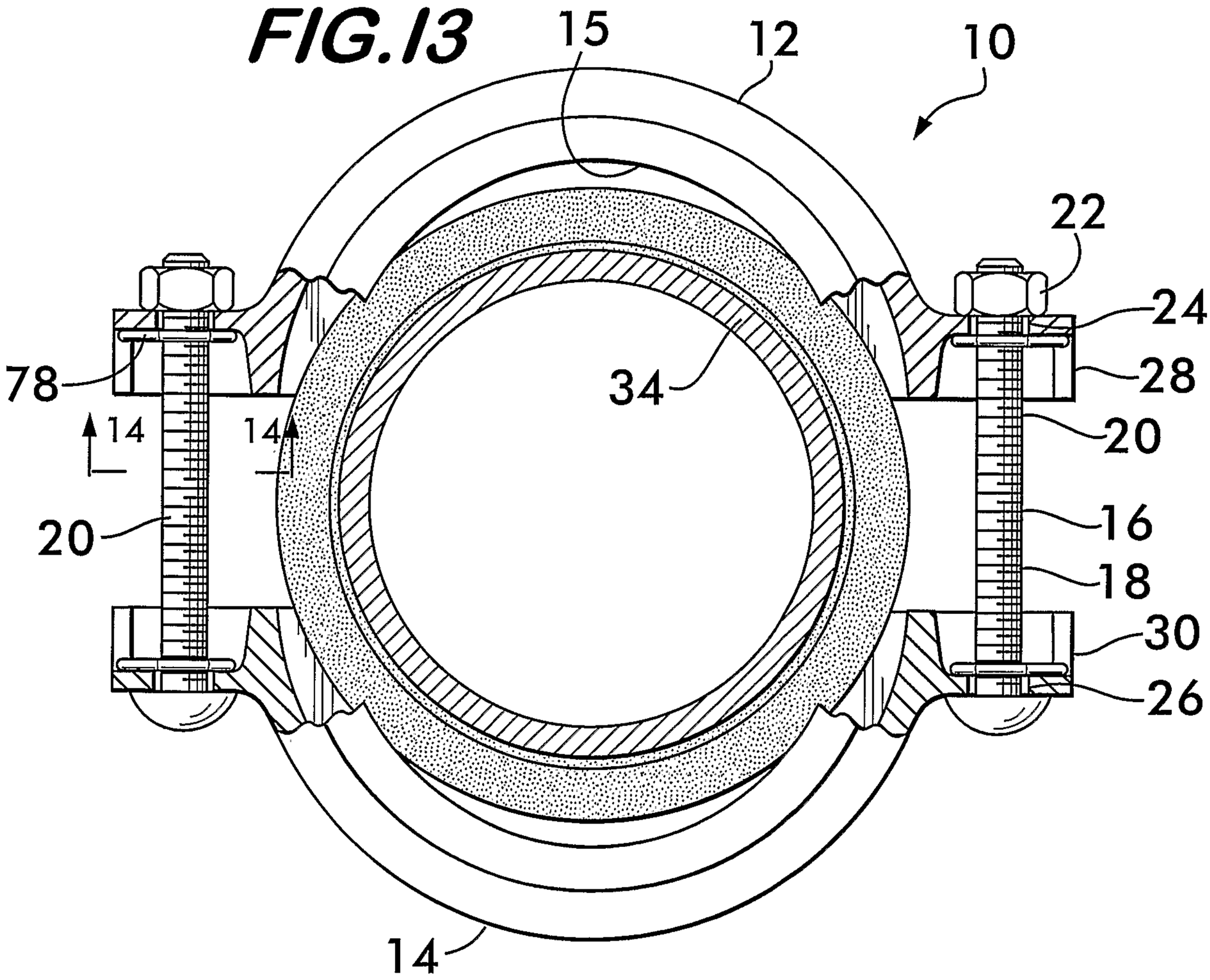


FIG.12

FIG.13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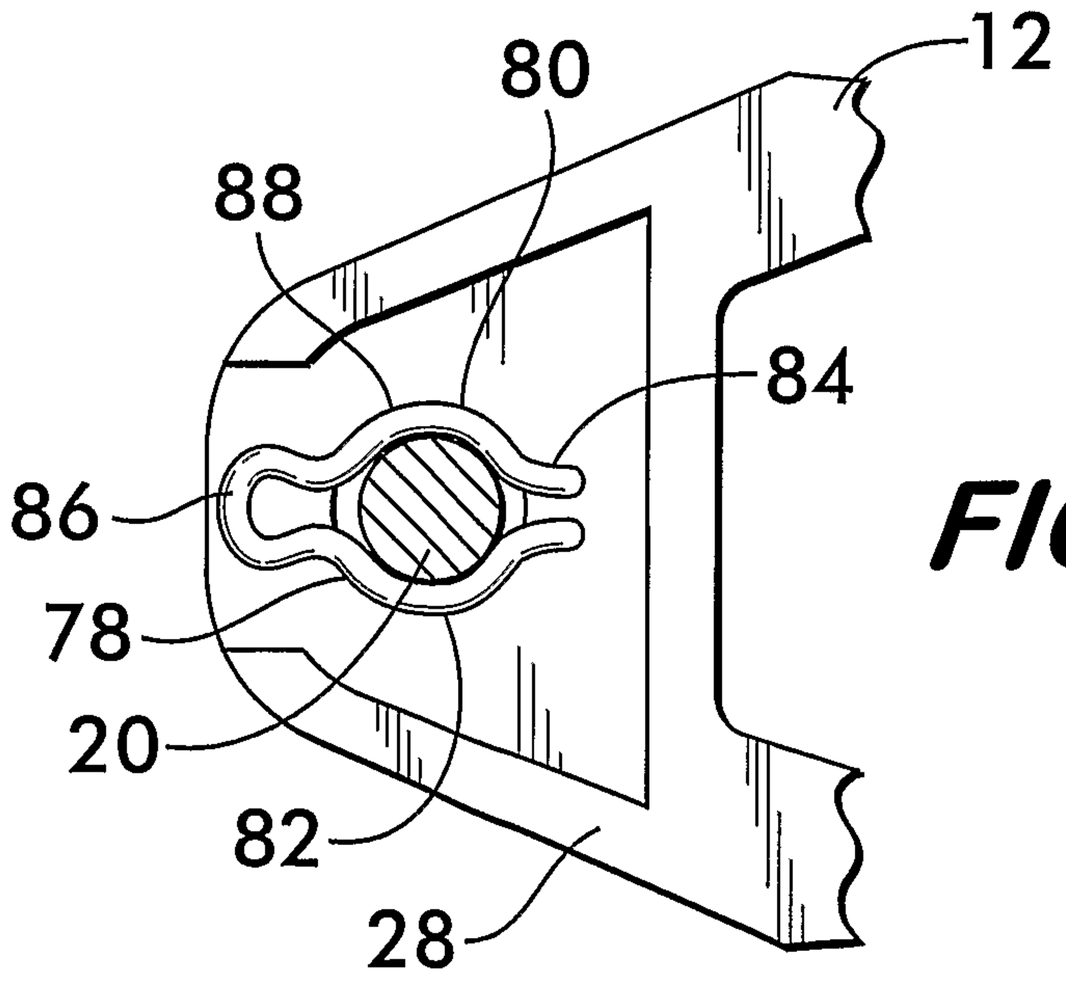
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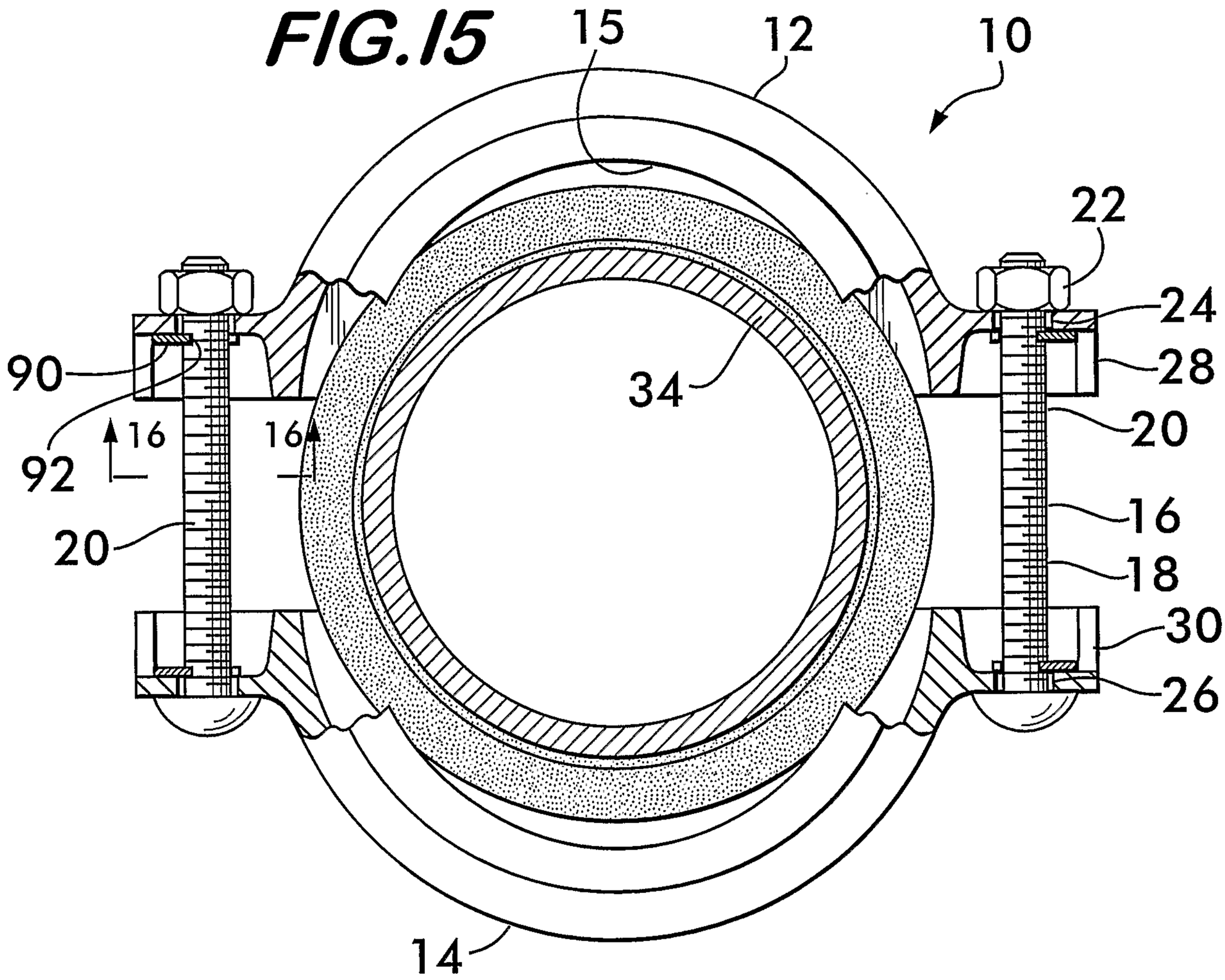
FIG.14

FIG.15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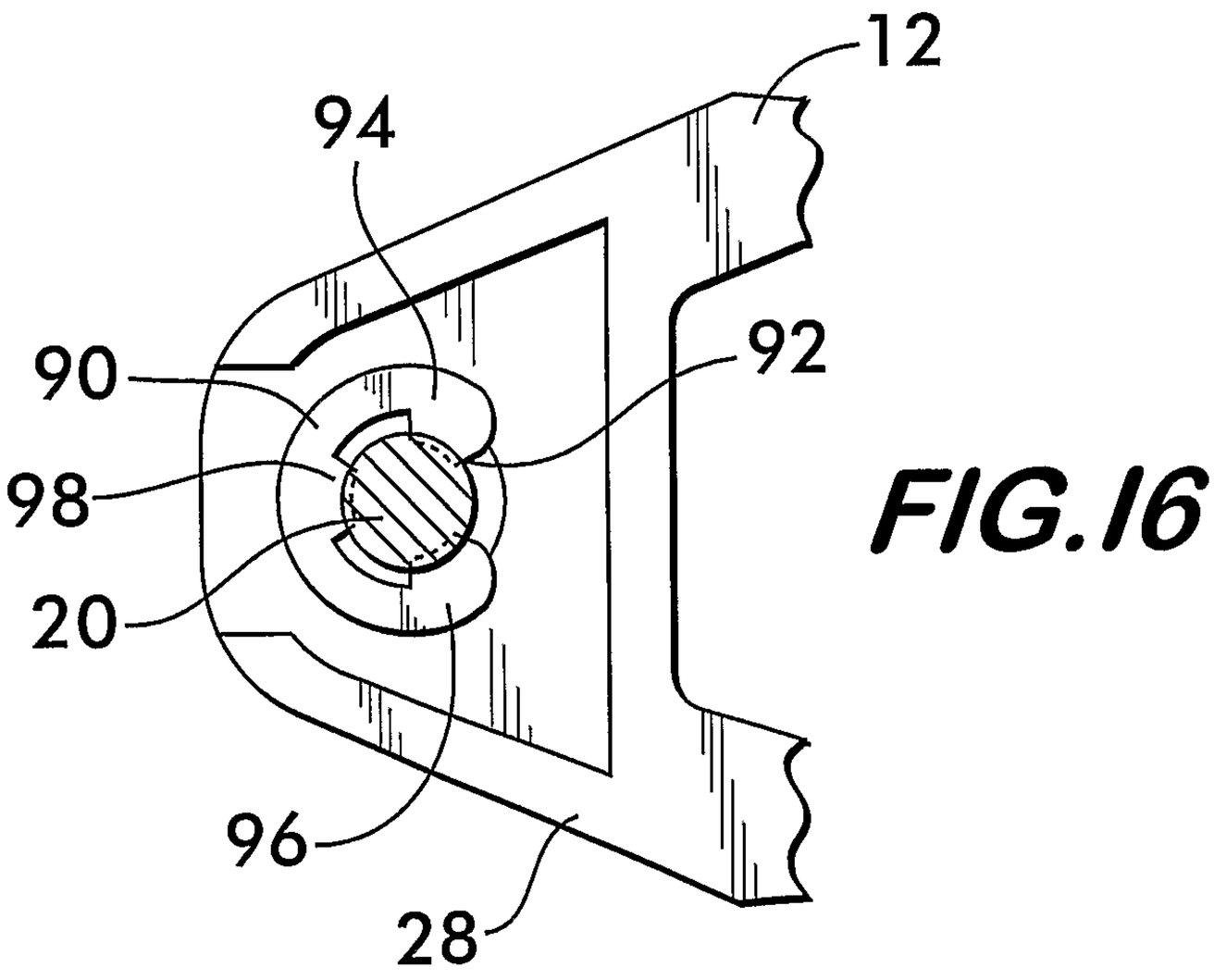
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FIG.16

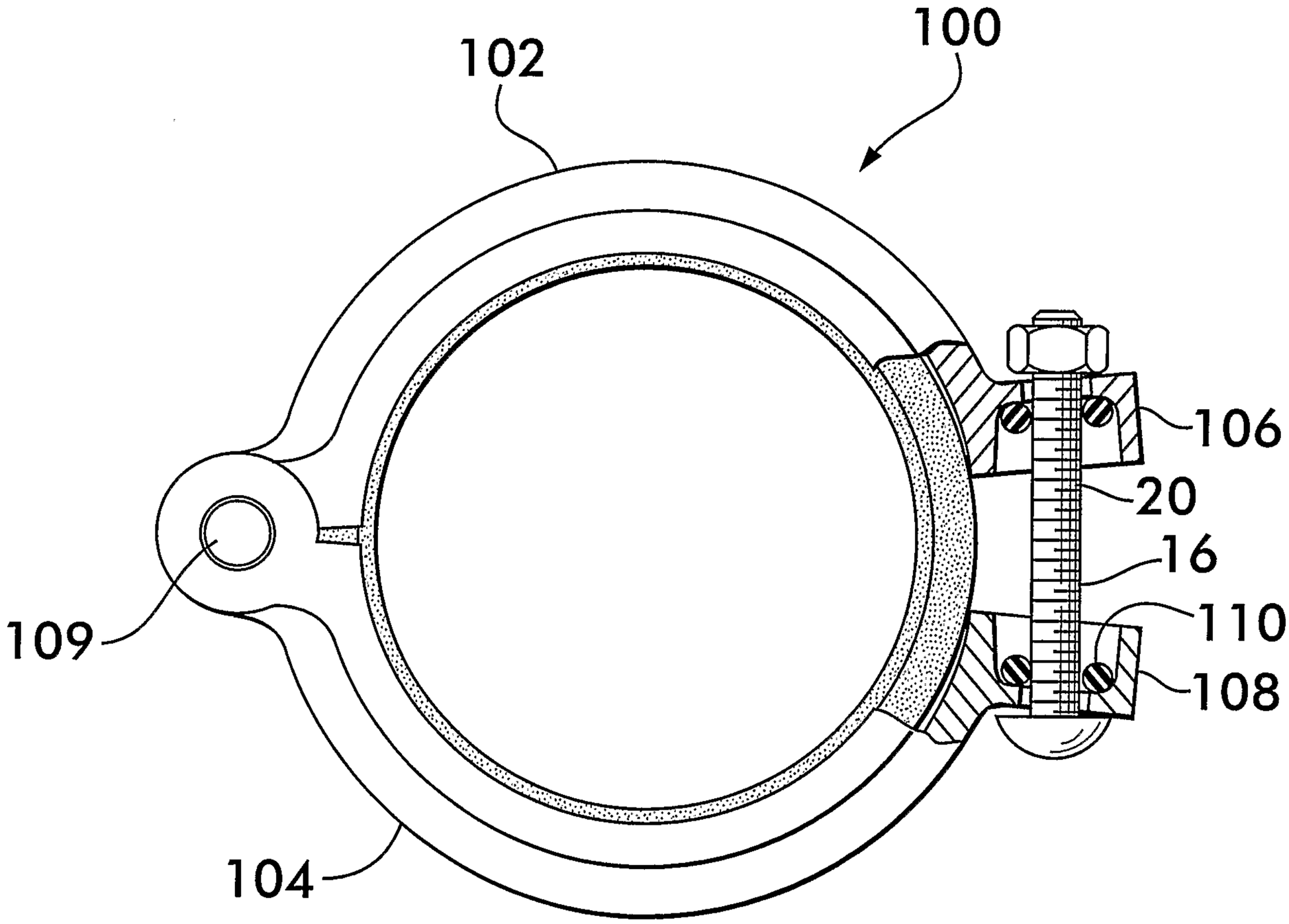
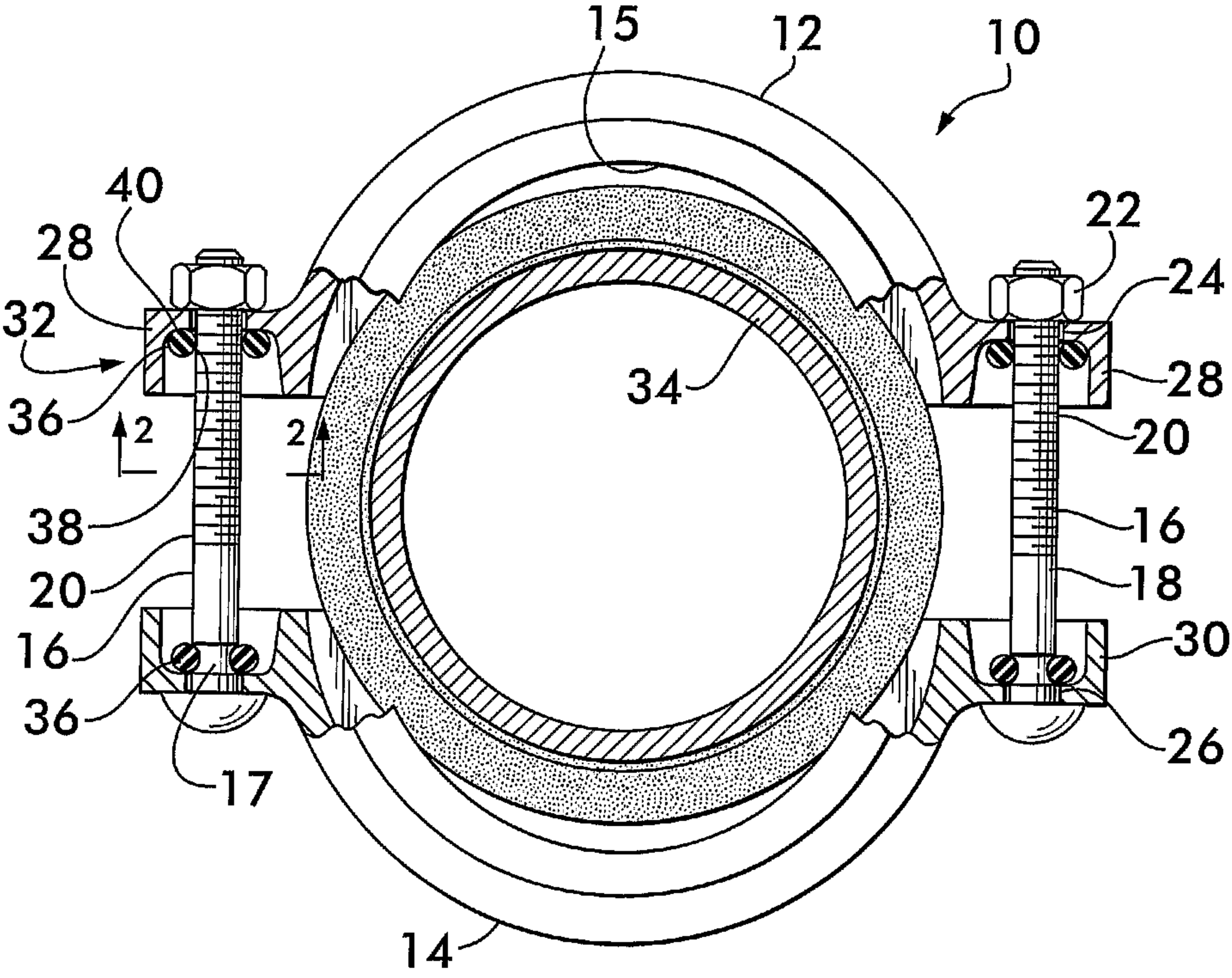


FIG.17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