**[0004]** As downhole testing equipment gets progressively smaller to accommodate smaller boreholes and increasingly complex tools, the high pressures and temperatures of the downhole environment are pushing the limits of conventional testing apparatus. The embodiments disclosed herein overcome these deficiencies and others in the prior art.

## SUMMARY

**[0004a]** In a first aspect, there is provided a piston accumulator system comprising: a cylindrical housing with an axial bore extending between end portions of the housing; a soft piston slidably disposed in the axial bore; an end cap coupled to each end portion of the cylindrical housing to contain the soft piston in the axial bore; and a seal assembly disposed between the soft piston and the axial bore, the seal assembly comprising rigid outer components and a pliable inner component.

**[0004b]** In a second aspect, there is provided a piston accumulator system comprising: a metal cylindrical housing with an axial bore extending between end portions of the housing; a soft piston slidably disposed in the axial bore, wherein the soft piston comprises at least one of PTFE plus fiberglass and Rulon; a seal assembly disposed between the soft piston and the axial bore, the seal assembly comprising rigid outer components and a pliable inner component; an end cap coupled to each end portion of the cylindrical housing to contain the soft piston in the axial bore; a spacer captured between each end cap and each housing end portion.

**[0004c]** In a third aspect, there is provided a method for accumulating downhole formation fluids comprising: moving a soft piston in an axial bore of a metal cylindrical housing between end caps of the metal cylindrical housing, to draw formation fluids into the bore; sealing between the soft piston and the metal cylindrical housing bore with a pliable inner component of a seal assembly; and backing up the pliable inner component with rigid outer components of the seal assembly.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0005]** For a detailed description of exemplary embodiments of the invention, reference will now be made to the accompanying drawings in which:

**[0006]** Figure 1 is a schematic view, partly in cross-section, of a drilling apparatus with a formation tester;

**[0007]** Figure 2 is a schematic view, partly in cross-section, of a formation tester conveyed by wireline;

**[0008]** Figure 3 is a schematic view, partly in cross-section, of a formation tester disposed on a wired drill pipe connected to a telemetry network;

**[0009]** Figure 4 is a cross-section view of a section of wired drill pipe;

**[0010]** Figure 5 is a side view, partly in cross-section, of a drill collar including a formation probe assembly;

**[0011]** Figure 6 is a perspective view of an embodiment of a piston of a piston accumulator system;

**[0012]** Figure 7 is an end view of the piston of Figure 6;

**[0013]** Figure 8 is a longitudinal cross-section view of the piston of Figures 6 and 7;

**[0014]** Figure 9 is a longitudinal cross-section view of an embodiment of an assembled piston accumulator system including the piston of Figures 6-8;

**[0015]** Figure 9A is an enlarged view of the seal assembly of the piston of Figure 9;

**[0016]** Figure 10 is a cross-section view of an alternative coupling between the piston tube and the end coupler to capture the spacer, in another piston accumulator system;

**[0017]** Figure 11 is a flow chart of a method for accumulating formation fluids downhole during a large pressure-temperature cycle using embodiments of the piston accumulator system; and

**[0018]** Figure 12 is a flow chart of another method for accumulating formation fluids downhole during a large pressure-temperature cycle using embodiments of the piston accumulator system.

## DETAILED DESCRIPTION

**[0019]** In the drawings and description that follow, like parts are typically marked throughout the specification and drawings with the same reference numerals. The drawing figures are not