ABSTRACT: A transducer adapted to be driven by pressure fluid to produce mechanical oscillations, comprising a piston member and a cylinder member mounted for relative oscillating movement, the piston member having a face bounding a chamber in the cylinder member, valve means for cyclically pressurizing and depressurizing said chamber with pressure fluid to cause said relative oscillating movement, control means adapted to generate a first position signal as the members move relatively through a first relative position, and to generate a second position signal as the members move relatively through a second relative position, means to pass said position signals to control means including a bistable element which is adapted to control the valve means in response to said position signals the control means responding only to those first position signals, generated as the members move relatively in one sense through the first relative position, and only to those second position signals generated as the members move relatively in the opposite sense through the second relative position.
Fig. 2(a)

Fig. 2(b)

Fig. 3

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This invention relates to a transducer adapted to be driven by pressure fluid to produce mechanical oscillations. According to the invention, there is provided a transducer adapted to be driven by pressure fluid to produce mechanical oscillations, comprising a piston member and a cylinder member mounted for relative oscillating movement, the piston member having a face bounding a chamber in the cylinder member, valve means for cyclically pressurizing and depressurizing said chamber with pressure fluid to cause said relative oscillating movement, means adapted to generate a first position signal as the members move relatively through a first relative position, and to generate a second position signal as the members move relatively through a second relative position, and control means including a bistable element to control the valve means in response to said position signals, the control means responding only to those first position signals generated as the members move relatively in one sense through the first relative position, and only to those second position signals generated as the members move relatively in the opposite sense through the second relative position. We intend that the term 'depressurized' should be interpreted as meaning at a significantly lower pressure than 'pressurized', but that this significantly lower pressure is not necessarily zero.

There may be provided means to feed at least one of the position signals to the bistable element via a logic gate adapted in response to a control signal, to permit or prevent the passage of the position signal to the bistable element. The transducer may comprise means to feed each of the position signals through a respective logic gate, each gate being adapted to receive a respective control signal so that only the first position signals produced when the members move relatively in one sense through the first relative position are passed to the bistable element, and only those second position signals produced when the members move relatively in the opposite sense through the second relative position are passed to the bistable element.

There may be a further chamber bounded by a further face of the piston member, opposed to the first-mentioned face, the valve means being adapted to pressurize and depressurize the further chamber at substantially 180° phase difference relative to the first-mentioned chamber. Thus, there may alternatively be provided pressure-sensing means to sense the pressure in the first-mentioned and further chambers or pressures related thereto, and to pass control signals to each said logic gate such that first position signals are only passed to the bistable element when the chamber is pressurized, and second position signals are only passed to the bistable element when the chamber is depressurized.

There may be a further chamber bounded by a further face of the piston member, opposed to the first-mentioned face, the valve means being adapted to pressurize and depressurize the further chamber at substantially 180° phase difference relative to the first-mentioned chamber. Thus, there may alternatively be provided pressure-sensing means to sense the pressure in the first-mentioned and further chambers or pressures related thereto, and to pass control signals to each said logic gate such that first position signals are only passed to the bistable element when the chamber is pressurized, and second position signals are only passed to the bistable element when the further chamber is pressurized.

The valve means may be a shuttle valve, the bistable element being adapted to control said valve means by means of pressure fluid signals.

A said logic gate may be adapted to receive a control signal for starting and stopping the transducer.

There may be provided a resilient biasing means adapted to resiliently oppose said relative oscillating movement.

The resilient biasing means may comprise a fluid spring chamber adapted to contain fluid constituting a fluid spring, the pressure in said fluid in operation being applied to another face of the piston members.

In another aspect, the invention provides a transducer adapted to be driven by pressure fluid to produce mechanical oscillations, comprising a piston member and a cylinder member mounted for relative oscillating movement, the cylinder members having a chamber defined therein, the piston member having a face bounding said chamber, means for applying cyclic forces to the piston member and cylinder to produce said relative oscillating movement, said means including valve means or cyclically pressurizing and depressurizing said chamber with pressure fluid means to generate a transient first position signal as the members move relatively through a first relative position, and to generate a transient second position signal as the members move relatively through a second relative position, said positions not being extreme positions of said relative movement; control means to control the valve means in response to said position signals; and means to govern the control means to respond only to those first position signals generated as the members move relatively in one sense through the first relative position, and only to those second position signals generated as the members move relatively in the opposite sense through the second relative position. The invention will be described, merely by way of example, with reference to the accompanying drawings, wherein:

FIG. 1 shows one embodiment of a transducer according to the invention, the invention, FIG. 2 (a) and 2 (b) show position signal pulses plotted against time,

FIG. 3 shows an alternative embodiment of the invention, and

FIG. 4 shows another embodiment of the invention.

The terms left and right as used herein refer to the directions as seen in the drawings.

Referring to FIG. 1, there is shown a transducer adapted to be driven by pressure fluid to produce mechanical oscillations, comprising a piston member 10 mounted in a cylinder member 12 for relative sliding movement therebetween. The cylinder comprises a first chamber 14 which is bounded by an operative face 16 of the piston 10. The cylinder also comprises a fluid spring chamber 18 which is bounded by an operative face 20 of the piston members which is opposed to the face 16. The chamber 18 contains fluid constituting a fluid spring which urges the piston member 10 and cylinder 12 towards predetermined relative positions, thereby opposing relative movement thereof.

It will be noted that the piston member 10 comprises two relatively large diameter lands, 24, 26 which define a short groove 28, and that the operative face 20 is formed by the change in diameter between the large diameter portion 26 and a small diameter portion 30 which is effectively divided into two lands by an annular groove 31. The portion 30 of the piston member extends out of the cylinder 12 via a bore 32, and is arranged to drive, for example, a rock drill bit or an agricultural grass mower (not shown).

The chamber 14 is connected via a valve 34 alternately to a source of pressure fluid at substantially constant pressure via a line 38, or to a low-pressure tank via a line 40. The line 38 contains an accumulator 42 to maintain the pressure therein substantially constant.

Thus, when the chamber 14 is pressurized, pressure fluid is applied to the face 16 of the piston member 10 which is forced to the right relative to the cylinder 12, compressing the fluid in chamber 18. When the chamber 14 is depressurized, the fluid in chamber 18 forces the piston member 12 leftwards. Thus, relative oscillating motion of the piston member and the cylinder occurs.

The valve 34 comprises a shuttle valve 36, having two spaced-apart lands 44, 46, the end faces thereof bounding chambers 48, 50 respectively. Pressure fluid may be fed to either of chambers 48, 50 to move the valve member 36 from the one position to the other or vice versa. The fluid already in the opposite chamber is allowed to escape via restrictors 52, 54 to drains 56, 57. The valve member 36 can take two positions, depending on which of the chambers 48, 50 is pressurized, the first position in which the chamber 50 is pressurized, being shown in FIG. 1, wherein chamber 14 is connected to line 38. In the other position (not shown), the
chamber 48 is pressurized and chamber 14 is connected to line 40. The relatively large diameter lands 24, 26 and the groove 31 of the piston member 10 cooperate with spaced-apart ports 58, 59, 61, 63 in the cylinder wall. Ports 58, 59 are connected to a line 60 which in turn is connected to line 38, and thus contains pressure fluid. The ports 61, 63 are respectively connected via lines 62, 64 to chambers 48 and 50 of the valve 34. The port 59 is located opposite the port 63 in the cylinder wall so that, during relative oscillating motion, this port is briefly connected with the port 63 via the groove 28. Similarly, the ports 58 and 61 are arranged opposite to each other and are briefly interconnected by the groove 31 during oscillation. The ports 58, 59, 61 and 63 and the grooves 28, 31 constitute control means.

When the chamber 14 is pressurized the piston member 10 is moved to the right until the groove 31 briefly interconnects the ports 59, 61, thereby applying a short pulse of pressure fluid, constituting a first position signal to the line 62. When the chamber 14 is depressurized, leftward movement of the piston members 10 causes a similar short pulse of pressure fluid, constituting a second position signal to be applied to the line 64 when the groove 28 briefly uncover the ports 59, 63.

The lines 62 and 64 are respectively connected to chambers 48 and 50 via a bistable e.g. a flip-flop element 72, which has a "memory" so that once a short pulse of pressure fluid has been applied to lines 62 or 64, the flip-flop 72 switches and remains in that position until a pulse of pressure fluid is applied to the other line.

The flip-flop may be a pure fluid device, for example, a wall attachment element, or may be built from two three-way piston valves in a manner well known in "fluidics." Resistances 52 and 54 and drains 56 and 58 are not required if a wall attachment device is used, as these are incorporated in the element.

Whatever the form of the flip-flop, it acts as a switch for a flow of pressure fluid supplied to the flip-flop along a line which, as is conventional, is not illustrated, the switching occurring upon receipt of a signal along line 62 or 64 upstream of the flip-flop and the switched flow, derived from the illustrated supply line, occurring along line 62 or 64 downstream of the flip-flop to the chambers 48 or 50 respectively.

The transducer operates in the following way: when the ports are in the positions shown in FIG. 1, the chambers 14 and 50 are pressurized and the piston member 10 is moving rightwards. As the piston member 10 passes rightwards through the position (herein called the first relative position) in which the ports 58 and 61 are connected, and a first position signal is produced on the line 62. This signal pulse causes the flip-flop 72 to switch to a state in which it passes pressure fluid along line 62 to the chamber 48 thereby pressurizing chamber 48 even though some portion of the pressure fluid flow towards chamber 48 passes through resistance 52 to drain 56. Simultaneously, the flip-flop cuts off pressure fluid flow along line 64 towards chamber 50 and hence chamber 50 is pressurized and drained through resistance 54 to drain 57 thereby allowing the shuttle valve 36 to move to its second position under the influence of pressure in chamber 48. The chamber 14 is then depressurized and the fluid in the chamber 18 acts upon the piston member to move it leftwards. Due to the momentum of the piston member 10, it continues its rightward movement for a short time after the chamber 14 is depressurized. Consequently, when the piston member does move leftward, another (redundant) position signal is produced on the line 62. However, since the flip-flop 72 has already produced a response to the piston members position signal on the line 62, it ignores this redundant first position signal. The leftward movement of the piston member continues until the groove 28 uncovers the ports 59, 63 thereby briefly connecting line 64 with line 60 producing a second position signal. This causes the flip-flop 72 to change state and a pressure fluid pulse with line 60 producing a second position signal. This causes the flip-flop 72 to change state and provide a flow of pressure fluid along line 64 to chamber 50 thereby pressurizing the chamber 50 even though some of the flow is lost through resistance 54 to drain 57. The chamber 48 is simultaneously depressurized by discontinuance, by the flip-flop 72, of pressure fluid flow to chamber 48 and by bleedaway through resistance 52 to drain 56, and the valve member 36 is moved back to its first position, pressurizing chamber 14 again and repeating the cycle. Some overshoot of the piston member also occurs after the chamber 14 is pressurized and a redundant second position signal is produced in the same way as described above. Similarly, the flip-flop ignores this redundant signal.

The relative positions of the ports 58, 59, 61 and 63 and the spacing of the grooves 28, 31 determines, with the mass of the piston member 12 and the elasticity of the fluid spring 18, both the frequency of the relative oscillating movement of the piston member and the cylinder, and the phase difference of the cyclic pressurization of the chamber 14 relative to the relative oscillating motion.

Makeup flow is supplied to the chamber 18 via a line 66 containing a nonreturn valve 68. The makeup flow compensates for any leakage that may occur, for example, through the bore 32. The makeup flow may be taken from the line 40, which may be maintained at a relatively low pressure (e.g. 100 p.s.i., compared to a pressure of order 1,000 p.s.i. in the line 38). The makeup flow would then occur when the pressure in the chamber 18 falls below 100 p.s.i. The transducer as so far described may be controlled by means of a stop valve in one or other of lines 62 or 64, or by stop valve in the pressure fluid supply line 38. Closing a stop valve in line 62 or 64 stops the piston at the appropriate end of the cylinder, while closing a stop valve in line 38 stops the piston arbitrarily. A preferred means of control is illustrated in FIG. 1. The lines 62 and 64 are respectively connected to the flip-flop element 72 via logic gates 74 and 75. These gates are “AND” gates which may be used for starting and stopping the relative oscillating motion of the piston member and cylinder, depending upon the presence or absence of control signals applied to the gates via lines 77 and 78. For example, if a control signal is not present on line 78, the pressure fluid pulse from line 64 will not be allowed to pass the flip-flop element 72, so that the valve member 36 will not be pushed into its first position. The piston member 10 will thus stop at the left hand end of the cylinder 12.

Furthermore, line 78 may incorporate a pulse-shaping element 80, so that any control signal that is applied thereto is converted to a pulse with a time duration shorter than the period of one cycle of the relative oscillating motion. Assuming a control signal to be present in line 77 and that line 64 is pressurized, then, on application of such a pulse to line 78, only one cycle of relative oscillating motion will then occur before the piston member comes to rest again since by the time that line 64 is again pressurized, the control signal in line 78 has disappeared and the gate 75 does not permit pressure fluid pulse in line 64 to be fed to the flip-flop element 72. Alternatively, the pulse-shaping element 80 can be incorporated in line 77.

The “AND” gates and the pulse shaping element may be pure fluid devices of the types now well known, or may be produced by piston valves. The “AND” gates may be replaced by “NOR” gates, reversing the logic.

If it is desired to operate the transducer at a high frequency, then it is necessary to advance the timing of the first and second position signals relative to the movement of the piston member 10, in order that the cyclic pressurization of the chamber 14 is at the correct phase difference relative to the piston movement.

This is achieved by altering the spacing of the grooves 28, 31 and the ports 59, 63, 58, 61.

For operation at very high frequencies say 5000 c.p.m., the timing of the position signals may have to be advanced to such a degree that the redundant first position signal produced as described above occurs after the nonredundant second posi-
tion signal, and similarly the redundant second position signal occurs after the nonredundant first position signal. The timing advance is necessary due to the finite time required to presurize and depressurize the chamber.

Referring to FIGS. 2(a) and 2(b), FIG. 2(a) shows the occurrence of the first and second position signals P1 in time T as produced by a transducer such as that of FIG. 1 when operating at a moderate frequency. It will be seen that the first and second nonredundant position signals P1 and P2 and the redundant first and second position signals P1 and P2 are produced in the sequence P1, P2, P1, P2, P1, P2, P1, P2, P1, P2 etc. and consequently the flip-flop 72 would treat some of the redundant position signals as nonredundant and vice versa, resulting in the pressure cycles in the chamber 14 being wrongly timed, unless the transducer is modified as described hereafter.

Referring to FIG. 3, there is shown a modified transducer for use at high frequencies. Parts described with reference to FIGS. 2 are shown by the same reference numbers. The gates 74, 75 are arranged to receive control signals via respective lines 81, 82. The lines 81, 82 are connected to a pressure sensor 84 which is arranged to sense the pressure in the chamber 14. The sensor 84 is shown connected to the chamber 14 via a line 86, but it will be appreciated that it is described that this line is as short as possible, the sensor preferably being built into the wall of the chamber 14. Of course, a pressure related to the pressure in the chamber 14 could be sensed instead, provided its relationship thereto is a univalued function. The sensor 84 is such that a control signal is provided on the line 81 only when the chamber 14 is presurized, and a control signal is provided on the line 82 only when the chamber 14 is depressurized.

The gates 74, 75 operate as follows. Assuming the piston member is moving rightwards form it left-hand extreme position E1, the chamber 14 is depressurized. Firstly, a nonredundant first position signal P1 is produced on the line 62. Since the chamber 14 is presurized, the “AND” gate 74 passes the first position signal to the flip-flop 72, which then initiates depressurization of the chamber 14. The next position signal produced is a redundant second position signal P2 on the line 64, as the groove 28 passes the ports 59, 63. However, since the chamber 14 takes a finite time to depressurize, the pressure therein is still sufficient at this time for the sensor to produce a control signal on the line 81, and not the line 82. Consequently, the “AND” gate 75 does not pass the redundant signal to the flip-flop 72. The piston member 10 then reaches the end of its stroke at E2 and begins to move in the opposite sense (leftwards). A nonredundant second position signal P2 is then produced, and by this time the chamber 14 has depressurized sufficiently for the sensor 84 to produce a control signal on the line 82, and not on the line 81. Consequently, the “AND” gate 75 passes the second position signal to the flip-flop 72, which initiates pressurization of the chamber 14.

As the piston member 10 continues to move leftward, a redundant first position signal P1 is produced, but since the chamber 14 is at this time still at relatively low pressure, i.e. it is still “depressurized,” there is no control signal on the line 81, and the redundant first position signal is not fed to the flip-flop 72. The piston member 10 reaches the end of its stroke at E1 and begins moving rightward, the pressure in chamber 14 by this time being sufficient for the sensor to produce a control signal on the line 81 and not on the line 82. The cycle described is then repeated.

Thus, it will be appreciated that nonredundant first position signals are only produced, and are only fed to the flip-flop 72 when the piston member is moving rightward whereas nonredundant second position signals are only produced and are only fed to the flip-flop 72 when the piston member 10 is moving leftward.

Control signal lines 77, 78 are provided as in the FIG. 1 embodiment, the logic gates 74, 75 having three inputs as shown in the drawing, (e.g. by making each logic gate of two two-input gates in cascade).

To operate the transducer, control signals are applied to the lines 77, 78 and to stop the transducer with the piston at a chosen end of its stroke, the appropriate control signal (on line 77 or 78) is removed. If it is required to stop the piston at a particular end of its stroke, only the appropriate one of the two lines 77, 78 need be provided. Then the other logic gate need only be of the two-input-type.

If the transducer is such that there is a marked difference in the duration of the leftward and rightward piston movements (e.g. if the transducer is operating a quick-return mechanism) it may be necessary to advance the timing of one of the position signals so that both nonredundant position signals occur when the piston member is moving in one direction. To permit this it is necessary to arrange that the chamber 14 is pressurized more quickly than it is depressurized (or vice versa, depending on the exact piston movement employed). This can be achieved for example by adjusting the relative flow areas of the inlet and outlet lines 38, 40.

A double-acting transducer is shown schematically in FIG. 4. Those features that correspond with the features of FIGS. 1 and 3 are given the same reference numerals, and may be assumed to operate in the same manner.

The transducer is provided with a further chamber 15 bounded by a further operative face 17 of the piston member 10, opposed to the face 16. A further fluid spring chamber 19 is provided, acting on a yet further face 21 of the piston member 10, opposed to the face 20 thereof. The faces 20, 21 are of the same area. It will be appreciated that the fluid pressures in the chambers 18, 19 serve to resiliently bias the piston member against movement in either direction.

The chambers 14, 15 are cyclically pressurized and depressurized at 180° phase difference with each other, by means of a modified control valve 34, which employs a three-land shuttle valve 37, and has two spaced-apart ports connected to the low-pressure line 40 and has two further ports connected to the chambers 14 and 15 via lines 90, 92.

In the control circuit, instead of a single pressure sensor 84 there are provided two sensors 94, 96 respectively arranged to sense the pressures in the chambers 14 and 15, or pressures functionally related thereto. Unlike the sensor 84, the sensors 94, 96 have only one output line 98, 100 respectively, upon which respective control signals are produced only when the chambers 14 and 15 respectively are pressurized.

The operation of the transducer is the same as that of the FIG. 3 transducer except that the “AND” gate 75 receives signals indicative of high pressure in the chamber 15 instead of low pressure in the chamber 14. This is practicable because of the 180° phase difference between the pressure cycles in the two chambers.

In the arrangement illustrated in FIG. 4, the flip-flop 72 is of the wall attachment type which renders it unnecessary to include resistances 52, 54 and diodes 56, 58. When the flip-flop 72 receives the first position signal from “AND” gate 74, it switches application of fluid pressure from line 62 leading to chamber 48 to line 64 leading to chamber 50 whereby chamber 50 is pressurized and moves the valve 37 leftwards as seen in FIG. 4 while chamber 48 is depressurized and drains along line 62 to and through the bleed or vents in the flip-flop. When the flip-flop receives the second position signal from the “AND” gate 75, it switches application of fluid pres-
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sure from line 64 leading to chamber 50 to line 62 leading to chamber 48 whereby chamber 48 is pressurized and moves the valve 37 rightwards as seen in FIG. 4 while chamber 50 is depressurized and drains along line 64 to and through the bleed or vents in the flip-flop.

Employing FIG. 2(b) to explain the operation of the FIG. 4 transducer, and assuming the piston member is moving rightwards from its left-hand extreme position \( P_i \), the chamber 14 is pressurized. Firstly, a nonredundant first position signal \( P_i \) is produced on line 62. Since the chamber 14 is pressurized, sensor 94 provides a gate control signal on the line 98 and the "AND" gate 74 passes the first position signal to the flip-flop 72, which then initiates depressurization of the chamber 14 and pressurization of the chamber 15. The next position signal produced is a redundant second position signal \( P_i' \), on the line 64, as the groove 28 passes the ports 58, 63. However, since the chamber 15 takes a finite time to pressurize, the pressure therein is still insufficient at this time for the sensor 96 to produce a control signal on the line 100. Consequently, the "AND" gate 75 does not pass the redundant signal to flip-flop 72. The piston member 10 then reaches the end of its stroke at \( E_s \) and begins to move in the opposite sense (leftwards) due to the pressure in chamber 15. A nonredundant second position signal \( P_i \) is then being produced and the high pressure in chamber 15 causes the sensor 96 to produce a control signal on the line 100. Consequently, the "AND" gate 75 passes the second position signal to flip-flop 72, which initiates pressurization of the chamber 14 and depressurization of the chamber 15.

As the piston member 10 continues its leftward movement, a redundant first position signal \( P_i' \) is produced but since the chamber 14 is at this time still at relatively low pressure, i.e., it is still "depressurized," there is no control signal on the line 98, and the redundant first position signal is not fed to the flip-flop 72. The piston member then reaches the end of its stroke at \( E_s \) and begins moving rightward, the pressure in chamber 14 by this time being sufficient for the sensor 94 to produce a control signal on the line 98. The cycle described then repeated.

It will be appreciated that alternatively, a control circuit as in FIG. 3 employing a single sensor 84 sensing the pressure in either the chamber 14 or 15 can be employed with the double-acting transducer of FIG. 4. Because of the phase difference, a high-pressure signal from chamber 14 implies that chamber 15 is depressurized, and vice versa.

In both the single- and double-acting versions of the transducer, the chamber 14 or chambers 18 or 19 can be chosen to be small compared to the fluid spring or chambers 18 or 18, 19. It will be appreciated that the drawings are not to scale and are not intended to indicate the relative sizes of the chambers.

In the case of the double-acting transducer, the fluid springs may act upon a separate piston which contacts the piston 10. The term piston member used herein is to be taken to include such a construction. For example, the positions of the chambers 14 and 19 may be interchanged, the separate piston being constituted by the lands 24, 26 which then are moveable relative to the remainder of the piston member, and have shoul-
ders (not shown) for engagement therewith.

The relative proportions of the areas of the piston faces will depend on whether an impact, or a continuous output motion is required. If an impact-output motion is required, the areas are such that the piston member tends to drift away from the anvil or drill bit.

It will be appreciated that by choosing the shape of the ports in the control valve 34, and the shape of the lands thereof, the waveform of the cyclically applied pressure may be controlled. As described, the waveform is substantially a square wave, but alternative waveforms may be preferable if the transducer is not required to produce impacts.

The biasing means, instead of being a fluid spring as hereinbefore described may in any of the embodiments be, for example, a mechanical spring, a magnetic spring, or when the work-
ing fluid is a liquid, a pneumatic spring. In that case the chamber would be divided into two portions by a flexible diaphragm, one portion containing gas under pressure, the other containing working fluid in contact with the face 20. In the double-acting embodiments, the chamber 19 would be similarly divided.

Although the invention has been described in a form in which the piston member 10 moves relative to the cylinder member, a construction in which the opposite movement occurs may be employed. Also, it will be appreciated that instead of linear oscillations, angular oscillations can be produced by analogous apparatus disposed to impart an oscillating torque to a rotatably mounted shaft.

I claim:
1. A transducer adapted to be driven by pressure fluid to produce mechanical oscillations, said transducer comprising: a piston member and a cylinder member mounted for relative oscillating movement, the cylinder member having a chamber defined therein, the piston member having a face bounding said chamber, means for applying cyclic forces to the piston member and cylinder to produce said relative oscillating movement, said means including valve means for cyclically pressurizing and depressurizing said cylinder with pressure fluid, means for generating a transient first position signal as the members move relatively through a first relative position and to generate a transient second position signal as the members move relatively through a second relative position, said first and second positions being intermediate extreme positions of said relative movement, control means including a bistable element to control the valve means in response to said position signals, the control means responding only to those first position signals generated as the members move relatively in one sense through the first relative position and only to those second position signals generated as the members move relatively in the opposite sense through the second relative position.
2. A transducer as in claim 1 comprising: a logic gate, means to feed at least one of the position signals to the bistable element via said logic gate, means to feed a gate control signal to the logic gate, the logic gate being adapted in response to the gate control signal, to permit or prevent the passage of the position signal to the bistable element.
3. A transducer as in claim 2 wherein said logic gate comprises means to receive a signal for starting and stopping the transducer.
4. A transducer as in claim 1 wherein the valve means is a shuttle valve, the bistable element, being adapted to apply pressure fluid signals to the valve means.
5. A transducer as in claim 1 wherein means for applying comprises resilient biasing means to resiliently bias the piston member and cylinder member to relative movement in a predetermined sense.
6. A transducer as claimed in claim 5 wherein the resilient biasing means comprises a fluid spring chamber adapted to contain fluid constituting a fluid spring, another face of the piston member being subjected in operation to the pressure of said fluid.
7. A transducer as in claim 1, including: means to govern the control means by receiving the position signals and passing to the control means the first position signals generated only during said relative movement in the first sense, and the second position signals generated only during relative movement in the second sense.
8. A transducer as in claim 7 wherein the governing means comprises: first and second logic gates for the first and second position signals, means for producing gate control signals related to the sense of the relative movement of the members, and
9 means for applying said signals to the gates to control the passage of the position signals therethrough.

9. A transducer as in claim 8 wherein the producing means comprises pressure sensing means to sense the pressure in the chamber, or a pressure related thereto the first logic gate passing first position signal to the bistable element only when the chamber is pressurized, the second logic gate passing second position signals to the bistable element only when the chamber is depressurized.

10. A transducer as in claim 8 wherein:
the means for applying comprises a further chamber bounded by a further face of the piston member, opposed to the first-mentioned face, the valve means being adapted to pressurize and depressurize the further chamber at substantially 180° phase difference relative to the first-mentioned chamber, and
the producing means comprises pressure-sensing means to sense the pressure in the first-mentioned and further chambers, or pressures related thereto, and to pass gate control signals to each said logic gate, the gates passing first position signals to the bistable element only when the first mentioned chamber is pressurized, the gates passing second position signals to the bistable element only when the further chamber is pressurized.

11. A transducer as in claim 1 wherein the means to generate comprises:
for each position signal, a first port in the cylinder member wall,
means to supply pressure fluid to the first port, a second port in the cylinder member wall,
means connecting said second port to the control means, and
a groove in the piston member, said groove transiently connecting said first and second ports as the piston member and the cylinder pass through a said first or second relative position.

12. A transducer adapted to be driven by pressure fluid to produce mechanical oscillations, said transducer comprising:
a piston member and a cylinder member mounted for relative oscillating movement,
the cylinder member having a chamber defined therein, the piston member having a face bounding said chamber, means for applying cyclic forces to the piston member and cylinder to produce said relative oscillating movement, said means including valve means for cyclically pressurizing and depressurizing said chamber with pressure fluid, means to generate a transient first position signal as the members move relatively through a first relative position and to generate a transient second position signal as the members move relatively through a second relative position, said positions not being extreme positions of said relative movements,
control means to control the valve means in response to said position signals, and
means to govern the control means to respond only to those positions signals generated as the members move relatively in one sense through the first relative position, and only to those second position signals as the members relatively in the opposite sense through the second relative position.