A valve plate for a axial hydraulic unit where the mass of the front side is equal to the backside and the masses of the front side and the backside are equally distributed over the area of the sides of the plate. This improvement makes the manufacturing costs higher but significantly reduces the operating costs which makes it more economical.
VALVE PLATE FOR AXIAL HYDRAULIC PISTON PUMP OR MOTOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

REFERENCE TO A MICROFICHE APPENDIX

[0003] Not Applicable

BACKGROUND OF THE INVENTION

[0004] This invention relates to a valve plate applicable to axial hydraulic pumps/motors.

[0005] In axial hydraulic piston pumps, of fixed or variable displacement, valve plates are used to channel the flow of fluid from the barrel, which may contain multiple pistons, to the outlet ports in the port head. There are some instances where there are a multiple of valve plates. These are usually referred to as the bearing plate or the port plate. Since these plates function the same as the valve plate, the nomenclature "valve plate" will be used to refer to all.

[0006] Valve plates have certain characteristics. The front side of the plate, or the side facing the barrel face, has bearing pads [2] arranged along the outside diameter, an inner bearing area [3], and a multiple of kidney ports [1]. The bearing pads [2] provide more area for the hydraulic float and for stabilization. The inner bearing area [3] is where the hydraulic fluid separates the valve plate from the face of the barrel. Kidney ports [1], which are machined through the plate, are the ports which are used to channel the fluid from the barrel to the port head. These kidney ports [1] usually have "fishtails" which are used to reduce cavitation of the fluid flow. Fishtails are explained by Moon, Jr. in U.S. Pat. No. 3,585,901.

[0007] The front side valve plate [FIG. 1] is separated from the face of the barrel [5] by a thin film of fluid [6]. This acts both as a seal for the hydraulic fluid and as a bearing medium. As the barrel [4] rotates, the piston pushes the fluid through the barrel face [5] and through the kidney ports [1] of the plate valve. The barrel [4] is held against the valve plate by spring tension. Only this thin film of oil [6] keeps the barrel face [5] from touching the front side of the valve plate. The backside of the valve plate is pinned or fastened to the port head face [8]. The barrel face [5], the front and back sides of the valve plate and the face of the port head [8] must all be lapped to within one light band of green achromatic light (0.0000116 in.). This flatness is important in order to maintain the seal between the valve plate and the barrel face [5] and to maintain hydraulic float.

BRIEF SUMMARY OF THE INVENTION

[0008] In prior art, little concern is given to the backside of the valve plate. Since the inner bearing area [3] is not needed on the back side of the valve plate and the outer bearing area is used only for stabilization, and since machining costs are a concern, the back face is usually left blank except for the kidney ports [1] and the machining necessary for the shaft.

[0009] This lack of attention given the backside of the valve plate has led to many problems. As the temperature of the hydraulic fluid increases, the heat from the fluid is absorbed by the front and back sides of the valve plate at different rates. If the mass of one side is greater than the other, the side with the lesser mass will move in relation to the side with the greater mass. Since the film of fluid [6] that separates the barrel face [5] and the front side of the valve plate is measured in millions of an inch, it takes only the slightest of a movement for the surface tension of the fluid to be broken. Once the surface tension is broken the valve plate can lift and separate from the face of the barrel [5] due to the influx of hydraulic fluid between the valve plate and barrel face [5] caused by the high pressure involved. Once this lift and separation occurs the seal between the barrel face [5] and the valve plate is removed the pump can experience the loss of oil and the loss of oil pressure resulting in lower pump efficiency. The movement of the valve plate can also result in the valve plate coming into contact with the barrel face [5]. The touching of the valve plate to the barrel face [5] while the unit is operating can cause scorching, shallow or deep scratches, gouges, or galling depending on the amount of movement. If this happens, both the barrel face [4] and the valve plate will have to be relapped or replaced depending on the amount of damage. This problem increases the cost associated with axial hydraulic piston pumps and motor due to the cost of overhauling the unit and due to the cost in time the unit is not use. This more than outweighs the cost associated with the additional machining of the backside of the valve plate.

[0010] It is the object of the present invention to provide a valve plate where the mass of the front side [FIG. 1] and the mass of back side of the valve plate [FIG. 2] are equal and whose masses are evenly distributed over the surface of each side of the valve plate.

[0011] By reducing the amount of movement of the valve plate it improves the bearing efficiency, makes for a better seal, and helps maintain design tolerances. The damages such a movement can cause to the barrel face and the valve plate is therefore minimized.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE INVENTION

[0012] FIG. 1 shows the front side of the valve plate.

[0013] FIG. 2 shows the backside of the valve plate.

[0014] FIG. 3 shows a block diagram of the placement of the valve plate in the system.

DETAILED DESCRIPTION OF THE INVENTION

[0015] The easiest way of machining the valve plate to obtain the equal ratio of masses is to mirror the backside of the valve plate [FIG. 2] to the front side [FIG. 1]. Although, any configuration which maintains the ratio of the mass of the front side to the mass of the backside and evenly distributes that mass equally of the front and back surfaces of the valve plate will maintain the same efficiency.
I claim:

1. A valve plate used in an axial hydraulic piston pump/motor which is made of a hardened material where the mass of the front side of the valve plate and the mass of the backside of the valve plate are equal within design tolerance limitations and said masses are equally distributed over the surfaces of the front and back side of the valve plate.