THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1) A reciprocating engine including:
   a) a crankshaft;
   b) a cylinder defining an internal chamber
   c) a piston positioned in the chamber, the piston being connected to the crankshaft and being configured to reciprocate inside the chamber;
   d) a head attached to the cylinder and closing the chamber at an end opposing the piston, the head including a port for allowing fluid communication between the chamber and a respective manifold; and,
   e) a valve arrangement including:
      i) a valve for operatively controlling fluid flow through the port;
      ii) a bridge coupled to the valve, wherein movement of the bridge in a first direction causes the valve to close and movement of the bridge in a second direction causes the valve to open;
      iii) a closing actuator for causing the bridge to move in the first direction based on the reciprocation of the piston, to thereby positively close the valve; and,
      iv) at least one biasing member for biasing the bridge towards the second direction.
2) An engine according to claim 1, wherein the valve arrangement is configured so that the biasing member causes the valve to open when the closing actuator is not being used to positively close the valve.
3) An engine according to claim 1 or 2, wherein the closing actuator includes a cam mounted on a camshaft that is rotationally coupled to the crankshaft, the cam being configured to control the movement of the bridge depending on a rotational position of the crankshaft, the bridge including a cam follower for engaging the cam.
4) An engine according to claim 3, wherein the bridge includes a first bridge portion to which the valve is coupled and a second bridge portion including the cam follower.
5) An engine according to claim 4, wherein the bridge defines a cavity between the first bridge portion and the second bridge portion, the camshaft extending through the cavity.
6) An engine according to any one of claims 1 to 5, wherein each biasing member is a spring coupled to the bridge.
7) An engine according to claim 6, wherein each spring is coupled to the bridge so that the spring is compressed when the bridge is moved in the first direction using the closing

actuator to positively close the valve so that the compressed spring urges the bridge in the second direction to thereby open the valve when the closing actuator is not being used to positively close the valve.

8) An engine according to claim 6 or claim 7, wherein each spring is mounted on a stud extending outwardly from the head.

9) An engine according to any one of claims 1 to 8, wherein the valve arrangement includes a pair of biasing members arranged symmetrically about the valve.

10) An engine according to any one of claims 1 to 9, wherein the movement of the bridge in the first direction involves the bridge moving away from the head and the movement of the bridge in the second direction involves the bridge moving towards the head.

11) An engine according to any one of claims 1 to 10, wherein the valve arrangement includes two or more valves coupled to the bridge, each valve being for operatively controlling fluid flow through a respective port, whereby movement of the bridge causes synchronised operation of the two or more valves.

12) An engine according to any one of claims 1 to 11, wherein the engine is a pressurised gas engine configured to be driven by compressed gas.

13) An engine according to any one of claims 1 to 11, wherein the engine is an internal combustion engine and further includes at least one of:

a) an ignition source;

b) a glow plug; and,

c) a fuel injector.

14) An engine according to claim 1, wherein the valve arrangement further includes an opening actuator for causing the bridge to move in the second direction based on the reciprocation of the piston, to thereby positively open the valve.

15) An engine according to any one of claims 1 to 14, wherein the valve arrangement includes a seal breaking actuator for causing the bridge to move in the second direction to positively break a seal between the port and the valve after the valve is closed.

16) An engine according to claim 15, wherein the closing actuator includes a first cam mounted on a camshaft that is rotationally coupled to the crankshaft and the seal breaking actuator includes a second cam mounted on the same camshaft, the first and second cams being configured to control the movement of the bridge depending on a rotational position of the crankshaft.

17) An engine according to claim 16, wherein the first cam includes a first cam lobe and the second cam includes a second cam lobe, and wherein upon rotation of the camshaft, the first cam lobe urges the bridge in the first direction to thereby positively close the valve and the second cam lobe urges the bridge in the second direction to positively break the seal.

18) An engine according to claim 16 or claim 17, wherein the bridge includes a first cam follower for engaging the first cam and a second cam follower for engaging the second cam.

19) An engine according to claim 18, wherein the bridge includes:

a) a first bridge portion to which the valve is coupled, the first bridge portion including the second cam follower; and,

b) a second bridge portion including the first cam follower.

20) An engine according to claim 19, wherein the camshaft extends between the first and second bridge portions.

21) An engine according to any one of claims 1 to 20, wherein the valve arrangement is configured such that the biasing member cushions the closing of the valve.

22) A piston machine including:

a) a rotating shaft;

b) a housing defining an internal chamber

c) a piston positioned in the chamber, the piston being connected to the shaft and being configured to move inside the chamber as the shaft rotates;

d) a port provided in the housing for allowing fluid communication between the chamber and a respective manifold; and,

e) a valve arrangement including:

i) a valve for operatively controlling fluid flow through the port;

ii) a bridge coupled to the valve, wherein movement of the bridge in a first direction causes the valve to close and movement of the bridge in a second direction causes the valve to open;

iii) a closing actuator for causing the bridge to move in the first direction based on the reciprocation of the piston, to thereby positively close the valve; and,

iv) at least one biasing member for biasing the bridge towards the second direction.

23) A piston machine according to claim 22, wherein the piston machine is at least one of a compressor and a reciprocating engine.

24) A valve arrangement for use in a piston machine, the valve arrangement including:

a) a valve for operatively controlling fluid flow through a port;

b) a bridge coupled to the valve, wherein linear movement of the bridge in a first direction causes the valve to close and linear movement of the bridge in a second direction causes the valve to open;

c) a closing actuator including a rotatable cam having a cam lobe, and wherein upon rotation of the cam, the cam lobe urges the bridge in the first linear direction to thereby positively close the valve; and,

d) at least one biasing member for biasing the bridge in the second linear direction so that the at least one biasing member opens the valve when the valve is not positively closed by the actuator.

25) A valve arrangement for use in a piston machine, the valve arrangement including:

a) a valve for operatively controlling fluid flow through a port;

b) a bridge coupled to the valve, wherein linear movement of the bridge in a first direction causes the valve to close and linear movement of the bridge in a second direction causes the valve to open;

c) a closing actuator including a rotatable first cam having a first cam lobe, and wherein upon rotation of the first cam, the first cam lobe urges the bridge in the first linear direction to thereby positively close the valve; and,

d) an opening actuator for causing the bridge to move in the second direction to thereby at least positively open the valve.

26) A valve arrangement according to claim 25, wherein the valve arrangement includes a first cam follower mounted on the bridge, the first cam follower cooperating with the first cam to cause movement of the bridge in the first linear direction.

27) A valve arrangement according to claim 26, wherein the first cam is positioned between the first cam follower and the valve.

28) A valve arrangement according to claim 27, wherein the first cam lobe urges the first cam follower in the first linear direction away from the valve.

29) A valve arrangement according to any one of the claims 26 to 28, wherein the first cam follower is movably mounted to the bridge.

30) A valve arrangement according to claim 29, wherein the first cam follower is urged in the second direction relative to the bridge by a biasing spring.

31) A valve arrangement according to claim 29 or claim 30, wherein a position of the first cam follower in the first or second direction is adjusted to adjust a degree of valve lift.

32) A valve arrangement according to any one of the claims claim 25 to 30, wherein the opening actuator includes a rotatable second cam having a second cam lobe, and wherein upon rotation of the second cam, the second cam lobe urges the bridge in the second linear direction to thereby positively open the valve.

33) A valve arrangement according to claim 32, wherein the valve arrangement includes a second cam follower mounted on the bridge, the second cam follower cooperating with the second cam to cause movement of the bridge in the second linear direction.

34) A valve arrangement according to claim 33, wherein the second cam follower is positioned between the second cam and the valve.

35) A valve arrangement according to any one of the claims 32 to 34, wherein the second cam is mounted coaxially and rotationally invariant with the first cam.

36) A valve arrangement according to any one of the claims 32 to 35, wherein the valve arrangement includes first and second cams mounted on a common camshaft.

37) A valve arrangement according to any one of the claims 32 to 36, wherein the valve arrangement includes at least two first cams spaced apart along a common camshaft, the at least two first cams cooperating with corresponding at least two first cam followers mounted on the bridge.

38) A valve arrangement according to any one of the claims 32 to 37, wherein the valve arrangement includes at least two second cams spaced apart along a common camshaft, the at least two second cams cooperating with corresponding at least two second cam followers mounted on the bridge.

39) A valve arrangement according to any one of the claims 32 to 38, wherein the valve arrangement includes a plurality of first cams spaced apart along a common camshaft.

40) A valve arrangement according to any one of the claims 32 to 39, wherein the second cam lobe further restricts movement of the bridge in the first linear direction when first cam lobe is not urging the bridge in the first linear direction.

41) A valve arrangement according to any one of the claims 25 to 40, wherein the opening actuator includes a spring for biasing the valve in the second linear direction.

42) A valve arrangement according to any one of the claims 25 to 41, wherein the bridge includes first and second bridge portions

43) A valve arrangement according to claim 42, wherein the first and second bridge portions define an opening therebetween, a camshaft extending through the opening in use.

44) A valve arrangement according to claim 42 or claim 43, wherein the valve is coupled to the first bridge portion and wherein the valve arrangement includes a first cam follower mounted on the second bridge portion.

45) A valve arrangement according to claim 44, wherein the valve arrangement includes a second cam follower coupled to the first bridge portion.

46) A valve arrangement according to any one of the claims 25 to 45, wherein the valve arrangement includes at least one cam and cam follower laterally offset from the bridge.

47) A valve arrangement according to any one of the claims 25 to 46, wherein the valve arrangement includes a plurality of valves, bridges, and opening actuators in a spaced apart arrangement, each opening actuator including at least one first cam, each first cam being mounted on a common camshaft.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1) A reciprocating engine including:
   a) a crankshaft;
   b) a cylinder defining an internal chamber
   c) a piston positioned in the chamber, the piston being connected to the crankshaft and being configured to reciprocate inside the chamber;
   d) a head attached to the cylinder and closing the chamber at an end opposing the piston, the head including a port for allowing fluid communication between the chamber and a respective manifold; and,
   e) a valve arrangement including:
      i) a valve for operatively controlling fluid flow through the port;
      ii) a bridge coupled to the valve, wherein movement of the bridge in a first direction causes the valve to close and movement of the bridge in a second direction causes the valve to open;
      iii) a closing actuator that engages the bridge for causing the bridge to move in the first direction based on the reciprocation of the piston, to thereby positively close the valve; and,
      iv) at least one biasing member for biasing the bridge towards the second direction.
2) An engine according to claim 1, wherein the valve arrangement is configured so that the biasing member causes the valve to open when the closing actuator is not being used to positively close the valve.
3) An engine according to claim 1 or 2, wherein the closing actuator includes a cam mounted on a camshaft that is rotationally coupled to the crankshaft, the cam being configured to control the movement of the bridge depending on a rotational position of the crankshaft, the bridge including a cam follower for engaging the cam.
4) An engine according to claim 3, wherein the bridge includes a first bridge portion to which the valve is coupled and a second bridge portion including the cam follower.
5) An engine according to claim 4, wherein the bridge defines a cavity between the first bridge portion and the second bridge portion, the camshaft extending through the cavity.
6) An engine according to any one of claims 1 to 5, wherein each biasing member is a spring coupled to the bridge.

7) An engine according to claim 6, wherein each spring is coupled to the bridge so that the spring is compressed when the bridge is moved in the first direction using the closing actuator to positively close the valve so that the compressed spring urges the bridge in the second direction to thereby open the valve when the closing actuator is not being used to positively close the valve.
8) An engine according to claim 6 or claim 7, wherein each spring is mounted on a stud extending outwardly from the head.
9) An engine according to any one of claims 1 to 8, wherein the valve arrangement includes a pair of biasing members arranged symmetrically about the valve.
10) An engine according to any one of claims 1 to 9, wherein the movement of the bridge in the first direction involves the bridge moving away from the head and the movement of the bridge in the second direction involves the bridge moving towards the head.
11) An engine according to any one of claims 1 to 10, wherein the valve arrangement includes two or more valves coupled to the bridge, each valve being for operatively controlling fluid flow through a respective port, whereby movement of the bridge causes synchronised operation of the two or more valves.
12) An engine according to any one of claims 1 to 11, wherein the engine is a pressurised gas engine configured to be driven by compressed gas.
13) An engine according to any one of claims 1 to 11, wherein the engine is an internal combustion engine and further includes at least one of:
    a) an ignition source;
    b) a glow plug; and,
    c) a fuel injector.
14) An engine according to claim 1, wherein the valve arrangement further includes an opening actuator for causing the bridge to move in the second direction based on the reciprocation of the piston, to thereby positively open the valve.
15) An engine according to any one of claims 1 to 14, wherein the valve arrangement includes a seal breaking actuator for causing the bridge to move in the second direction to positively break a seal between the port and the valve after the valve is closed.
16) An engine according to claim 15, wherein the closing actuator includes a first cam mounted on a camshaft that is rotationally coupled to the crankshaft and the seal breaking actuator includes a second cam mounted on the same camshaft, the first and second cams

being configured to control the movement of the bridge depending on a rotational position of the crankshaft.

17) An engine according to claim 16, wherein the first cam includes a first cam lobe and the second cam includes a second cam lobe, and wherein upon rotation of the camshaft, the first cam lobe urges the bridge in the first direction to thereby positively close the valve and the second cam lobe urges the bridge in the second direction to positively break the seal.

18) An engine according to claim 16 or claim 17, wherein the bridge includes a first cam follower for engaging the first cam and a second cam follower for engaging the second cam.

19) An engine according to claim 18, wherein the bridge includes:

a) a first bridge portion to which the valve is coupled, the first bridge portion including the second cam follower; and,

b) a second bridge portion including the first cam follower.

20) An engine according to claim 19, wherein the camshaft extends between the first and second bridge portions.

21) An engine according to any one of claims 1 to 20, wherein the valve arrangement is configured such that the biasing member cushions the closing of the valve.

22) A piston machine including:

a) a rotating shaft;

b) a housing defining an internal chamber

c) a piston positioned in the chamber, the piston being connected to the shaft and being configured to move inside the chamber as the shaft rotates;

d) a port provided in the housing for allowing fluid communication between the chamber and a respective manifold; and,

e) a valve arrangement including:

i) a valve for operatively controlling fluid flow through the port;

ii) a bridge coupled to the valve, wherein movement of the bridge in a first direction causes the valve to close and movement of the bridge in a second direction causes the valve to open;

iii) a closing actuator that engages the bridge for causing the bridge to move in the first direction based on the reciprocation of the piston, to thereby positively close the valve; and,

iv) at least one biasing member for biasing the bridge towards the second direction.

23) A piston machine according to claim 22, wherein the piston machine is at least one of a compressor and a reciprocating engine.

24) A valve arrangement for use in a piston machine, the valve arrangement including:

a) a valve for operatively controlling fluid flow through a port;

b) a bridge coupled to the valve, wherein linear movement of the bridge in a first linear direction causes the valve to close and linear movement of the bridge in a second linear direction causes the valve to open;

c) a closing actuator including a rotatable first cam having a first cam lobe, and wherein upon rotation of the first cam, the first cam lobe urges the bridge in the first linear direction to thereby positively close the valve;

d) an opening actuator including a rotatable second cam having a second cam lobe, and wherein upon rotation of the second cam, the second cam lobe urges the bridge in the second linear direction to thereby positively open the valve; and,

e) at least one biasing member for biasing the bridge in the second linear direction.

25) A valve arrangement according to claim 24, wherein the valve arrangement includes a first cam follower mounted on the bridge, the first cam follower cooperating with the first cam to cause movement of the bridge in the first linear direction.

26) A valve arrangement according to claim 25, wherein the first cam is positioned between the first cam follower and the valve.

27) A valve arrangement according to claim 26, wherein the first cam lobe urges the first cam follower in the first linear direction away from the valve.

28) A valve arrangement according to any one of the claims 25 to 27, wherein the first cam follower is movably mounted to the bridge.

29) A valve arrangement according to claim 28, wherein the first cam follower is urged in the second linear direction relative to the bridge by a biasing spring.

30) A valve arrangement according to claim 28 or claim 29, wherein a position of the first cam follower in the first or second linear direction is adjusted to adjust a degree of valve lift.

31) A valve arrangement according to claim 30, wherein the valve arrangement includes a second cam follower mounted on the bridge, the second cam follower cooperating with the second cam to cause movement of the bridge in the second linear direction.

32) A valve arrangement according to claim 31, wherein the second cam follower is positioned between the second cam and the valve.

33) A valve arrangement according to any one of the claims 30 to 32, wherein the second cam is mounted coaxially and rotationally invariant with the first cam.

34) A valve arrangement according to any one of the claims 30 to 33, wherein the valve arrangement includes first and second cams mounted on a common camshaft.

35) A valve arrangement according to any one of the claims 30 to 34, wherein the valve arrangement includes at least two first cams spaced apart along a common camshaft, the at least two first cams cooperating with corresponding at least two first cam followers mounted on the bridge.

36) A valve arrangement according to any one of the claims 30 to 35, wherein the valve arrangement includes at least two second cams spaced apart along a common camshaft, the at least two second cams cooperating with corresponding at least two second cam followers mounted on the bridge.

37) A valve arrangement according to any one of the claims 30 to 36, wherein the valve arrangement includes a plurality of first cams spaced apart along a common camshaft.

38) A valve arrangement according to any one of the claims 30 to 37, wherein the second cam lobe further restricts movement of the bridge in the first linear direction when first cam lobe is not urging the bridge in the first linear direction.

39) A valve arrangement according to any one of the claims 24 to 38, wherein the opening actuator includes a spring for biasing the valve in the second linear direction.

40) A valve arrangement according to any one of the claims 24 to 39, wherein the bridge includes first and second bridge portions

41) A valve arrangement according to claim 40, wherein the first and second bridge portions define an opening therebetween, a camshaft extending through the opening in use.

42) A valve arrangement according to claim 40 or claim 41, wherein the valve is coupled to the first bridge portion and wherein the valve arrangement includes a first cam follower mounted on the second bridge portion.

43) A valve arrangement according to claim 42, wherein the valve arrangement includes a second cam follower coupled to the first bridge portion.

44) A valve arrangement according to any one of the claims 24 to 43, wherein the valve arrangement includes at least one cam and cam follower laterally offset from the bridge.

45) A valve arrangement according to any one of the claims 24 to 44, wherein the valve arrangement includes a plurality of valves, bridges, and opening actuators in a spaced apart arrangement, each opening actuator including at least one first cam, each first cam being mounted on a common camshaft.