

I claim:

1. An apparatus for liquid sampling comprising a housing provided with a sample inlet branch and a sample outlet branch characterized by:

- 1) a pressurizable sample chamber (20) communicating with the inlet and the outlet branches;
- 2) an air displacer (32) adapted to generate
  - a) a sub-atmospheric pressure in a vacuum duct (34); and
  - b) a super-atmospheric pressure in a pressure duct (35);
- 3) an array of four branches (36, 37, 38, 39) made up of:
  - a) a first branch (36) linking the pressure duct (35) to an atmospheric outlet (40) and incorporating a first valve (V1);
  - b) a second branch (37) linking the vacuum duct (34) to the sample chamber (20) by way of pressure control port (24) and incorporating a second valve (V2);
  - c) a third branch (38) linking the pressure duct (35) to the sample chamber (20) by way of pressure said control port (24) and incorporating a third valve (V3); and
  - d) a fourth branch (39) linking the vacuum duct (34) to an atmospheric inlet (41) and incorporating a fourth valve (V4);
- 4) the first valve (V1) and the second valve (V2) comprising a first cam (46), a first anvil (57) and flexible sections of each of the first branch (36) and of the second branch (37) passing between the first cam (46) and the first anvil (57); the third valve (V3) and the fourth valve (V4) comprising the first cam (46) and a second anvil (56) and flexible sections of each of the third branch (38) and of the fourth branch (39) passing between the first cam (46) and the second anvil (56); the first cam (46) being operable to deform and release from deformation the flexible sections of pairs of the first to the fourth branches (36-39) so that:
  - a) in a first operating mode, the first valve (V1) and the second valve (V2) are each open, and the third valve (V3) and the fourth valve (V4) are each closed to provide for the pressure duct (35) to vent to atmosphere by way of the first branch (36) and the outlet (40) and for the vacuum duct (34) to communicate with the sample chamber (20) by way of the second branch (37);
  - b) in a second operating mode, the first valve (V1), the second valve (V2), the third valve (V3) and the fourth valve (V4) are all open to allow the vacuum duct (34) to be open to atmosphere by way of the fourth branch (39), the pressure duct (35) to be open to atmosphere by way of the first branch (36) and the sample chamber (20) to vent to atmosphere;
  - c) in a third operating mode, the third valve (V3) and the fourth valve (V4) are each open and the first valve (V1) and second valve (V2) are each closed, to provide for the vacuum duct (34) to be vented to atmosphere by way of the fourth branch (39) and the inlet (41) and the pressure duct (35) to communicate with the sample chamber (20) by way of the third branch (38); and
  - d) in a fourth operating mode, the first valve (V1), the second valve (V2), the third valve (V3) and the fourth valve (V4) are all open to provide for the vacuum duct (34) to open to atmosphere by

way of the fourth branch (39), the pressure duct (35) to be open to atmosphere by way of the first branch (36) and the sample chamber (20) to vent to atmosphere;

- 5) the sample outlet branch (23) including a delivery valve (25), disposed in the outlet branch (23), for regulating liquid flow there along from the sample chamber (20); the delivery valve (25) comprising a clamping device made up of a pinch cam (49) driving a clamp (50, 51), and a flexible section of the outlet branch (23) extending through the clamp (50, 51); the delivery valve (25) being operable, in relation to a state of the first, the second, the third and the fourth valves (V1 to V4), between:
    - i) a closed position in which the clamp (50, 51) serves to clamp the flexible section of the outlet branch (23) to inhibit the flow of liquid along the outlet branch (23) from the sample chamber (20) to a sample collection device; and
    - ii) an open position in which the clamp (50, 51) does not inhibit the passage of liquid through the outlet branch (23) to the sample collection device; and
  - 6) a prime mover (45) coupled to drive both the first cam (46) and the pinch cam (49) providing for operation of the first, the second, the third and the fourth valves (V1, V2, V3, V4) and the delivery valve (25) to be mechanically related.
2. An apparatus for liquid sampling as claimed in claim 1 wherein the apparatus is a vertical separation apparatus with at least one of an inlet end (22') of the inlet branch (22) and an outlet end (23') of the outlet branch (23) being vertically adjustable to vary the size of a retained sample (27) in the sample chamber (20).
3. An apparatus for liquid sampling as claimed in claim 2 wherein at least a portion of the sample chamber (20) is made of a transparent material and a light source (L) is provided for propagating a beam of light into the sample chamber (20) and for detecting at least one of the beam and characteristics of the beam.
4. An apparatus for liquid sampling as claimed in claim 1 wherein at least a portion of the sample chamber (20) is made of a transparent material and detection means (L) is provided for propagating a beam into the sample chamber (20) for detecting a presence of liquid in the sample chamber (20).
5. An apparatus for liquid sampling comprising a housing provided with a sample inlet branch and a sample outlet branch characterized by:
- 1) a pressurizable sample chamber (20) communicating with the inlet and the outlet branches;
  - 2) an air displacer (32) adapted to generate a relatively low, sub-atmospheric, pressure in a vacuum duct (34);
  - 3) an array of two branches (37, 39) made up of:
    - a) a suction branch (37) linking the vacuum duct (34) to the sample chamber (20) by way of a pressure control port (24) and incorporating a suction valve (V2); and
    - b) a venting branch (39) linking the vacuum duct (34) to an atmospheric inlet (41) and incorporating a vent valve (V4);
  - 4) the suction valve (V2) comprising a first cam (46), a first anvil (57) and a flexible section of the suction branch (37) passing between the first cam (46) and the first anvil (57); the vent valve (V4) comprising the first cam (46), a second anvil (56) and a flexible