CLAIMS

1. A pressure transfer device for transferring pressure energy from a high pressure first ~~fluid~~ liquid to a lower pressure second ~~fluid~~ liquid to provide a pressurized second ~~fluid~~ liquid, which device comprises:

a rotatably mounted cylindrical rotor having a pair of opposite planar end faces with ~~at least two~~ a plurality of channels extending axially therethrough between openings located in said planar end faces; and

a pair of opposite end covers having axially inward and outward end surfaces, with said axially inward end surfaces of each having flat regions that interface with and slidingly and sealingly engage said respective planar end faces of said rotor,

each said end cover having two or more inlet passageways and two or more discharge passageways which at least four passageways open into said axially inward end surfaces, said end covers being aligned so that when one said channel in said rotor is aligned with an inlet passageway opening in one said end cover, it is also aligned with a discharge passageway opening of substantially the same size in said opposite end cover, said inlet passageway openings and ~~each~~ said discharge passageway openings in said same end cover being constantly sealed from one another during the operation by a sealing region at ~~the~~ an interface between said rotor planar end face and said end cover inward end surface,

whereby, at least twice during each revolution of said rotor, said rotor channel openings are, in alternating sequence, brought into ~~partial or~~ full alignment with both ~~an~~ one of said inlet passageway openings in one said end cover and ~~a~~ one of said discharge passageway openings in the opposite said end cover and then into ~~partial or~~ full alignment with both ~~a~~ one of said discharge passageway openings in said one end cover and ~~an~~ one of said inlet passageway openings in said opposite end cover, ~~at least twice during each revolution of said rotor,~~ so that each said rotor channel is at least twice ~~supplied~~ during each revolution supplied with the high pressure first liquid ~~fluid~~ and at least twice discharges pressurized second ~~fluid~~ liquid.

2. The pressure transfer device according to claim 1 wherein said inlet passageways in said one end cover, through which said high pressure first ~~fluid~~ liquid

would flow, have oblique ramps adjacent said surface openings which create directional ~~fluid~~ liquid outflows into said rotor channels and wherein said aligned outlet passageways also have similar oblique ramps, as a result of which said rotor is caused to revolve.

3. The pressure transfer device according to claim 2 wherein said oblique ramps in said high pressure inlet passageways in said one end cover are aligned at between about 7° to 40° to the planar end face of said rotor.

4. The pressure transfer device according to claim 3 wherein said oblique ramps in said low pressure inlet passageways in said opposite end cover are aligned at a greater angle to the planar end face of said rotor than said oblique ramps in said high pressure inlet passageways in said one end cover.

5. The pressure transfer device according to claim 4 wherein said oblique ramps in said low pressure inlet passageways in said opposite end cover are aligned at an angle of about 25° to 50° to the planar end face of said rotor.

6. The pressure transfer device according to ~~any one of~~ claims ~~1 to 5~~ wherein each said end cover has two ~~diametrically opposed~~ of said inlet passageways and two ~~diametrically opposed~~ of said outlet passageways which respectively connect to four openings in the axially inward end surface which openings are of substantially the same size and shape, and which are equiangularly located on said end surface.

7. The pressure transfer device according to claim 1 wherein said rotor revolves about a stator that is interconnected with both said end covers.

8. The pressure transfer device according to claim 7 wherein said stator has two axially spaced apart lateral bearing surfaces, with a circumferential groove therebetween which will hold a reservoir of ~~fluid~~ liquid for lubricating said bearing surfaces.

9. The pressure transfer device according to claim 8 wherein a supply passageway extends generally radially inward from said groove and a branch passageway in said stator connects said supply passageway to a region of high pressure ~~fluid~~ liquid.

10. The pressure transfer device according to claim 1 wherein said openings to said passageways are located in radially outer regions of said end covers close to the periphery thereof.

~~10~~11. The pressure transfer device according to claim 1 wherein said rotor revolves within a circumscribing sleeve, the opposite ends of which sleeve abut said pair of end covers.

12. A pressure transfer device for transferring pressure energy from a high pressure first liquid to a lower pressure second liquid to provide a pressurized second liquid, which device comprises:

a rotatably mounted cylindrical rotor having a pair of opposite planar end faces with a plurality of channels extending axially therethrough between openings located in said planar end faces;

a pair of opposite end covers having axially inward and outward end surfaces and having inlet and discharge passageways, said axially inward end surfaces of each end cover having flat regions that interface with and slidingly and sealingly engage said respective planar end faces of said rotor, said inlet and discharge passageways connecting to openings in said axially inward end surfaces, and said end covers being aligned so that when one said channel in said rotor is aligned with one said inlet passageway opening in one said end cover, it is also aligned with one said discharge passageway opening in said opposite end cover, said inlet passageway openings and each said discharge passageway openings in said same end cover being constantly sealed from one another during the operation by a sealing region at an interface between said rotor planar end face and said end cover; and

a stator that is interconnected with both said end covers about which said rotor revolves,

said stator having two spaced apart lateral bearing surfaces, with a circumferential groove therebetween which will hold a reservoir of liquid for lubricating said bearing surfaces, having a supply passageway which extends generally radially inward from said groove, and having a branch passageway which connects said supply passageway to an interior region of high pressure liquid within the pressure transfer device,

whereby during revolution of said rotor said rotor channel openings are, in alternating sequence, brought into full alignment with both an inlet passageway opening in one said end cover and a discharge passageway opening in the opposite said end cover and then into full alignment with both a discharge passageway opening in said one end cover and an inlet passageway opening in said opposite end cover, at least twice during each revolution of said rotor, so that each said channel is at least twice supplied with the high pressure first liquid and at least twice discharges pressurized second liquid.

13. The pressure transfer device according to claim 12 wherein said inlet passageways in said one end cover, through which said high pressure first liquid would flow, have oblique ramps adjacent said surface openings which create directional liquid outflows into said rotor channels and wherein said aligned outlet passageways also have similar oblique ramps, as a result of which said rotor is caused to revolve.

14. The pressure transfer device according to claim 13 wherein said oblique ramps in said inlet passageways in said one end cover are aligned at between about 7° to 40° to the planar end face of said rotor.

15. The pressure transfer device according to claim 14 wherein said oblique ramps in said inlet passageways in said opposite end cover are aligned at a greater angle to the planar end face of said rotor than said oblique ramps in said one end cover.

16. The pressure transfer device according to claim 15 wherein said oblique ramps in said inlet passageways in said opposite end cover are aligned at an angle of

about 25° to 50° to the planar end face of said rotor.

~~11~~17. A method for transferring pressure energy from a high pressure first ~~fluid~~ liquid to a lower pressure second ~~fluid~~ liquid to provide a pressurized second ~~fluid~~ liquid, which method comprises the steps of:

rotatably mounting a cylindrical rotor in a housing, which rotor has a pair of opposite planar end faces and has ~~at least two~~ a plurality of channels extending longitudinally therethrough between openings located in said planar end faces;

disposing a pair of opposite end covers in the housing having axially inward surfaces with flat surface regions so that their axially inward end surfaces interface with and slidingly and sealingly engage said planar end faces of said rotor, which end covers each have a plurality of inlet passageways and a plurality of discharge passageways which open into said flat surface regions in openings of substantially the same size,

supplying a high pressure first ~~fluid~~ liquid to said inlet passageways in one end cover while simultaneously discharging a pressurized second ~~fluid~~ liquid from said aligned discharge passageways in the end cover at the opposite end, and

causing said rotor to revolve about its axis so said channels ~~openings~~ are respectively brought into ~~partial or~~ full alignment with ~~an~~ one of said inlet passageway openings in one end cover and ~~a~~ one of said discharge passageway openings in the other end cover at least twice during each revolution of the rotor, whereby an increased volume of pressurized second liquid is discharged for each revolution of the rotor because each channel is ~~filled~~ supplied with liquid and discharged at least twice.

~~12~~18. The method according to claim ~~11~~ 17 wherein said rotation of said rotor is caused by the directional entry of at least said high pressure ~~fluid~~ liquid into said channels past oblique ramps.

~~13~~19. The method according to claim ~~11 or 12~~ 18 wherein said high pressure liquid is caused to enter ~~one end of~~ said channels at one end of said rotor at ~~at least~~ two of four equiangularly spaced apart ~~locations~~ said openings in one said end cover past said oblique ramps oriented at between 7° and 40° to the adjacent flat surface and said low pressure liquid is caused to enter the channels at two of four equiangularly spaced

apart said openings in said other end cover at the opposite end of said rotor past said oblique ramps oriented at between 25° and 50° to the adjacent flat surface.

~~14. The method according to claim 13 wherein said entry is at two diametrically opposed locations in said end cover.~~

20. The method according to claim 17 wherein said rotor rotates about a stator having two axially spaced bearing surfaces separated by a circumferential groove which groove is fed with high pressure liquid through a radial passageway to lubricate said bearing surfaces.