curve-shape in cross section or a polygonal-shape in cross-section (see FIGS. 6A-E, FIG. 6B being the preferred shape). Additionally, one or more of the sealing elements 20 could be configured as cleaning element, including but not limited to having a scraping or peeling edge. For certain crosssection shapes, the area of outer circumferential surface 23 in sliding seal engagement with the pipe wall P changes as sealing element 20 changes size (compare e.g. FIGS. 7 & 8).

Each sealing (or cleaning) element 20 is a hollow sealing element, having an internal cavity 21 sized to house a first volume of a fluid "F" and a reservoir 29 sized to house a second volume of the fluid F. Preferably, the fluid F is a liquid. The reservoir 29 and internal cavity 21 communicate with one another by way of a passageway 25 that permits a portion of the first and second volumes of the fluid F to between the internal cavity 21 and the reservoir 29. This movement of fluid F is triggered by the outer circumferential surface 23 of the sealing element 20 experiencing increased force or resistance as it transitions to a smaller diameter pipe or decreased force or resistance as it transitions to a larger diameter pipe.

Together, the internal cavity 21 and the reservoir 29 form a closed fluid containment system. As the first volume of fluid F increases in the internal cavity 21, the second volume of fluid F decreases in the reservoir 29 (and vice versa). Therefore, when the first volume is at its maximum, the second volume is at its minimum and sealing element 20 is at its maximum diameter or circumference. When the second volume is at its maximum, the first volume is at its minimum and sealing element 20 is at its minimum diameter or circumference. In this way, each sealing element 20 collapses or expands between a first size "S1" and a second different size "S2". In cases in which first size S1 corresponds to maximum diameter and second different size S2 corresponds to the minimum diameter, there are intermediate or in-between sizes of the sealing element 20 which provide sliding seal engagement. The centerline 43 of the sealing element 20, which extends in a lateral direction relative to the central longitudinal axis 13 of the mandrel 11, is at a different angle relative to the central longitudinal axis 13 of the mandrel 11 when the sealing element 20 is in the first size or diameter S1 than when in the second different size or diameter S2.

WHAT IS CLAIMED

1. A pipeline pig (10) comprising:

a central mandrel;

a hollow elastomeric seal element (20) arranged about said central mandrel (11) of the pipeline pig (10) and having a centerline extending laterally outward relative to the central mandrel, said hollow elastomeric seal element defining an internal cavity surrounded by said hollow elastomeric seal element, the hollow elastomeric seal element (20) arranged to move between a first diameter (S1) corresponding to a first diameter pipeline to be traversed and a second different diameter (S2) corresponding to a second different diameter pipeline to be traversed, said hollow elastomeric seal element containing only a volume of fluid, said volume of fluid housed in said internal cavity (21) of the elastomeric seal element (20) being greater when in the first diameter (S1) than in the second different diameter (S2); and

an accumulator (30) in communication with the hollow elastomeric seal element (20) and forming a closed fluid containment system with the internal cavity of the hollow elastomeric seal element, the accumulator (30) arranged to self-balance a sliding seal pressure of the volume of the hydraulic fluid housed by the internal cavity (21) of the elastomeric seal element (20) with a differential driving pressure of the pipeline pig when in the first diameter (S1) and the second different diameter (S2);

wherein the first diameter S1 is a maximum diameter of the pipeline pig when traversing the first diameter pipeline under differential pressure and the second different diameter S2 is a maximum diameter of the pipeline pig when traversing the second diameter pipeline under differential pressure; and

wherein the centerline of the hollow elastomeric seal element is at a different angle relative to the central mandrel when the hollow elastomeric seal element is in the first diameter than when in the second different diameter.

2. A pipeline pig (10) comprising:

an elastomeric seal element (20) arranged about a central mandrel of the pipeline pig and having a centerline extending laterally outward relative to the central mandrel and an internal cavity (21) surrounded by said elastomeric seal elements, said internal cavity sized to house a first volume of a fluid and a reservoir (29) sized to house a second volume of the fluid, the reservoir (29) arranged so a portion of the said volumes of the fluid can move between the internal cavity and the reservoir (29); and

at least one accumulator (30) arranged to self-balance a sliding seal pressure of the first and second volumes of the fluid with a different driving pressure of the pipeline pig, the internal cavity and the at least one accumulator forming a closed fluid containment system, the sliding seal pressure being effective for the elastomeric seal element (20) to form a first sliding seal diameter (S1) corresponding to a first diameter pipeline and a second different sliding seal diameter (S2) corresponding to a second different diameter pipeline, said sliding seal diameters being a maximum diameter of the pipeline pig when traversing a respective first or second different diameter pipeline under differential pressure;

wherein said elastomeric seal element contains only said fluid; and

wherein the centerline of the elastomeric seal element is at a different angle relative to the central mandrel when in the first sliding seal diameter than when in the second different sliding seal diameter.

3. A pipeline pig (10) according to claim 2 wherein the sliding seal pressure is effective for the elastomeric seal element (20) to form an intermediate sliding seal diameter (P2) between the first (S1) and second different sliding seal diameters (S2).

4. A pipeline pig (10) according to claim 2 wherein a total volume of the accumulator (30) is less than the second volume of the fluid when the second volume of fluid is at a maximum.

5. A pipeline pig (10) according to claim 2 wherein the accumulator (30) is housed by a central mandrel (11) of the pipeline pig (10).

6. A pipeline pig (10) according to claim 2 wherein the reservoir (20) is housed within the accumulator (30).

7. A pipeline pig (10) according to claim 2 wherein the fluid is a liquid.

8. A pipeline pig (10) according to claim 2 wherein the elastomeric seal element (20) is curve-shaped in cross section.

9. A pipeline pig (10) according to claim 2 wherein the elastomeric seal element (20) is polygonal shaped in cross-section.

10. A pipeline pig (10) according to claim 2 wherein the elastomeric seal element (20) is configured as a cleaning element.

11. A pipeline pig (10) according to claim 2 wherein the first sliding seal diameter (S1) is 1.05 times that of the second different sliding seal diameter (S2).

12. A pipeline pig (10) according to claim 2 wherein the first sliding seal diameter (S1) is 1.5 times that of the second different sliding seal diameter (S2).

13. A pipeline pig (10) according to claim 2 wherein the first sliding seal diameter (S1) is 3.0 times that of the second different sliding seal diameter (S2).

14. A pipeline pig (10) according to claim 2 wherein the pipeline pig (10) does not require an element separate from that of the elastomeric seal element (20) to support the pipeline pig (10) within a pipe.

15. The pipeline pig according to claim 2 wherein the first sliding seal diameter is in a range of 1.05 times to 3.0 times that of the second different sealing diameter.

16. The pipeline pig according to claim 1 wherein the elastomeric seal element is curve-shaped in cross section.

17. The pipeline pig according to claim 1 wherein the elastomeric seal element is polygonal shaped in cross-section.

18. The pipeline pig according to claim 1 wherein the elastomeric seal element is configured as a cleaning element.

19. The pipeline pig according to claim 1 wherein the first sliding seal diameter is in a range of 1.05 times to 3.0 times that of the second different sealing diameter.