CLAIMS

1. A cylindrical rotor having channels that extend end to end for use in a rotary energy recovery device for transferring high pressure from one ~~fluid~~liquid to a lower pressure ~~fluid~~liquid wherein the rotor will revolve about its axis in a cavity between means that sealingly interface with opposite ends of the rotor, and wherein a high pressure first ~~fluid~~liquid and a low pressure second ~~fluid~~liquid are supplied to opposite ends of the rotor resulting in the simultaneous ~~fluid~~liquid inlet flow and ~~fluid~~liquid discharge flow axially within said rotor channels, as a result of ~~fluid~~liquid flow,

wherein the improvement comprises:

at least a plurality of said channels having a cross section which varies longitudinally from end to end, which variance is the result of shaping an interior surface of a wall portion of each of said plurality of channels, which wall portion is located along what will be the trailing portion of said channel in the revolving rotor, so that a low pressure region is established as a result of axial ~~fluid~~liquid flow through said channel and as a consequence creates a torque that causes said rotor to revolve, wherein each of said plurality of channels has a cross section of segmental shape with two straight sidewalls and outer and inner end walls and wherein said one sidewall which trails in the motion of the revolving rotor has an airfoil shape and the other sidewall is substantially flat.

~~2. The rotor of claim 1 wherein each of said plurality of channels has a cross section of segmental shape with two straight sidewalls and outer and inner end walls and wherein said one sidewall which trails in the motion of the revolving rotor has an airfoil shape and the other sidewall is substantially flat.~~

~~3~~2. The rotor of claim ~~2~~ 1 wherein said flat sidewalls of said plurality of channels are each aligned substantially radially of the central axis of said rotor.

43. The rotor of claim 3 2 wherein said two sidewalls of each of said plurality of channels are aligned at an angle to each other of between about 20 degrees and about 40 degrees and wherein said outer and inner end walls are curved.

54. The rotor of claim 2 1 wherein said airfoil-shaped trailing sidewalls have a camber which is symmetrical with respect to both ends of the rotor and establish the low pressure region in an axially central region of said channel.

65. The rotor of claim 2 1 wherein said airfoil-shaped trailing sidewalls have a camber which is non-symmetrical so that, in addition to creating the torque, an axial force is also created upon the rotor.

76. The rotor of claim 2 1 wherein said cylindrical rotor contains some axial channels which have only longitudinally rectilinear sidewalls.

87. The rotor of claim 2 1 wherein said cylindrical rotor contains between about 10 and 20 channels arranged substantially equiangularly about the axis of the rotor.

98. The rotor of claim 1 wherein said cylindrical rotor has flat end faces.

109. An energy recovery device for transferring high pressure from one fluidliquid to a lower pressure fluidliquid, which device comprises, in combination with a cylindrical rotor according to any one of claims 1 to 9 8,

a housing in which said cylindrical rotor revolves, and

first and second end covers in said housing having interior faces arranged in sealing relationship with said rotor end faces,

said end covers each having at least one inlet passageway and at least one discharge passageway extending therethrough,

the angular alignment of said end cover passageways being such that, when a rotor channel is aligned with an inlet passageway in one end cover, it is simultaneously aligned with an outlet passageway in the other end cover.

~~11~~10. The energy recovery device of claim ~~10~~ 9 wherein said end covers have flat interior faces and passageways which are shaped so that ~~fluid~~liquid entry into and exit from said rotor channels is in an axial direction.

~~12~~11. An energy recovery device for transferring high pressure from one ~~fluid~~liquid to a lower pressure ~~fluid~~liquid, which device comprises

a cylindrical rotor having axial channels that extend between opposite end faces,

a housing in which said cylindrical rotor revolves,

first and second end covers in said housing having interior faces arranged in sealing relationship with said rotor end faces,

said end covers each having at least one inlet passageway and at least one discharge passageway extending therethrough,

the angular alignment of said end cover passageways being such that, when a rotor channel is aligned with an inlet passageway in one end cover, it is simultaneously aligned with an outlet passageway in the other end cover, and

at least two of said rotor channels having a cross section which varies from end to end as the result of one channel sidewall, that is oriented generally radially and that has a shape which establishes a low pressure region in such channel as a result of ~~fluid~~liquid flow axially therethrough, so that torque is created causing said rotor to revolve as a result of such flow through said channel, wherein each of said at least two channels has a cross section of segmental shape with two straight sidewalls and outer and inner end walls, and wherein said one channel sidewall has an airfoil shape and the other straight sidewall is substantially flat.

~~13. The energy recovery device of claim 12 wherein each of said at least two channels has a cross section of segmental shape with two straight sidewalls and outer and inner end walls, and wherein said one channel sidewall has an airfoil shape and the other straight sidewall is substantially flat.~~

~~14~~12. The energy recovery device of claim ~~13~~ 11 wherein each said flat sidewall of said at least two channels is aligned substantially radially of the central axis of said rotor, wherein the camber in said airfoil-shaped walls is symmetrical with respect to both ends, wherein said two straight sidewalls of each of said at least two rotor channels are aligned at an angle of between about 20 degrees and about 40 degrees, and wherein said channels have outer and inner end walls that are curved.

~~15~~13. In a rotary energy recovery device for transferring high pressure from one ~~fluid~~liquid to a lower pressure ~~fluid~~liquid wherein a substantially cylindrical rotor having channels extending axially therethrough revolves about its axis in a cavity between a pair of end covers that sealingly interface with opposite ends of the rotor, and wherein a high pressure first ~~fluid~~liquid and a low pressure second ~~fluid~~liquid are supplied to opposite ends of the rotor through passageways extending through said end covers resulting in the simultaneous filling with and discharge of ~~fluid~~liquids through the passageways in the opposite

end covers as a result of ~~fluid~~liquid flow through said channels, the improvement which comprises

at least a plurality of said channels in the rotor having a cross section which varies from end to end as the result of one sidewall region, that is oriented generally radially to the axis, having a shape which establishes a low pressure region along said sidewall region as a result of ~~fluid~~liquid flow through said channel and as a consequence creates a torque that causes said rotor to revolve, wherein each of said plurality of rotor channels has a cross section of segmental shape with two straight sidewalls and outer and inner end walls, with said one sidewall of each said channel having an airfoil shape and with the other sidewall being substantially flat.

~~16. The energy recovery device of claim 15 wherein each of said plurality of rotor channels has a cross section of segmental shape with two straight sidewalls and outer and inner end walls, with said one sidewall of each said channel having an airfoil shape and with the other sidewall being substantially flat.~~

~~17~~14. The energy recovery device of claim ~~16~~ 13 wherein said flat sidewalls of said rotor channels are each aligned substantially radially of the central axis of said rotor.

~~18~~15. The energy recovery device of claim ~~17~~ 14 wherein said two sidewalls of each channel are aligned at an angle of between about 20 degrees and about 40 degrees and wherein said outer and inner end walls are curved.

~~19~~16. The energy recovery device of claim ~~15~~ 13 wherein said airfoil-shaped sidewalls have a camber which is symmetrical with respect to both axial ends of said rotor and establish the low pressure region in an axially central region of said rotor channel.

~~20~~17. The energy recovery device of claim ~~15~~ 13 wherein said rotor end faces are flat and said end covers have flat interior faces and wherein said end covers have inlet and outlet passageways which are aligned relative to said rotor channels such that, when a rotor channel is aligned with an inlet passageway in one end cover and with an outlet passageway in the other end cover, there is ~~fluid~~liquid entry into said channel in an axial direction and exit out of said channel in an axial direction.