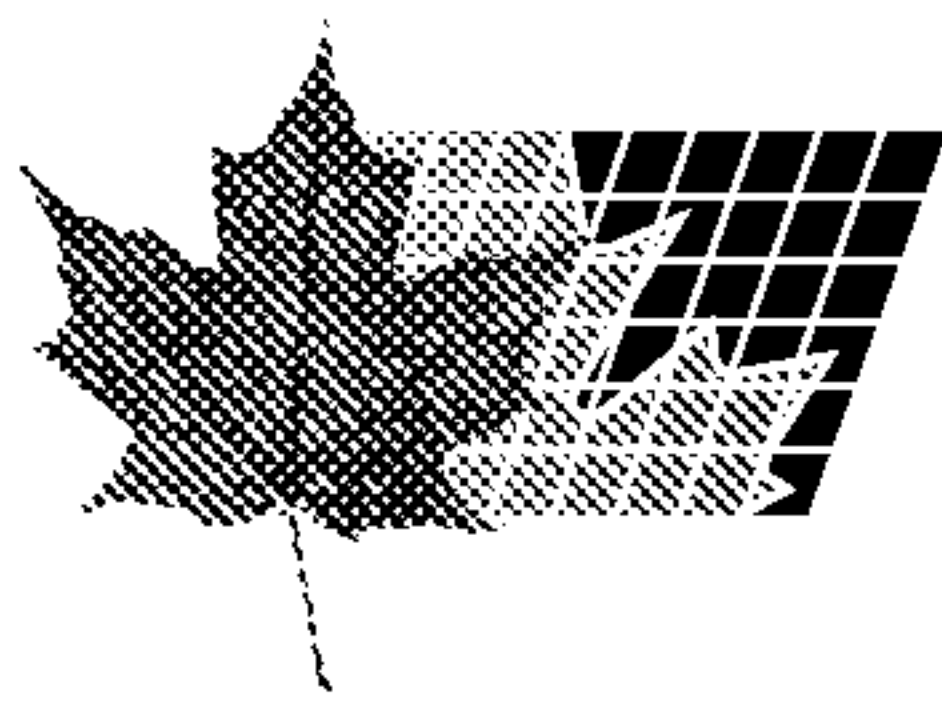




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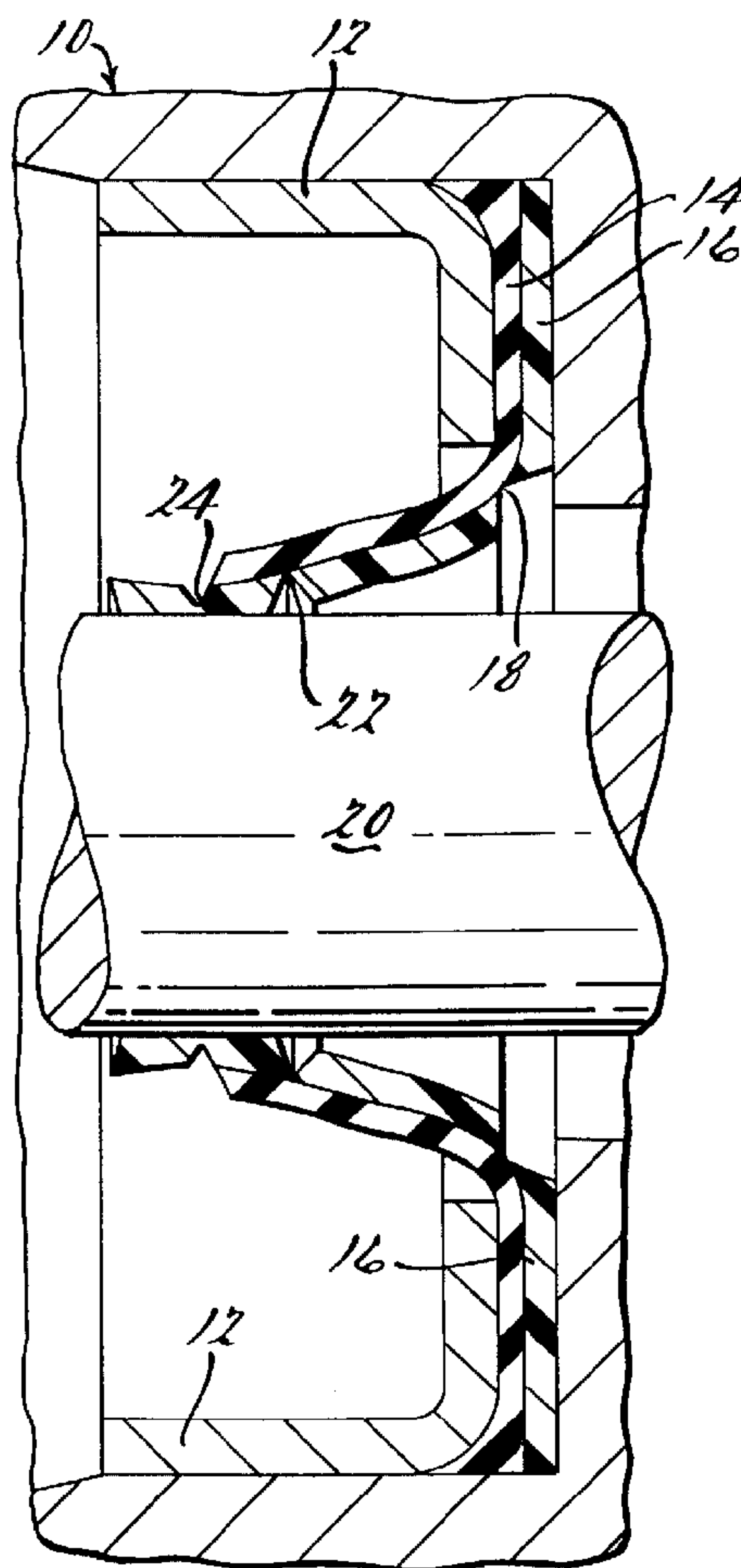
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(54) **JOINT EN POLYTETRAFLUOROETHYLENE ET EN
ELASTOMERE**

(54) **POLYTETRAFLUOROETHYLENE AND ELASTOMER SEAL**



(57) A bi-material shaft seal for sealing a shaft. The shaft seal includes a rigid case and a hinge member connected to the case. The shaft seal further includes a resilient sealing element bonded to the hinge member. The seal element has a first notch. The first notch extends through the seal element to the hinge member.

Abstract

A bi-material shaft seal for sealing a shaft. The shaft seal includes a rigid case and a hinge member connected to the case. The shaft seal further includes a resilient sealing element bonded to the hinge member. The seal element has a first notch. The first notch extends through the seal element to the hinge member.

POLYTETRAFLUOROETHYLENE AND ELASTOMER SEAL

Background of the Invention

1. Field of the Invention:

The present invention relates to seals in general and in particular to shaft seals for use at low temperatures.

2. Description of Related Art:

Shaft seals made of a composite material or bi-material have been known for many years in the art. Prior art shaft seals have been designed for sealing against lubricant leakage along shafts such as engine crank shafts and motor vehicle drivetrain shafts. It is known in the art to create seals in a composite manner using both polytetrafluoroethylene and elastomer. These composite seals usually do not have substantially uniformed thickness. The PTFE and elastomer of the seals are usually separately manufactured and molded. Furthermore, many of the prior art seals create bending effects in the PTFE portion of the seal which reduces shaft followability and sealability thus resulting in leaks along the shaft through the seal member. There have been particular problems in PTFE seals being used in low temperature environments.

Therefore, there is a need in the art for a combination PTFE elastomer shaft seal that has greater flexibility and permits the PTFE to achieve better followability and sealability along the shaft particularly at low temperatures.

Summary of the Invention:

One object of the present invention is to provide a new polytetrafluoroethylene and elastomer seal.

Another object of the present invention is to provide a shaft seal where the polytetrafluoroethylene retains its hoop stiffness and rigidity while having its bending effects reduced.

Another object of the present invention is to provide a shaft seal that has a flexible elastomer hinge which allows polytetrafluoroethylene to better follow an eccentric shaft.

Still a further object of the present invention is to provide a shaft seal which is particularly suited for use at low temperatures.

To achieve the foregoing objects a shaft seal for use on a shaft includes a rigid case. The shaft seal further includes a hinge member connected to the rigid case. The shaft seal also includes a resilient sealing element bonded to the hinge member. The sealing element includes a notch that extends through to the hinge member.

One advantage of the present invention is that it provides a new and improved polytetrafluoroethylene and elastomer shaft seal.

A further advantage of the present invention is that it provides a shaft seal that uses a polytetrafluoroethylene sealing element which retains its hoop stiffness and rigidity while bending effects are reduced.

Yet another advantage of the present invention is that it provides a shaft seal with a flexible

hinge which allows for better followability and sealability along an eccentric shaft particularly at low temperatures.

Other objects, features and advantages of the present invention will become apparent from the subsequent description and appended claims, taken in conjunction with the accompanying drawings.

Brief Description of the Drawings:

Fig. 1 shows a cross section of the present invention.

Fig. 2 shows a cross section of an alternate embodiment of the present invention.

Fig. 3 shows a cross section of an alternate embodiment of the present invention.

Best Mode of Carrying Out the Invention and Description of the Preferred Embodiment(s):

Referring to the drawings, a polytetrafluoroethylene (PTFE) and elastomer shaft seal 10 is shown. A composite shaft seal is for use on shafts of all types and allows for better followability of the PTFE on an eccentric shaft particularly at low temperatures. The PTFE will provide stiffness and rigidity but will not display bending effects as had been seen in previous shaft seal designs. An elastomer portion of the shaft seal 10 will act as a hinge which will be very flexible and will permit the PTFE to better follow and seal an eccentric shaft. The shaft seal 10 is particularly suited for low temperature environments but it should be noted the shaft seal 10 provides advantages at all temperatures but particularly low temperatures.

The shaft seal 10 includes a rigid case 12 which generally has an L-shaped cross section. In the preferred embodiment the rigid case 12 is made of metal however, it should be noted that any other rigid material such as ceramics, hard plastics, or any other rigid material known may be used.

The shaft seal 10 also includes a hinge member 14 which is connected to an outside surface of the rigid case 12. The hinge member 14 is connected via bonding to the rigid case 12 however, it should be noted that any other type of connection may be used such as gluing, chemical bonding, mechanical bonding or the like. The hinge member 14 is preferably made of an elastomer material however, it should be noted that any other type of flexible plastic or rubbers may be used depending on the operating environment of the seal. The hinge member 14 has a generally ring like appearance but is flexible. The flexibility of the hinge member 14 allows for the sealing element 16 to better follow an eccentric shaft which particularly occurs at low temperatures.

The shaft seal 10 also includes a sealing element 16 which is bonded directly to the elastomer hinge member 14 on its outside edge opposite the side bonded directly to the case 12. The sealing element 16 is preferably made of a polytetrafluoroethylene material however, any other material that exhibits the same stiffness and rigidity as that of PTFE may be used depending on the needs of the operating environment. The PTFE sealing element 16 retains its hoop stiffness and rigidity while any bending effects are reduced because of the bond to the elastomer member 14. Furthermore, the PTFE sealing element 16 is cut through to the elastomer 14 at a critical diameter or diameters depending on the sealing application. However, there is at least one notch 18 cut into the sealing element 16. The first notch 18 cut into the sealing element 16 is located near an end of the metal

case 12 which creates a bending moment where the notch 18 appears at the elastomer 14 such that the seal element 16 will have better followability on an eccentric shaft 20 because of the notches 18 in the sealing element 16 through to the elastomer hinge member 14. The sealing element 16 may also have another notch 22 on its outer surface which is cut through to the hinge member 14 such that the end of the sealing element 16 will even further follow the eccentricities of the shaft 20 during normal operation. Any type of sealing unit which is bi-directional or uni-directional may be used with the notched or cut through sealing element. A third notch 24 may also be used on the inside surface of the sealing element such that the third notch 24 is adjacent to the end of the elastomer hinge member 14. Thus, creating a bending moment such that the PTFE sealing element 16 will stay in complete contact with the eccentricities of a shaft 20. Therefore, with the notches 18 cut through to the sealing element to the elastomer hinge member 14 the sealing element 16 has better followability on an eccentric shaft particularly at low temperatures.

Figure 2 shows an alternate embodiment of the present invention. It includes a single notch 218 in the sealing element 216. The notch 218 extends through to the hinge member 214.

Figure 3 shows a shaft seal 310 where there is a single notch 318 in the seal element 316 through to the hinge member 314. The hinge member 314 also comes into contact with the shaft 320. The sealing element 316 also includes a plurality of notches 326 which do not extend through to the hinge member 314.

The present invention has been described in an illustrative manner, it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather

than of limitation.

Many modifications and variations of the present invention are possible in light of the above teachings. Therefore, within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described.

What Is Claimed Is:

1. A shaft seal, said seal including:
a rigid case;
a hinge member connected to said rigid case;
a resilient sealing element bonded to said hinge member, said sealing element having a notch, said notch extends through to said hinge member.
2. The shaft seal of claim 1 wherein said rigid case is made of metal.
3. The shaft seal of claim 1 wherein said sealing element is made of polytetrafluoroethylene.
4. The shaft seal of claim 1 wherein said sealing element having a second notch, said second notch extends through to said hinge member.
5. The shaft seal of claim 1 wherein said sealing element having a third notch, said third notch on an inside surface of said sealing element.
6. The shaft seal of claim 1 wherein said hinge member has a bending moment at said

notch.

7. The shaft seal of claim 1 wherein said notch is placed at a predetermined diameter.
8. The shaft seal of claim 1 wherein said hinge member is made of an elastomer.
9. A bi-material shaft seal for sealing a shaft, said shaft seal including:
 - a rigid case;
 - a hinge member bonded to an outer surface of said case;
 - a resilient seal element bonded to an outer surface of said hinge member, said seal element having a first notch, said first notch extends through said seal element to said hinge member.
10. The shaft seal of claim 9 wherein said case is made of a metal material.
11. The shaft seal of claim 9 wherein said hinge member is made of an elastomer.
12. The shaft seal of claim 9 wherein said seal element is made of polytetrafluoroethylene.
13. The shaft seal of claim 9 wherein said first notch is located near an end of said case.

14. The shaft seal of claim 13 wherein said hinge member has a bending moment at said first notch.

15. The shaft seal of claim 9 further including a second notch, said second notch extends through said seal element to said hinge member.

16. The shaft seal of claim 15 further including a third notch.

17. A bi-material shaft seal for use in sealing a shaft, said shaft seal including:
a rigid case, said case having a generally L-shaped cross section;
a flexible hinge member connected to an outer surface of said case; and
a seal element bonded to said hinge member, said seal element having a first notch which extends through to said hinge member, said first notch located near an end of said case, said first notch creates a bending moment on said hinge member.

18. The bi-material shaft seal of claim 17 wherein said case is made of metal.

19. The bi-material shaft seal of claim 17 wherein said hinge member is made of elastomer.

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20. The bi-material shaft seal of claim 17 wherein said seal element is polytetrafluoroethylene.

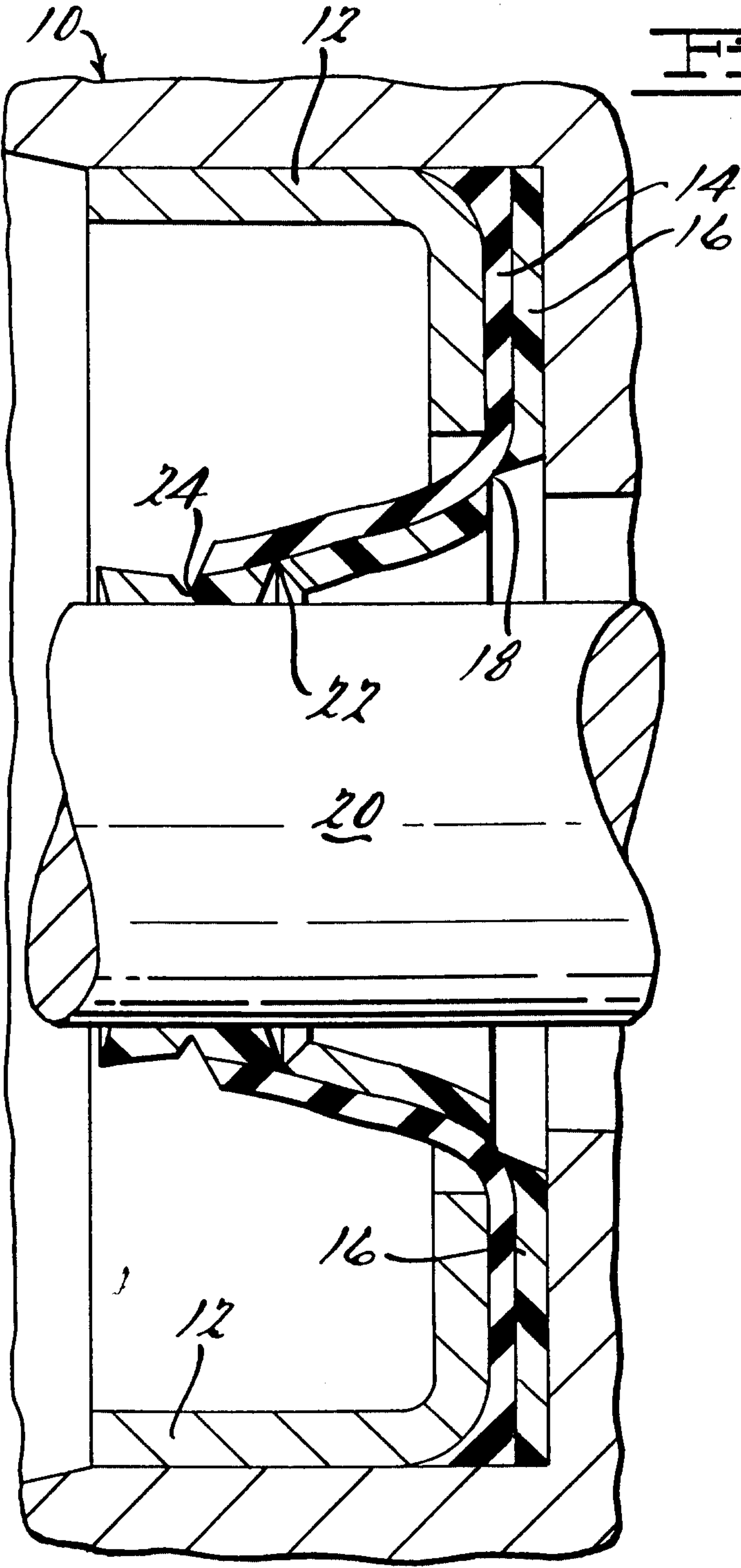


Fig. 1.

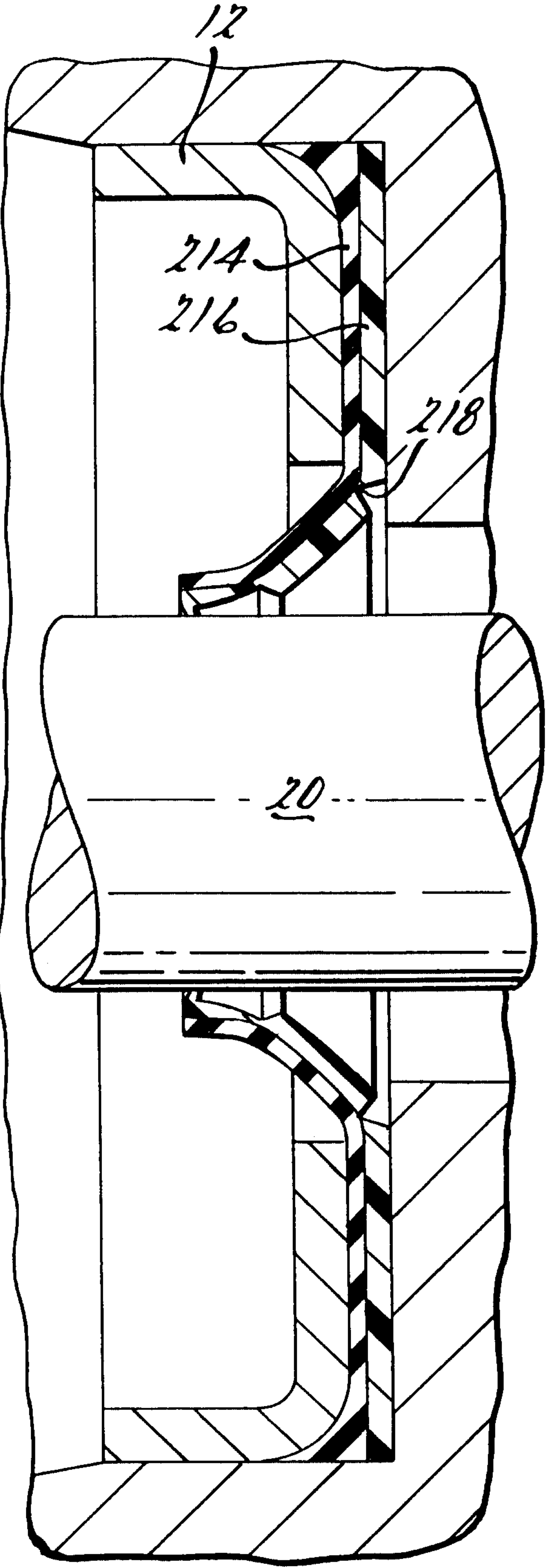


Fig. 2.

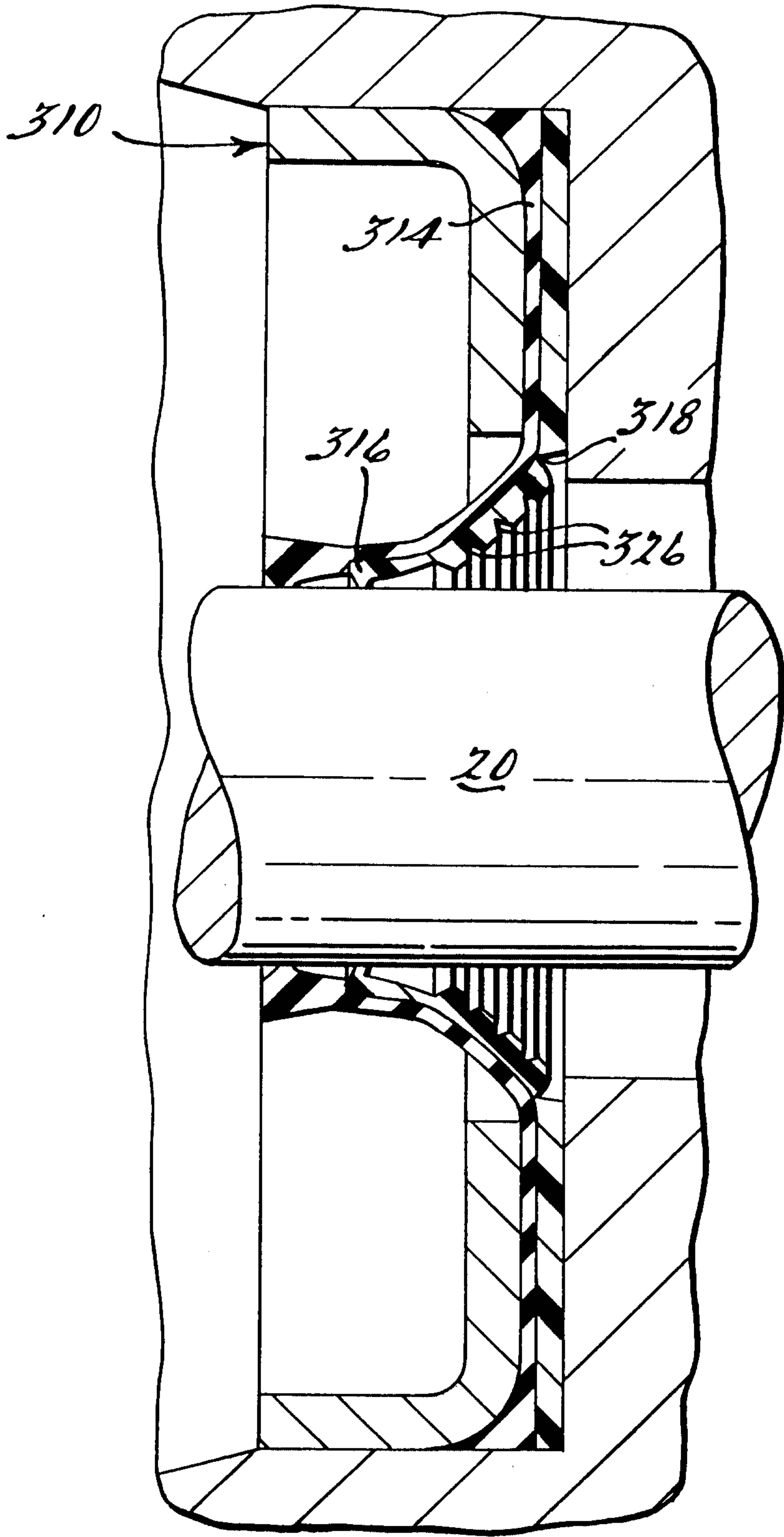


FIG. 3.