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(54) A carburettor for a controlled-ignition engine

(57) A carburettor (1) for a controlled-ignition engine (1a) having a float chamber (3) for containing fuel (2) arriving through an inlet duct (5) of the carburettor (1) and for supplying fuel (2) to an outlet (6) of the carburettor (1); the inlet duct (5) being engageable by a needle (20) movable with a body (18) floating in the fuel (2) contained in the chamber (3), and the outlet duct (6) being engageable by a needle (24) controllable by a first cam-and-rocker device (13); a second cam-and-rocker device (14) being movable in phase with the said first device (13) for moving a second body (45) inside the chamber (3) so as cause particular variations in the level of the fuel (2), and to operate a pumping assembly (16) arranged in the chamber (3) itself and operable to supply fuel (2) to the outlet (6) of the carburettor (1).

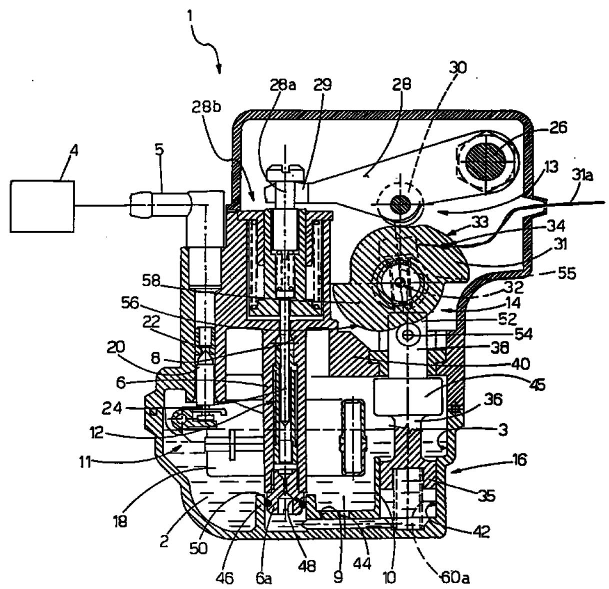

Fig.1

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Description

The present invention relates to a carburettor for a controlled-ignition engine.

It is known that a controlled-ignition engine can operate if supplied with a mixture of air drawn in from outside the engine and fuel contained in a carburettor which receives fuel from a tank. The two components of the mixture are mixed together in an induction duct shaped like a Venturi tube, arranged upstream of the carburettor and ending with a valve for regulating the air flow, the butterfly of which is controlled by the accelerator. The pressure inside the induction duct falls as the butterfly valve opens. The flow of fuel from the carburettor and the speed of the engine therefore increase in dependence on the degree of opening of the induction duct. In addition, the more the butterfly valve is open and therefore the more the pressure decreases inside the induction duct, the smaller is the head of fuel inside the carburettor with respect to the induction duct.

In order to alter the running conditions of the engine quickly, some carburettors have an extra supply pump which is activated so as to supply, up to the moment the new running conditions are established, a greater fuel flow from the carburettor than would be supplied by the pressure differential alone, and which reduces the said head of fuel.

Naturally, adding this pump makes the carburettor more complex, with the result that it requires longer to be tuned and becomes less reliable.

The object of the present invention is to provide a carburettor for controlled-ignition engines which makes it possible to alter the running conditions of the engine quickly without needing to use an additional pump and which is therefore especially simple and economical.

According to the present invention there is provided a carburettor for a controlled-ignition engine, which includes in its lower portion a float chamber for containing fuel; an inlet duct for directing fuel to the float chamber and an outlet duct whereby fuel is drawn out of the carburettor; the said inlet and outlet ducts are engaged respectively by first and second needles, both substantially vertical, the said first needle being fixed for movement with a vertically movable body floating in the float chamber; first control means being arranged above the said float chamber to move the said second needle axially within the said outlet duct; characterised in that it includes a connecting duct between the said float chamber and the said outlet duct and a pump assembly for pumping fuel through the said connection duct; second control means movable in phase with the said first means being provided to control the said pumping assembly so as to supply fuel from the said connecting duct towards the said outlet duct of the carburettor; and hydraulic communication means being provided to connect the said connection duct with the said float chamber.

The invention will now be described with reference to the appended drawings, which illustrate an embodiment by way of non-limitative example, in which:

Figure 1 is a cross section of a carburettor according to the present invention;
Figure 2 schematically illustrates a system into which the carburettor of Figure 1 is normally fitted;
Figure 3 is a side elevation view, on an enlarged scale, of a detail of Figure 2; and
Figures 4 and 5 are side elevation views, on an enlarged scale, of several embodiments of the detail of Figure 3.

In Figure 1, a carburettor for a controlled ignition engine 1a (Figure 2) which runs on liquid fuel 2 is generally indicated with the reference numeral 1.

The carburettor 1 includes a float chamber 3 arranged in its lower portion for receiving fuel 2 from a tank 4 through a substantially cylindrical inlet duct 5 which is substantially vertical and in Figure 1 is arranged on the side nearer the tank 4. The carburettor 1 also has an outlet duct 6 which receives fuel 2 from the chamber 3 and directs it to a substantially horizontal outlet aperture 8 positioned above and at a predetermined distance from the bottom of the float chamber 3.

The carburettor 1 also includes a further duct 9 for the fuel 2 drawn from the bottom of the chamber 3, this duct 9 hydraulically connecting the duct 6 with a cylinder 10 which is upwardly open and extends vertically from the bottom of the float chamber 3.

The carburettor 1 further includes an assembly for controlling the opening of the duct 5 so as to regulate the flow of fuel 2 into the chamber 3 to be inversely proportional to the level of fuel 2 in the chamber itself; and an assembly 12 for controlling the flow of fuel 2 out of the carburettor 1 through the duct 6.

The carburettor also includes two cam-and-rocker devices 13 and 14, arranged above the chamber 3, and a volumetric type pumping assembly 16 operable to pump fuel 2 from the chamber 3 to the duct 6 through the duct 9. In particular, the device 13 and the device 14 are operable in phase and the device 14 is operable to control the pumping assembly 16.

The assembly 11 includes a hollow toroidal body 18 which is fitted around the duct 6 so as to be freely slidable but fixed against rotation and which carries, within a downwardly open mouth of the duct 5, a cylindrical needle 20, the cross section of which is slightly greater than the internal diameter of the duct 5 and which ends at the top in a conical end portion 22 whereby, when the fuel 2 in the chamber 3 is at a predetermined level, there is a flow passage of predetermined dimensions through the induction aperture of the duct 5. In particular, as the level of fuel 2 in the chamber 3 drops, the flow passage for the fuel 2 increases in such a way that a predetermined level of fuel 2 is rapidly re-established within the chamber 3.

In the same way, the control assembly 12 includes a needle 24, the peripheral surface of which is slightly conical so that when it is in a predetermined position inside the duct 6 it leaves a predetermined flow passage for the fuel 2 from the float chamber 3 and, in any case, this passage decreases as the needle descends.

The control device 13 includes a pivot 26, perpendicular to the longitudinal axis of the needle 24 and on which is pivoted a rocker arm 28. The arm 28 is connected to the needle 24 by an interposed rod 28a coaxial with the needle 24 and forming part of a resilient device 28b operable to rotate the arm 28 anti-clockwise, as shown in Figure 1, so as to bias the needle 24 to its rest position, to which corresponds a minimum flow of fuel 2 through the duct 6. In addition, substantially half-way between the pivot 26 and the portion 29, the arm 28 has a cam follower roller 30 parallel to the pivot 26. The arm 28 can oscillate under the action of a cylindrical body 31, arranged beneath the arm 28, pivoted on a axis 32 parallel to the pivot 26 and rotatable about the axis 32 by slightly less than 180°. The body 31 is defined peripherally by a surface perpendicular to the needle 24, a peripheral portion 33 of this surface (facing upwardly in Figure 1) is shaped to form a cam 34 which will be described in more detail later. The body 31 is rotatable about the axis 32 under the action of a metal wire 31a biased by the action of a return spring which is not shown as it is entirely conventional. In addition to the pivot 26, the device 13 naturally includes the arm 28, the cam 34 and the roller 30.

With reference to Figure 2, it is useful to note that the wire 31a is controlled together with a rod, known and therefore not illustrated, controlling the butterfly valve 32a of the carburettor 1 itself so as to increase the flow of air through a narrow portion 32b of an induction duct 32c of the engine 1a.

The pumping assembly 16 has a piston 35 engaging the cylinder 10 so as to hydraulically seal it, and forming the lower portion of a vertical rod 36, the upper portion of which passes through a partition 40, isolating an upper portion of the carburettor 1 containing the control devices 13 and 14 from a lower portion of the carburettor itself.

It should be noted that the pumping assembly 16 also includes a chamber 42 defined by a bottom surface of the piston 35 and by the peripheral and bottom surfaces of the cylinder 10, and that this chamber 42 is supplied with fuel during the upward stroke of the piston 35 through an inlet hole 44 formed in the duct 9 substantially half-way between the cylinder 10 and the duct 6. In addition, beneath the partition 40 but above the upper rim of the float chamber 3, the rod 36 carries a cylindrical body 45, seen better in Figure 3, having a longitudinal axis and two faces substantially transverse this latter. The body 45 is securely fixed to the rod 36 and its function will be explained later.

It should further be noted that the duct 9 ends at the end of the duct 6 in an open, upward-facing cylindrical portion 46 which encloses an inlet aperture 6a of the duct 6 itself, defining an annular portion 48 which, in the present embodiment, is fitted with an annular seal 50, such as an "o-ring", whereby the ducts 6 and 9 are hydraulically sealed from each other.

The rod 36 ends above the partition 40 in an end portion 52 and the device 14 includes a cam follower roller 54 perpendicular to the rod 36 and supported by the end portion 52, and a rocker arm 55 securely fixed to the cylindrical body 31 and thus operable to oscillate about the axis 32. The roller 54 is freely rotatable about its own longitudinal axis and tangential to a portion 58 of the lower surface of the body 31 opposite the portion 33 and shaped to form a cam 58.

The operation of the carburettor will now be described with reference to Figures 1 and 2 and starting from an operating condition in which the engine 1a is running at a steady state and creates a depression of a predetermined value between the narrow portion 32b and the inside of the carburettor 1.

At this point, should the user of the engine 1a want to increase the speed of the engine, he presses on the accelerator to turn a rotatable member 60, the so-called "butterfly", and thereby increase the opening of the induction duct 32c. Simultaneously, the wire 31a is pulled so as to rotate the body 31 anti-clockwise, as seen in Figure 1, until it reaches a particular angular position. The body 31, and in particular the cam 34, carries the roller 30 in clockwise rotation about the pivot 26, whereby the needle 24 is raised from the rocker arm 28 so as to open further the duct 6. In addition, the rod 36 is pushed downwards by the cam 58 against the action of a spring 60a contained inside the body 10 between the bottom of the chamber 3 and the downward-facing surface of the piston. As a result, the rod 36 moves downwards causing the body 45 to be immersed in the fuel 2 contained in the chamber 3. Therefore, the head of fuel 2 relative to the outlet 8 is reduced very rapidly owing to the principle of communicating chambers, and as a result of the thrust given the fuel 2 in the chamber 42 and in the duct 9 by the piston 35.

The fact that the body 31 and the rod 36 are held in the last positions they occupied brings about a stabilization of new running conditions resulting from the greater flow of fuel caused by the lowering of the body 18 and, naturally, by the descent of the needle 20, and by a wider opening of the duct 5.

Should the user of the engine want to reduce the speed of the engine, he acts on the accelerator to return it to its previous position. This action causes a partial closure of the induction duct 32c but, more importantly, causes the body 45 to return to its raised position while the rocker arm 28 rotates clockwise thereby reducing the aperture of the duct 6. The piston 35 is thus raised and the flow of fuel 2 to the outlet 8 is reduced very rapidly, In fact, in this case the device 14 raises the rod 36 whereby the body 45 and the piston 35 return to the positions they occupied previously.

Thanks to the principle of communicating chambers, and to the fact that the piston 35 draws fuel 2 from the duct 6 and the chamber 3 through the hole 44, the flow through the outlet 8 is reduced significantly and very quickly, which, due to the use of devices having no rapidly-moving parts, therefore has a low risk of failure. It is clear from the above that in a deceleration phase the quantity of fuel 2 flowing into the duct 32c is particularly small, meaning that fuel consumption is kept to the minimum required to keep the engine running and that exhaust fumes, which are notoriously polluting, are also cut considerably.

Naturally, the shape of the cams 34 and 58 influences the law of vertical movement of the rod 36 and the law of rotary movement of the rocker arm 28. By varying the external shape of the body 31 it is possible to vary the response of the engine 1a to acceleration and deceleration.

This can also be achieved more simply by adjusting the peripheral shape of the body 45, for example by giving it a frusto-conical shape as in Figures 4 and 5. It is clear that the two faces of the body 45 are of different sizes; in particular, in Figure 4, the larger face is arranged beneath the other face, so as to cause a gradual reduction of the head of fuel 2. On the other hand, the body 45 of Figure 5, which is inverted with respect to the body 45 of Figure 4, causes a sudden reduction followed by a gradual achievement of the new operating conditions. Naturally, a combination of the two embodiments of the body 45 of Figures 4 and 5 chosen in accordance with the field of application of the engine 1a can give rise to particularly advantageous laws of variation of the head of fuel.

Finally, it is clear that modifications and variations may be made to the carburettor 1 described and illustrated here without departing thereby from the protective scope of the present invention.

For example, in order to simplify the construction and assembly of the carburettor 1, the hole 44 and the seal 50 could be eliminated, so as to leave to the annular portion the function of communicating between the duct 9 and the chamber 3, originally carried out by the hole 44. On the other hand, should one want to reduce the amount of energy required to supply the fuel 2 to the chamber 42, one could eliminate the seal 50, leaving the hole 44.

Claims

1. A carburettor (1) for a controlled-ignition engine (1a), including a float chamber (3) arranged near the bottom thereof for containing fuel (2); an inlet duct (5) for supplying the said float chamber (3) with fuel (2), and an outlet duct (6) for drawing fuel (2) out of the carburettor (1); the said induction and outlet ducts (5, 6) being engaged respectively by a first and a second needle (20, 24), both substantially vertical, the said first needle (20) being connected for movement with a vertically-movable body (18) floating in the fuel (2) in the float chamber (3); first control means (13) being arranged above the said float chamber (3) for moving the said second pin (24) axially within the said outlet duct (6); characterised in that it contains a connecting duct (9) arranged between the said float chamber (3) and the said outlet duct (6) and a pumping assembly (16) for pumping fuel (2) through the said connecting duct (9); second movable control means (14), operating in phase with the said first control means, provided to control the said pumping assembly (16) so as to supply fuel (2) through the said connecting duct (9) to the said outlet duct (6) of the carburettor (1); and hydraulic communication means (44) (48) being provided to connect the said connecting duct (9) with the said float chamber (3).

2. A carburettor according to Claim 1, characterised in that the said pumping assembly (16) is contained in the float chamber (3).

3. A carburettor according to Claim 1 or Claim 2, characterised in that the said pumping assembly (16) is of a volumetric type.

4. A carburettor according to Claim 3, characterised in that the said pumping assembly (16) includes a tubular body (10) securely fixed to the float chamber (3) and connected at the opposite end from the outlet duct (6) to the connecting duct (9) so as to form a hydraulic seal; a hydraulic piston being housed in the tubular body (10), movable axially under the thrust of the said second control means (14).

5. A carburettor according to Claim 4, characterised in that the first and second control means (13, 14) are cam-and-rocker devices.

6. A carburettor according to any one of the preceding claims, characterised in that it includes a cylindrical body (31) with a longitudinal peripheral surface perpendicular to the said second needle (24); the said cylindrical body (31) being rotatable by just under 180° about its own longitudinal axis (32); the said peripheral surface having first and second portions (33, 56) of substantially the same angular extent, each of which is shaped in a particular way so as to define a first and a second cam (34, 58).

7. A carburettor according to Claim 6, characterised in that the said second control means (14) include a first rocker arm (55) oscillatable about an axis (32) parallel to, and arranged above, the said cylindrical body (31); a first rod (36) coaxial with the said piston (35) and connected thereto, and a first cam follower roller (54) parallel to the said axis (32) and pivoted on the said first rod (36) in a position beneath the said cylindrical body (31) in such a way that it is tangential to the said second cam (58).

8. A carburettor according to any one of the preceding claims, characterised in that the said first control means (13) include a second rocker arm (28) oscil-

latable about the axis (32); a second rod (28a) coaxial with the said second needle (24) and controllable by the said second rocker arm (28) so as to move the said second needle (24) vertically; and a second cam follower roller (30) pivoted on the said second rocker (28) in a position above the said cylindrical body (31) so that it is tangential to the said first cam (34).

9. A carburettor according to any one of the preceding claims, characterised in that the said connecting duct (9) and the said outlet duct (6) are in communication by means of respective end portions (46, 6a), parallel to and facing each other.

10. A carburettor according to Claim 9, characterised in that the said respective end portions (46, 6a) define between them an annular portion (48).

11. A carburettor according to Claim 10, characterised in that the said annular portion (48) is engaged by a hydraulic seal (50) so as to connect and seal together the two end portions (46, 6a); the said communication means (44) including a hole (44) formed in the said connecting duct (9).

12. A carburettor according to Claim 10, characterised in that the said communication means (48) are defined by the said annular portion (48).

13. A carburettor according to Claim 11, characterised in that the said communication means also include the said annular portion (48).

14. A carburettor according to Claim 7, characterised in that it includes a second body (45) having a particular shape and connected to the first rod (36) in a position substantially above the said float chamber (3); the said second cam (58) being shaped in such a way as to move the second body (45) between a rest position in which the said second body (45) is outside the chamber (3) and a working position in which the said second body (45) engages the said chamber (3) so as to vary the level of the fuel (2) contained in the chamber (3) by a predetermined amount, dependent on the shape of the said second body (45) itself and on the shape of the said second cam (58).

15. A carburettor according to Claim 14, characterised in that the said second body (45) has a vertical axis and two faces which define it transversely.

16. A carburettor according to Claim 15, characterised in that the said second body (45) has a substantially cylindrical shape.

17. A carburettor according to Claim 16, characterised in that the said second body (45) has a substantially conical shape; one of the two said faces having a larger surface than the other face.

18. A carburettor according to Claim 17, characterised in that the face with the larger surface is lowermost.

19. A carburettor according to Claim 17, characterised in that the face with the larger surface is uppermost.

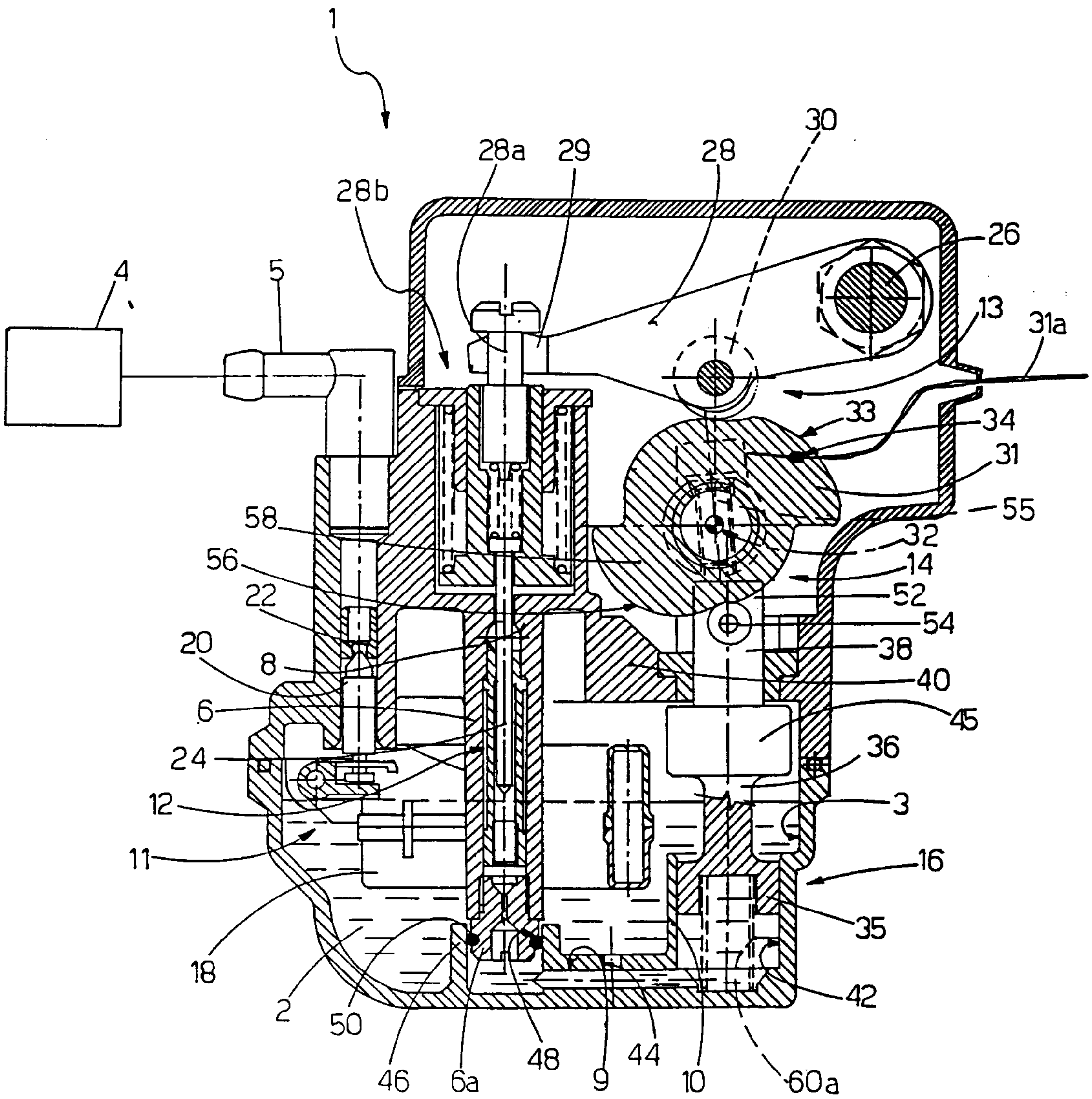
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Fig.1

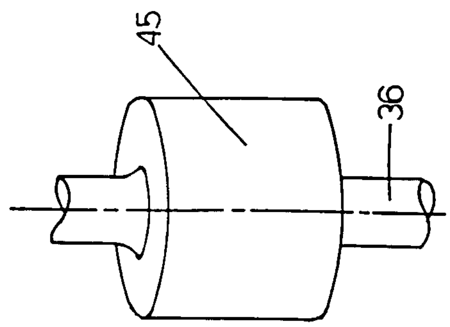

Fig. 3

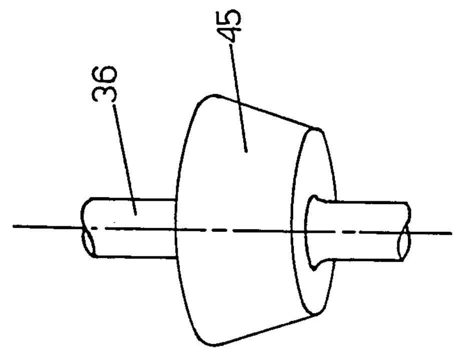

Fig. 4

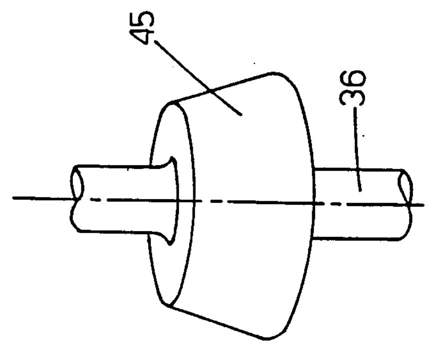

Fig. 5

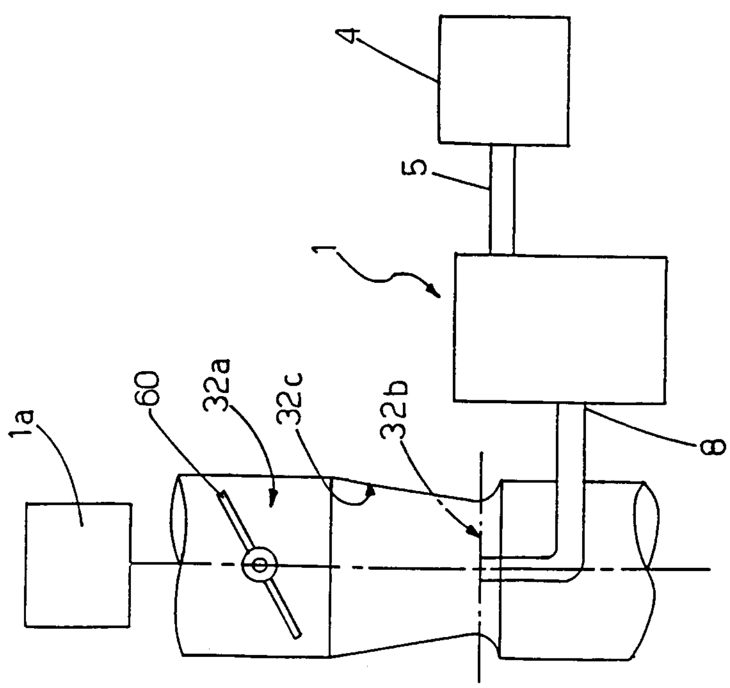

Fig. 2