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(54) **SEALING RING FOR A SWINGING YOKE HYDROSTATIC UNIT**

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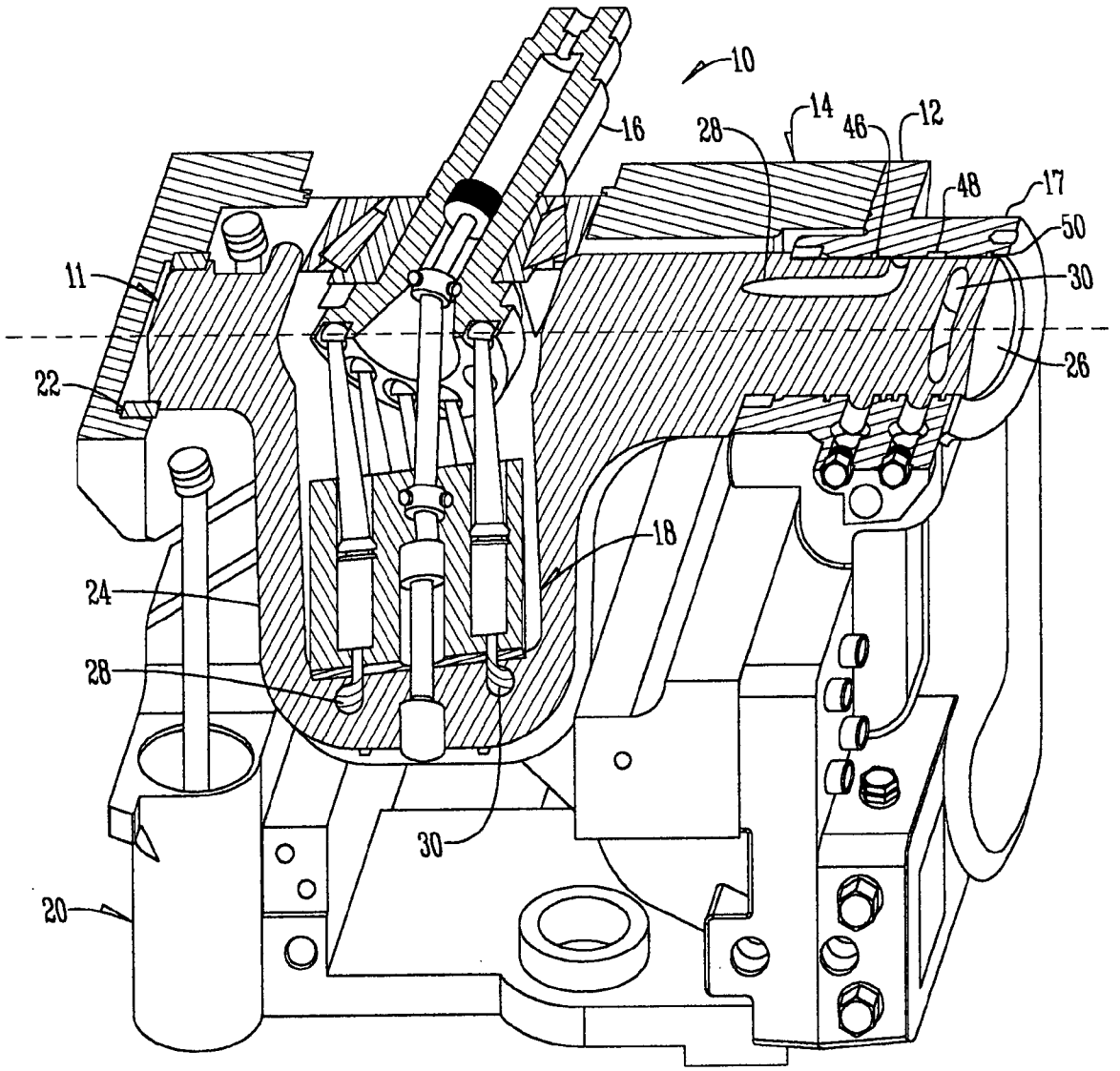
(57) **ABSTRACT**

An improved sealing ring for a hydrostatic transmission having a sideface with an irregular shaped chamfered portion such that when pressure reversal occurs within a hydrostatic transmission the seal will immediately shuttle across the mounting groove of the hydrostatic transmission by preventing a uniform extrusion within the clearance space between the manifold of the hydrostatic transmission and the yoke of the hydrostatic transmission.



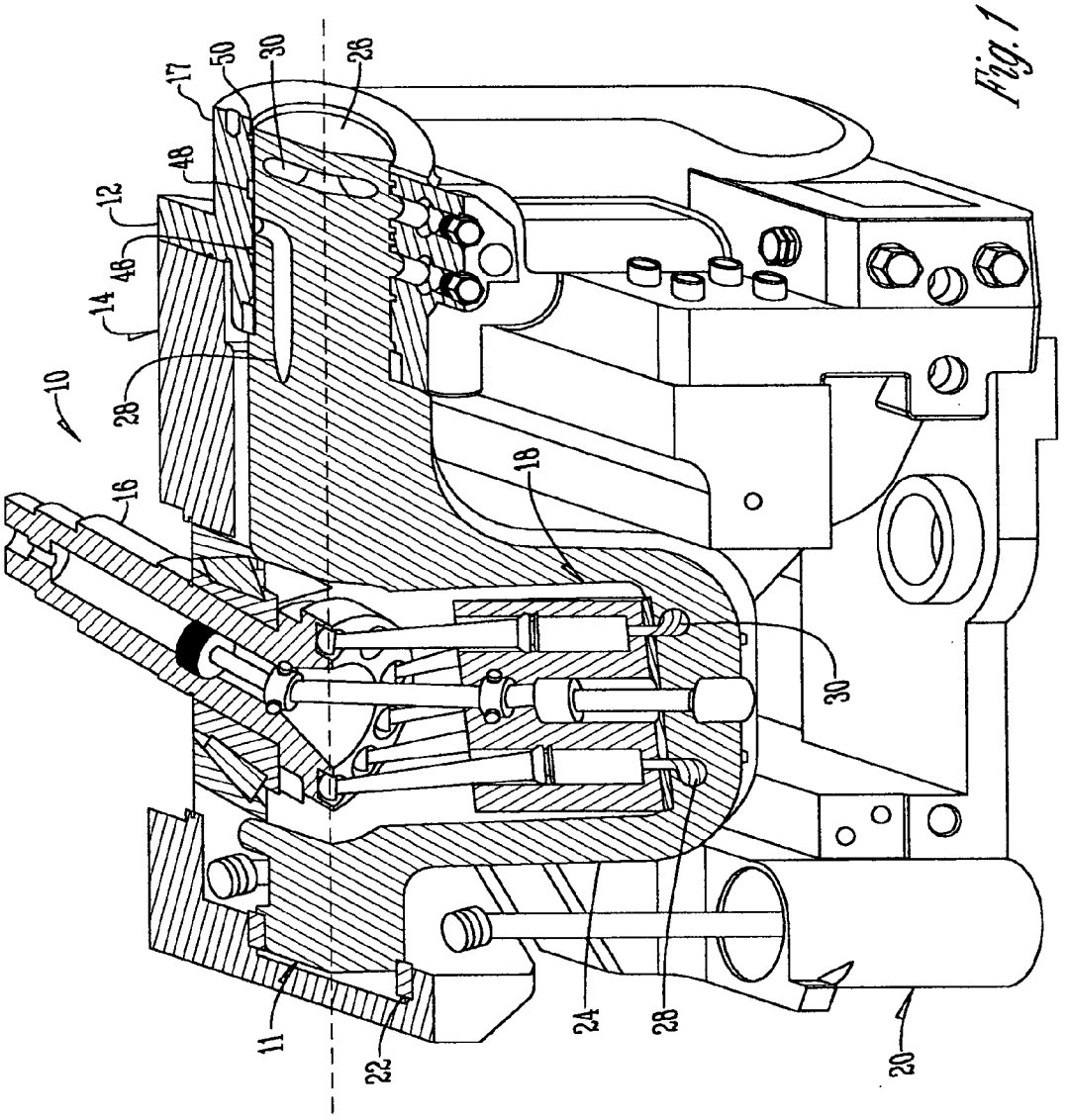


Fig. 1

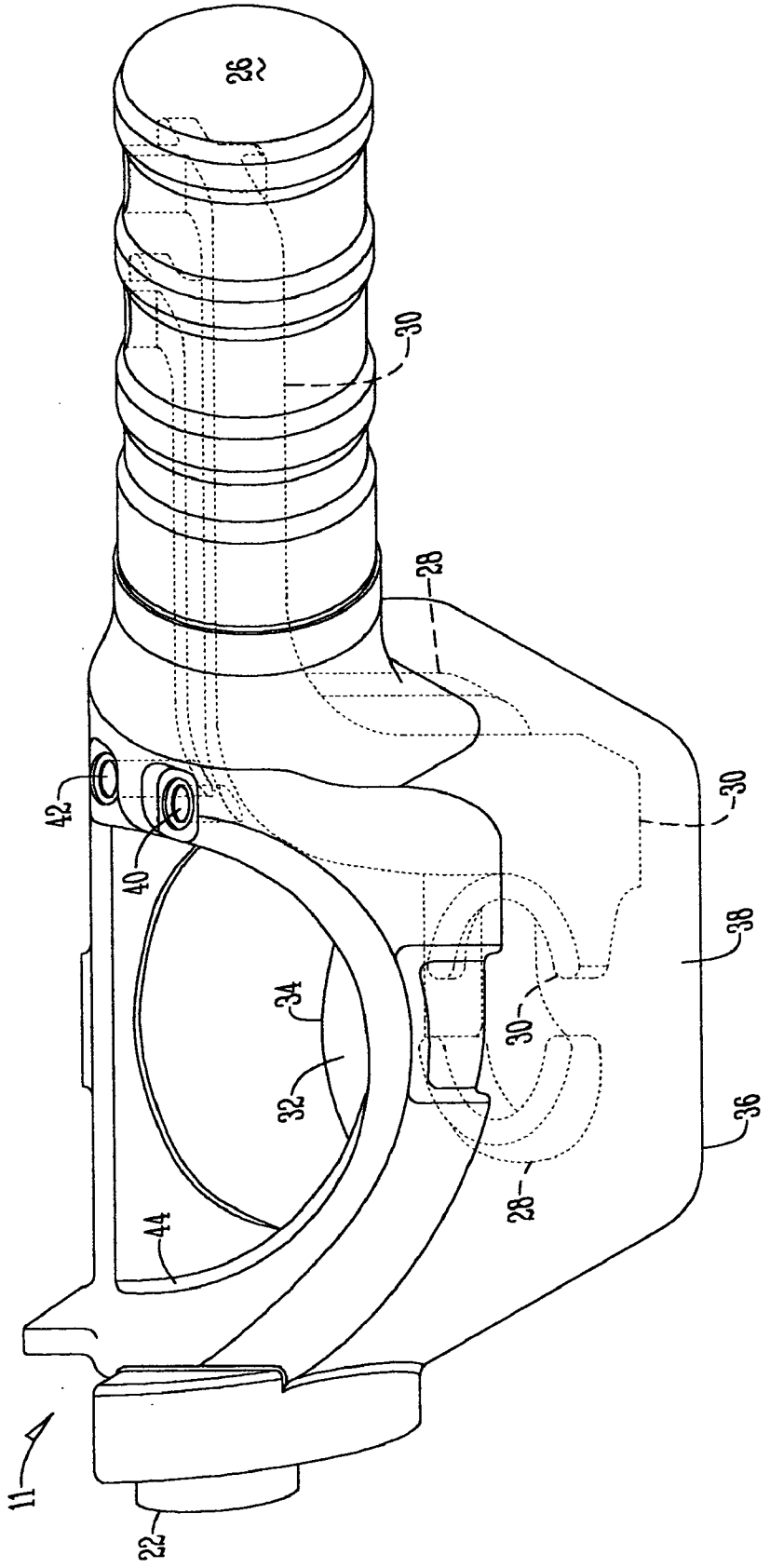


Fig. 2

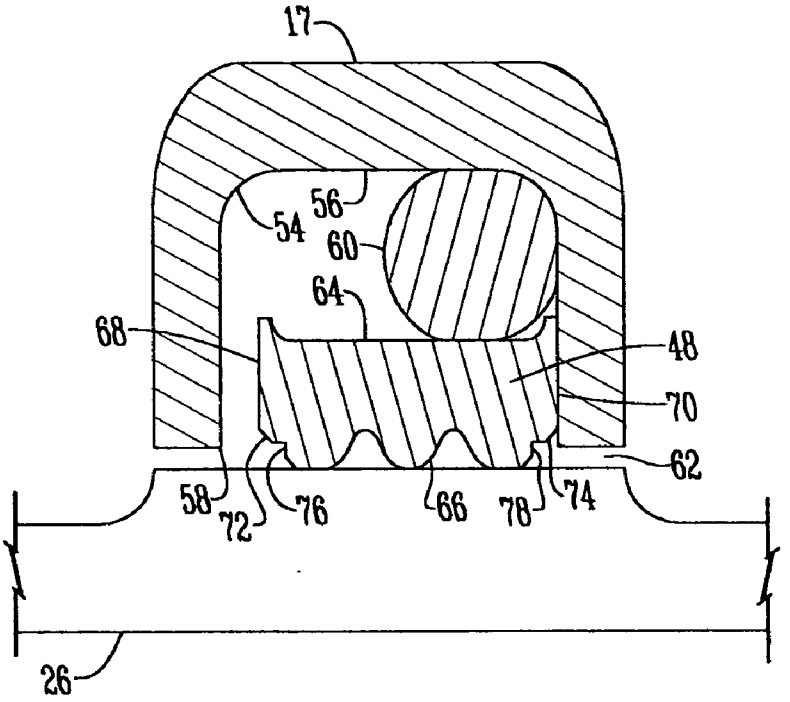

17
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Fig. 3

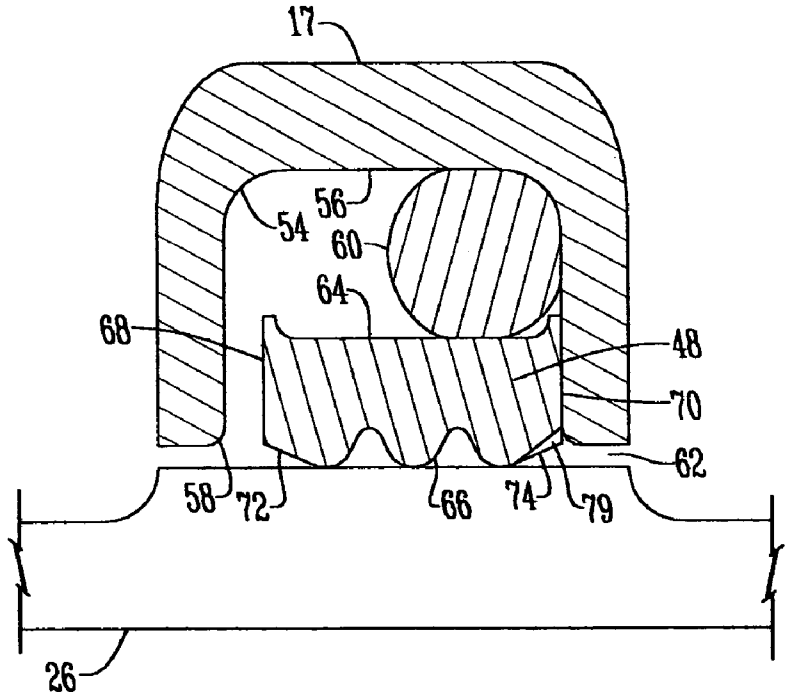
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Fig. 4

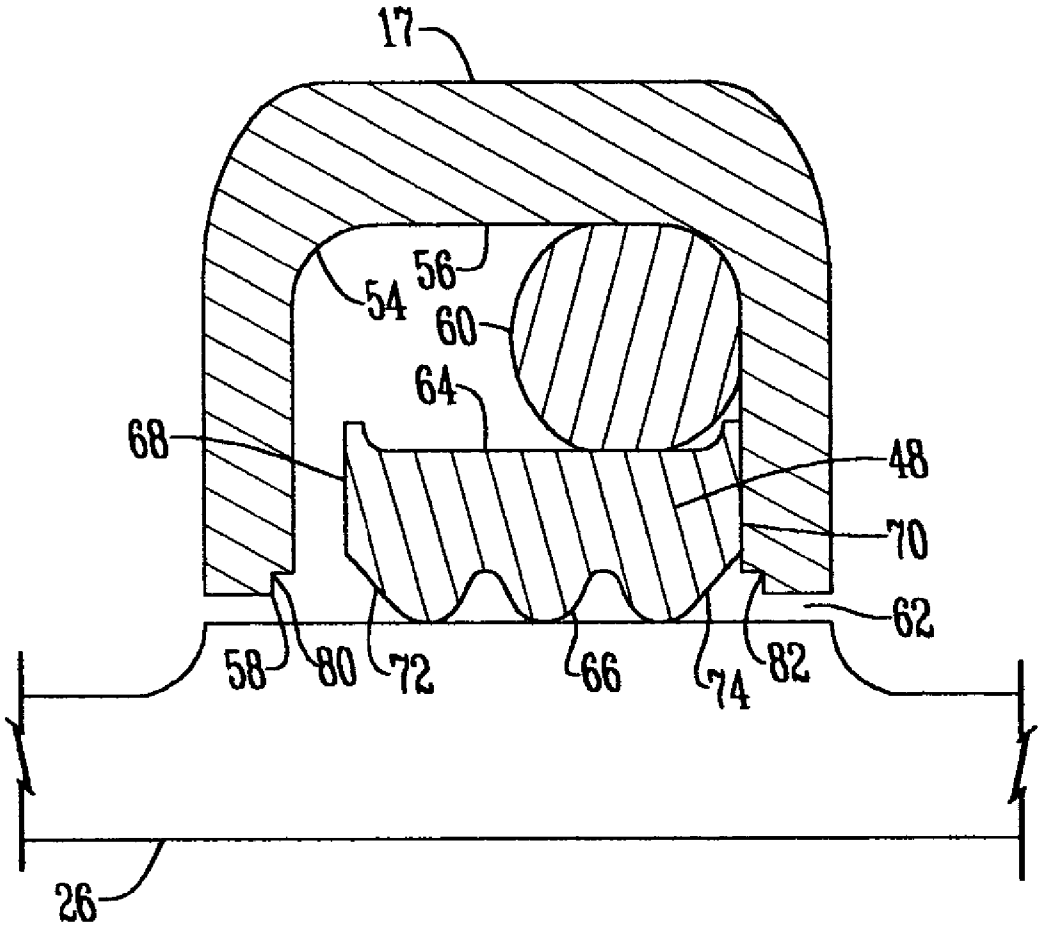

Fig. 5

SEALING RING FOR A SWINGING YOKE HYDROSTATIC UNIT

BACKGROUND OF THE INVENTION

[0001] This invention relates to a sealing system for a swinging yoke hydrostatic unit. Swinging yoke hydrostatic units are very well known in the art as can be seen in U.S. Pat. No. 6,203,283 to Fleming et al. and the U.S. Pat. No. 6,257,119 to Ryken et al. The prior art utilizes a sealing system in its trunnion and manifold that utilizes three seals. Fluid cavities within the trunnion are spaced apart from one another and represent two separate hydraulic fluid lines. Prior art teaches the sealing of these two fluid cavities by using three seals to prevent fluid from these passages from seeping out of the fluid cavities or in between the fluid cavities. This three seal arrangement has proven problematic.

[0002] The area of deficiency in the three seal arrangement is related specifically to the center seal. During operation of the swinging yoke hydrostatic unit the pressure in the fluid cavities fluctuates, causing a significant difference in the pressure between the two cavities. Because of this fact, the cavity containing high pressure fluid transitions between the cavities. Thus, the center seal is required to shuttle from one side of the seal mounting groove to the other depending upon which cavity contains the high pressure fluid. Currently in the art, to handle this shuttling back and forth within the mounting groove, seals are designed to have radial grooves on their sideface to facilitate the infusion of pressurized fluid against the side of the seal and into the area where the seal energizer ring is located to hasten the movement of the seal across the groove. Simultaneously, the radial grooves on the opposite side of the seal facilitate the evacuation of fluid from the seal cavity as the seal moves across the groove. Unfortunately, because of the current design, when used, the seal material will flow to form a uniformly extruded lip in the clearance area between the hydrostatic transmission manifold and the swinging yoke and thus, will effectively seal the path that pressurized fluid must flow to generate the required force to cause the seal to shuttle to the other side of the mounting groove. Consequently, when the seal fails to move, pressure builds upon the seal and eventually the seal can no longer hold back the high pressure and the seal is lifted and thus, a leak path between the high pressure and low pressure side of the hydrostatic loop is created. This condition of the seal being thrust out of the area between the yoke and the housing and lifted thus allowing for the leak is known as "blow-by".

[0003] There is a need in the art to provide for an improved seal design that alters the flow of the seal material such that a uniform extrusion will no longer be created between the manifold and the yoke so that "blow-by" does not occur within the hydrostatic transmission. Thus, it is a primary object of the present invention to provide a seal for a hydrostatic transmission that alters the sideface of the seal to disrupt the flow of the seal into a uniform extrusion and thus, improves upon the state of the art.

[0004] Yet another object of the present invention is to provide a seal that will immediately shuttle from one side of a mounting groove to another while maintaining a leak proof seal on the sealing surface when a pressure reversal within the hydrostatic transmission occurs.

[0005] These and other objects, features, or advantages of the present invention will become apparent from the specification and claims.

BRIEF SUMMARY OF THE INVENTION

[0006] The present invention is an improved sealing system for a hydrostatic transmission. The sealing system utilizes an improved seal that is to be placed in a mounting groove of the manifold and is in sealing contact with the swinging yoke trunnion of a hydrostatic transmission. The improved seal has a sideface with a chamfered portion therein and has an irregular shape. The irregular shape can be created by placing a notch in the chamfered portion or by cutting the sideface to form a different angle for the chamfered portion in relation to the sideface. Thus, when pressure reversal within the hydrostatic transmission occurs, the seal will immediately shuttle to the opposite side of the mounting groove and the seal will not flow to create a uniform extrusion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] **FIG. 1** is a perspective assembly view of a bent axis unit equipped with the sealing system of this invention. Portions have been cut away to expose the sealing system;

[0008] **FIG. 2** is a perspective view of the yoke of this invention;

[0009] **FIG. 3** is a sectional view of one embodiment of this invention wherein the chamfered portion of the seal has a notch therein;

[0010] **FIG. 4** is a sectional view of another embodiment of the present invention wherein the sideface of the ring is cut such that the chamfered section of the sideface is present at a new angle; and

[0011] **FIG. 5 a** sectional view of another alternative embodiment wherein a notch is placed within the manifold of the hydrostatic transmission thus allowing for the seal to be unaltered.

DETAILED DESCRIPTION OF THE INVENTION

[0012] **FIG. 1** shows the swinging yoke hydrostatic unit **10** that has a yoke **11** pivotally installed in the housing **12** of a bent axis unit **14** having a main shaft **16**. The housing **12** also has a manifold **17**. A rotatable cylinder block kit **18** varies (and thereby the fluid displacement of the unit **14** varies) as the yoke **11** is pivoted by servo means **20** with respect to the housing **12** and the main shaft **16**.

[0013] The yoke **11** has a central bucket portion **24** adapted to swingably carry the cylinder block kit **18** of the bent axis unit **14**. The yoke **11** also includes a trunnion bearing portion or arm **22** for swinging control on one side of the bucket portion **24** and a trunnion **26** for fluid porting on the other side of the bucket portion **24**.

[0014] The trunnion **26** has a pair of fluid passages or conduits **28** and **30** that intersect the running surface **32** in the area **34**. The conduits **28** and **30** extend separately and are entirely within the bottom wall **36**, the side wall **38**, and the trunnion for fluid porting **26**. One of the fluid conduits **28, 30** normally carries high pressured fluid (in the range of 0-550 BAR) when the cylinder block kit **18** rotates in one

direction. Meanwhile, the other of the fluid conduits **28**, **30** normally carries relatively low pressure fluid, such as control or charge pressure (in the range of 0-25 BAR). Of course, the normal pressures of the bent axis unit **14** may vary, depending upon the system requirements. The invention is applicable to other system pressure requirements with only minor modifications.

[**0015**] The conduits **28**, **30** extend across the bottom wall **36** of the yoke **11**. Then the conduits **28**, **30** extend upwardly within the side wall **38**. Near the top of the yoke **11**, gauge ports **40**, **42** can be provided. The gauge ports **40**, **42** extend into the yoke **11** adjacent to the open top **44** so that they intersect the fluid conduits **28**, **30** respectively. The fluid conduits **28**, **30** curve and extend into the trunnion **26** for fluid porting.

[**0016**] The sealing system of the present invention can be seen as seals **46**, **48**, and **50** located on the manifold **17** adjacent to the trunnion **26**. Each seal is disposed within a seal mounting groove **54**. For convenience, only seal **48** will be discussed. Seal **48** is located on the exterior side of conduit **28** and on the interior side of fluid conduit **30** thus, representing a center seal. One should appreciate that seal **48** seals fluid from fluid conduits **28** and **30** thus preventing fluid communication therebetween.

[**0017**] Mounting groove **54** is disposed within the manifold **17** around the yoke trunnion **26** and has a top or outer surface **56** with an inner open end **58**. Disposed within the mounting groove **54** is an energizer ring **60** that contacts the outer surface **56** and functions to force the seal **48** against the yoke trunnion **26**. Additionally, the space between the yoke trunnion **26** and the manifold **17** forms a clearance space or fluid conduit **62** therebetween.

[**0018**] The seal **48** can best be seen in **FIG. 3**. The seal **48** has a recessed top surface **64** that receives the energizer ring **60**. The bottom of the seal **66** is ribbed to facilitate sealing and movement. Additionally, the seal **48** has first and second sidefaces **68** and **70** respectively. The sidefaces **68** and **70** both have a chamfered portion **72** and **74** respectively. The chamfered portions **72** and **78** are of an irregular shape. For example, as shown in **FIG. 3** notches **76** and **78** are cut into the chamfered sections **72** and **74** of the sidefaces **68** and **70**. **FIG. 4** shows an alternate embodiment wherein the chamfered portions **72** and **74** are cut such that a space **79** is formed between the sidefaces **68** and **70** when the sidefaces are in sealing engagement with the groove **54** thus, preventing a uniform extrusion. In another embodiment as seen in **FIG. 5**, notches **80** and **82** are placed within the manifold adjacent the seal.

[**0019**] In operation, all of the modifications to the seal and manifold as seen in **FIGS. 3, 4**, and **5** will cause the same result. When there is a pressure reversal within the hydrostatic transmission, the seal **48** immediately transitions from one side of the mounting groove **54** to the other. The notches **76**, **78**, **80** and **82**, as well as the space **79** prevent a uniform extrusion in the fluid cavity **62**. This allows the seal **48** to avoid "blow-by" and consequently improves upon the state of the art. Therefore, all of the objectives of the present invention have been met.

[**0020**] It will be appreciated by those skilled in the art that other various modifications could be made to the device without the parting from the spirit in scope of this invention. All such modifications and changes fall within the scope of the claims and are intended to be covered thereby.

What is claimed is:

1. A sealing system for a swinging yoke hydrostatic unit having a housing with a yoke trunnion swingably mounted in a bore therein adjacent a manifold comprising:

a conduit within the trunnion and being fluidly connected to the manifold; and

a seal disposed within the manifold and around the trunnion located adjacent the fluid conduit, the seal having an irregular chamfered sideface portion.

2. The sealing system of claim 1 wherein the hydrostatic transmission is a bent axis hydrostatic transmission.

3. The sealing system of claim 1 wherein the seal has a top surface with a recess that receives an energizer ring.

4. The sealing system of claim 1 wherein the seal has a bottom surface that is ribbed.

5. The sealing system of claim 1 wherein the seal is within a mounting groove that is in the manifold and disposed around the trunnion.

6. A seal for a hydrostatic transmission having a housing with a yoke trunnion swingably mounted in a bore therein adjacent a manifold comprising:

a resilient body having a top, a bottom, and sidefaces having irregular chamfered sideface portions.

7. The seal for a hydrostatic transmission of claim 6 wherein the top of the seal is formed to have a recess.

8. The seal for a hydrostatic transmission of claim 6 wherein the bottom of the seal has a ribbed surface.

9. A sealing system for a swinging yoke hydrostatic unit having a housing with a yoke trunnion swingably mounted in a bore therein adjacent a manifold comprising:

a conduit within the trunnion and being fluidly connected to the manifold;

at least one mounting groove within the manifold disposed around the yoke and located adjacent the fluid conduit;

a notch disposed within the manifold adjacent the mounting groove; and

a seal disposed within a mounting groove and in fluid communication with the notch.

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