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(54) **Method and arrangement for control of an exhaust brake in a combustion engine**

Verfahren und Anordnung zur Steuerung einer Auspuffbremse einer Brennkraftmaschine

Procédé et agencement pour commander un frein d'échappement d'un moteur à combustion

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- **PATENT ABSTRACTS OF JAPAN vol. 95, no. 001**
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Description

[0001] The present invention relates to a method for control of an exhaust brake in a combustion engine in accordance with the preamble to claim 1, and an arrangement for the implementation of the method in accordance with the preamble to claim 8.

State of the art

[0002] A known means of improving the braking effect of an engine is to arrange an exhaust brake throttle in the exhaust pipe. The exhaust brake throttle is activated during operating circumstances when the engine speed has to be reduced quickly or the engine brake effect has to be increased, e.g. when the vehicle driver depresses the brake pedal. The exhaust brake throttle may be activated automatically by a computer-controlled gear-change system during the change to a lower ratio so that the engine quickly reaches a lower synchronous speed before the next higher gear is engaged.

[0003] In supercharged combustion engines with turbocharger driven by exhaust gases, the exhaust brake throttle is usually placed after the exhaust gas turbine. In so-called turbocompound engines with a second exhaust gas turbine for recovering further energy, e.g. for returning residual exhaust energy to the crankshaft or for driving a generator, the exhaust brake throttle may be placed after the second exhaust gas turbine.

[0004] The exhaust brake throttle may be rotatable about a throttle spindle which is centric or eccentric with respect to the exhaust pipe. An eccentric throttle spindle has the advantage that the exhaust brake throttle can more easily be made self-controlling, since the exhaust pressure in the opening direction of the throttle acts on a larger portion of the throttle. This means that with a given control pressure from an operating cylinder acting on the throttle the exhaust brake can be designed to open automatically at a predetermined exhaust pressure.

[0005] This makes it possible to avoid bypass control or throttle designs with perforations. Such design solutions are adopted for exhaust brakes with a centrally placed throttle spindle in order to prevent the engine stopping because of excessive exhaust backpressure and in order to reduce the temperature in the combustion engine.

[0006] In the design of exhaust brakes there are various criteria that have to be fulfilled. For the sake of lower engine speed with smaller exhaust flow, it is desirable to have a tight exhaust brake so that a high engine brake effect can be obtained despite the smaller flow. At higher engine speeds, however, the exhaust brake throttle must not be too tight, since this would result in exhaust temperatures being too high and in that the combustion engine exhaust valves may risk to start opening at incorrect non-synchronous points in the combustion cycle, which may occur if the exhaust pressure in the com-

bustion engine exhaust manifold becomes too great.

[0007] These conflicting criteria result in exhaust brakes generally representing a compromise solution. The throttle may be made tight with an eccentric throttle spindle but be acted on by a small closing force, whereby the exhaust exhaust brake throttle opens automatically when the force exerted by the exhaust pressure on the throttle exceeds the force exerted on it by the throttle control cylinder. The force of the control cylinder has to be so small that the throttle opens at a certain predetermined exhaust pressure in order to prevent the combustion engine becoming too hot. However, the smaller activating force makes the exhaust brake throttle more difficult to close at higher speeds and fully developed exhaust flows, thereby reducing the maximum effect and the response of the exhaust brake.

[0008] The alternative of designing the throttle too tight leads to low engine brake effect at low engine speed and exhaust flow. Other solutions include various types of active control systems. US 5,079,921 for example discloses an exhaust back pressure control systems in which an operating signal being generated to provide a desired back pressure as a function of engine coolant temperature, engine speed, engine fuel consumption and actual backpressure. Another solution is shown in DE 1103682 where the exhaust flow acts on a piston and reduce the effect of the exhaust brake. Other solutions include various types of active control such as bypass control or intermittently acting stops which prevent the throttle from closing completely.

[0009] It is also known for diesel engines to use the exhaust brake as a white-smoke limiter while the engine is cold. There the exhaust brake throttle closes in order to increase the engine load, thereby raising the engine temperature and hence reducing the amount of white smoke generated. In such cases the exhaust brake is activated by a substantially smaller closing force than what is normal for engine brake effect optimisation. Possible alternatives to a smaller closing force on the exhaust brake throttle include increased bypass flow round the throttle or stops which can be inserted temporarily to act directly against the throttle or the throttle mechanism and prevent the throttle closing completely.

Objects of the invention

[0010] The invention has the object of making exhaust brakes, preferably with an eccentric throttle spindle, achieve a higher exhaust brake effect and consequently greater engine brake effect when the exhaust brake is applied at various engine speeds than has hitherto been known.

[0011] A further object is to provide the same brake effect level and the same exhaust backpressure, when the exhaust brake is applied at high engine speeds, as the level and pressure which are obtained when it is applied at low engine speeds followed by the combustion engine speed being increased by continued application

of the exhaust brake to the corresponding relevant engine speed. Thereby the same brake effect is achieved at the same engine speed, irrespective of when the exhaust brake throttle is applied.

[0012] The method according to the invention is indicated by the characterising part of claim 1, and the arrangement for implementing the method according to the invention by the characterising part of claim 8.

[0013] Other features and advantages which distinguish the invention are indicated by the characterising parts of the other claims and by the description of embodiments set out below. The embodiments exemplified are described with reference to the diagrams indicated in the following list of drawings.

List of drawings

[0014]

Figure 1 depicts schematically a combustion engine with an exhaust brake throttle arranged eccentrically in the exhaust pipe and with an electrically operated pneumatic control device for the exhaust brake throttle.

Figure 2 depicts schematically an alternative control circuit of the exhaust brake throttle composed of an electrically controlled system with hydraulic components.

Figure 3 depicts the control pressure in the exhaust brake throttle operating cylinder.

Figure 4 depicts the pressure before the exhaust brake throttle in various operating situations A,B,C, measured after a supercharger turbine arranged in the exhaust pipe.

Figure 5 depicts the combustion engine brake effect in the same operating situations A,B,C as in Figure 4.

Description of embodiments

[0015] Figure 1 depicts schematically a vehicle combustion engine 1 with an exhaust brake 5 arranged in the combustion engine exhaust pipe 3. The exhaust pipe 3 leads the exhaust flow 4 from the combustion engine exhaust manifold 2, possibly via a supercharger turbine (not depicted), to the exhaust brake 5 and thereafter on to a second exhaust handling system such as a second compound turbine, a number of silencers or possibly a gas cleaning system. It is advantageous for the exhaust brake 5 to act on the whole exhaust flow 4 from the combustion engine. In V-engines, for example, it is possible to use twin exhaust gas throttles, one for the exhaust flow from each bank of cylinders.

[0016] The exhaust brake throttle 6 is conventionally

arranged for rotation on a spindle 7 which is arranged eccentrically in the exhaust pipe 3 at a distance E from the exhaust pipe centreline CC. The throttle 6 has a larger portion 6a and a smaller portion 6b situated on their respective sides of the throttle spindle. In figure 1, the throttle 6 is shown in its closed position and is opened by rotation in the direction OP. The throttle 6 is closed by rotation of the spindle 7. The throttle is preferably controlled by means of a pneumatic operating cylinder 10 which acts on a pull-rod 9 which is connected via a link 8 to a lever 17 which is arranged non-rotatably on the throttle spindle 7. In applications on heavy-duty vehicles, the operating cylinder 10 is preferably controlled by compressed air from the vehicle's compressed air system via a control valve 11 according to the invention and which is arranged in a compressed air connection 18 connected to the pressure accumulator 12 of the compressed air system. In other applications the operating cylinder may be of another type, e.g. hydraulic or electromechanical.

[0017] The control valve 11 arranged in the compressed air connection 18 may be a proportional valve or a pulsewidth-modulated valve capable of delivering a proportionally steplessly controlled pressure. Control of the valve 11 is by means of an electronic control unit 13 (supplied by a battery 16) responding to a number of sensors 15-15^x arranged in the vehicle. The sensors (or switches) may, for example, detect the position of the vehicle brake pedal 14, a manually imposed engine brake level, the combustion engine speed, the external temperature (used for white-smoke limitation), whether the vehicle retarder is activated or the ABS system is active or not.

[0018] The throttle 6 depicted in Figure 1 is known per se and functions as an exhaust pressure regulating valve which opens when the force exerted by the exhaust gases on the throttle exceeds the force exerted by the operating cylinder 10. The portion 6a of the throttle, which in Figure 1 is situated above the spindle 7, is larger than the portion situated below, thereby making the exhaust pressure continually endeavour to open the throttle 6. The response of the throttle to overpressure is therefore very rapid.

[0019] With an arrangement according to the invention in accordance with Figure 1, the control unit 13 controls the valve 11 so that a first higher primary control pressure is activated when exhaust braking commences. A timer or some programmed time-circuit 19 is used to apply an immediate or successive reduction of the pressure in the operating cylinder 10 to a second lower secondary control pressure within a second or a few, preferably 1 to 4 seconds. The valve 11 is connected to the compressed air connection 18 where it can pressurise the operating cylinder 10 with a selectable pressure level between the pressure level of the pressure source and the ambient atmospheric pressure. The valve 11 is preferably an electrically controlled proportional valve controlled by a current regulator 29 incorporated in the

control unit 13. On vehicles current control of the proportional valve is more advantageous than voltage control, since current control is not as sensitive to contact resistances in electrical connecting lines which are liable to be affected by the environment.

[0020] The engine brake effect is thus easy to control by controlling the force exerted by the operating cylinder 10. Devices such as various constrictions, stops or bypass ducts acting in the exhaust flow may therefore be dispensed with. This is of course advantageous in that all such devices are sensitive to exhaust deposits or other functionally impairing influences. Specific examples of control using various force levels, and their advantages, are discussed further on.

[0021] Figure 2 depicts a variant specially designed for the invention for controlling the operating cylinder 10 by using hydraulic components. The operating cylinder 10, whose piston 30 and return spring 32 are depicted here, can be pressurised in its pressure chamber 31 for control of the pull-rod 9. The pressure chamber 31 is pressurised by an activating valve 26 depicted in Figure 2 in a position which does not activate the exhaust brake throttle and in which the activating valve 26 connects the pressure chamber 31 via the conduits 37,38 to the ambient atmospheric pressure ATM. The pressure chamber 31 is thus vented to atmosphere and the return spring urges the piston 30 to the left in the diagram, making the exhaust brake throttle open in the direction OP.

[0022] The activating valve 26 is controlled by an electronic control unit 13 in response to input signals 15-15^x in a manner corresponding to Figure 1. The control unit 13 can switch the activating valve 26 to a position which closes the exhaust brake throttle and in which the activating valve 26 in a reversed position with respect to Figure 2 connects the pressure chamber 31 via a conduit 36 to a controlled pressure system in order to pressurise the pressure chamber 31. Pressurisation of the chamber 31 urges the piston 30 to the right in the diagram, against the action of the return spring 32, thereby closing the throttle.

[0023] The controlling pressure system depicted in Figure 2 is composed as follows:

[0024] The pressure source 12 is connected to the controlling pressure system via the conduit 21, which bifurcates into two conduits 21a,21b. Via the conduit 21a, a smaller pressure vessel 40 can be pressurised when a control valve 22 is positioned so that its connections 33,34 are connected together, as shown in the diagram, while at the same time the activating valve 26 is in the position shown in the diagram.

[0025] The pressure vessel 40 is connected to the conduit 36 via a double-acting check valve 24. The vessel 40 can be pressurised by the pressure prevailing in the pressure source 12 (primary control pressure). Via the conduit 21b, a reduced pressure from the pressure source 12 (secondary control pressure) can be obtained in the conduit 36 via a pressure reducing valve 25 and the check valve 24. The two conduits 21a,21b are thus

connected to the conduit 36 via the valve 24 which has the function of connecting to the conduit 36 whichever of the conduits 21a,21b has the higher pressure.

[0026] The controlling pressure system depicted functions as follows:

[0027] When the exhaust brake is to be activated by the control unit 13, the control valve 22 is positioned so that a connection 33 is closed and a connection 34 is connected to the conduit 35 which is itself connected to the ambient atmosphere ATM via a constriction 23. Simultaneously with switching of the control valve 22, the activating valve 26 is positioned so that the conduits 36,37 are connected. This makes the primary control pressure which momentarily prevails in the vessel 40 exceed the pressure supplied via the conduit 21b, since the double check valve 24 connects the vessel 40 to the conduit 36. The fact that the vessel 40 is connected to the atmosphere ATM via the control valve 22 and the constriction 23 makes the pressure in the vessel 40 decrease successively. When the pressure falls below the secondary pressure from the pressure reducing valve 25, the valve 24 switches, thereby connecting the conduit 21b to the conduit 36.

[0028] Figure 3 shows how the pressure in the conduit 36 decreases from the primary control pressure P_1 to the secondary control pressure P_2 during the period of time T_1 - T_2 when the vessel 40 during the same period of time vents to the atmosphere via the constriction 23. Experiments were carried out using a vessel of volume 1.6 litre, a constriction of diameter 1 mm and control pressures P_1, P_2 of 7.9 and 6.5 bar respectively. Under these conditions the pressure fell from P_1 to P_2 over a period of time T_1 - T_2 of approximately 2 seconds. As previously mentioned, corresponding pressure levels can also be obtained with an arrangement according to Figure 1. This means that a higher acting pressure is obtained during the whole throttle movement against the exhaust flow to the closed position and that a lower acting pressure is obtained after a limited time after the closure of the throttle.

[0029] The effects of pressure control as per Figure 3 are illustrated in Figures 4 and 5. Figure 4 shows how the exhaust backpressure builds up after a supercharger turbine located in the exhaust pipe 3, but before the throttle 6, at various engine speeds and in various operating situations.

[0030] Graph A represents the exhaust backpressure obtained if the exhaust brake is activated/closed by an operating cylinder control pressure corresponding to the secondary control pressure P_2 , preferably around 6.5 bar, at a low engine speed of 1000 rpm and is thereafter kept closed over the whole speed range up to 2200 rpm.

[0031] Graph B represents the exhaust backpressure obtained if the exhaust brake is activated at the respective engine speeds according to the invention by a higher primary control pressure, preferably around 7.9 bar, followed by a lower secondary control pressure, preferably around 6.5 bar, after one or a few seconds.

[0032] Graph C represents the exhaust backpressure obtained at the various engine speeds if the exhaust brake is activated at the respective speeds by a control pressure corresponding to the secondary control pressure P_2 , preferably around 6.5 bar.

[0033] Continuous control of the operating cylinder by a control pressure corresponding to the higher primary control pressure of around 7.9 bar is in practice impossible, since, as previously mentioned, it may lead to exhaust temperatures being too high and to such a high exhaust pressure that the combustion engine exhaust valves may open at non-synchronous points in the combustion cycle.

[0034] Graphs A and C show that quite different exhaust backpressures occur depending on the engine speed at which the exhaust brake is activated. Thus a substantially lower backpressure is obtained if, as per graph C, the exhaust brake is activated at a definitely higher engine speed than if, as per graph A, it is activated at a low speed which thereafter increases to a correspondingly higher speed. This latter case may occur, for example, when driving on steep downhill runs but is undesirable, since the same exhaust backpressure is desired at a specific engine speed, irrespective of the mode of driving.

[0035] In contrast, graphs A and B show that substantially the same exhaust backpressure is obtained irrespective of whether the exhaust brake is activated at a lower speed as per graph A or at a higher speed as per graph B.

[0036] Figure 5 shows as a function of engine speed the engine brake effect obtained in corresponding activation situations A,B,C as in Figure 4. It also shows that the engine brake effect is considerably greater at higher engine speeds with the method according to the invention (graph B) than with constant control pressure (graph C).

[0037] The difference between operating situations B and C according to Figures 4 and 5 is due to the exhaust brake having a hysteresis which depends on the effects of friction on throttle closing and opening respectively. When the throttle is closed, the friction between, inter alia, the outer edges of the throttle and the inside walls of the exhaust pipe will oppose the opening of the throttle, i.e. help to keep the throttle closed. When a tight throttle is closed, the exhaust pressure builds up to a higher level, after which the throttle only opens when overpressure exerts on the throttle a force which exceeds the force exerted on it by the operating cylinder plus the forces added by friction.

[0038] If the throttle is activated towards the closed position with a force too small, the latter will not be able entirely to overcome the developed exhaust forces and the friction forces acting to prevent closure. There is thus risk of the throttle not reaching a fully closed position but jerking towards the closed position, resulting in inferior results as per graph C in Figures 4 and 5.

[0039] Activation of the exhaust brake throttle accord-

ing to the invention by a higher primary control pressure in the initial stage, followed by a lower secondary control pressure after one or a few seconds, subjects the exhaust brake throttle to a substantially greater force until the throttle reaches a fully closed position, after which the secondary control pressure is applied to keep the throttle closed where friction opposes opening of the throttle, thereby promoting higher exhaust backpressure and greater engine brake effect.

[0040] The invention is not to be confused with mass-inertia compensating control whereby the control system is activated by a higher tractive force to set its movable masses in motion, followed by reduction of the force when the masses have definitely begun to move of themselves. The essential point of the invention is that a greater force level is activated throughout the throttle closing movement against the developed exhaust gas flow, so that a fully closed position is actually reached before a smaller acting force is activated.

[0041] The embodiment depicted in Figure 1 with a proportionally controlled valve 11 is also suitable for white-smoke limitation, which may be activated when the control unit 13 receives input signals which detect cold starting, whether manually or automatically. White-smoke limitation involves using a further third control pressure substantially lower than the secondary one. In a system where the primary and secondary control pressures are around 7.9 and 6.5 bar respectively, the third control pressure will be less than 50% of the primary, preferably around 3 bar. To achieve white-smoke limitation, the embodiment depicted in Figure 2 may be modified by connecting a second pressure reducing valve for pressurisation of the operating cylinder 10. This second pressure reducing valve may reduce the pressure to a considerably lower level than the pressure obtained from the pressure reducing valve 25. The third pressure is maintained until a predetermined value of a predetermined parameter is reached, e.g. until a certain time has passed or a certain engine temperature is reached.

[0042] The pressure control levels exemplified in this embodiment are entirely suited to the particular exhaust brake throttle lever 17. Different lengths of the lever 17 result in different control pressure values. The experiments and tests from which the graphs in Figures 4 and 5 are derived were based on using a lever 17 approximately 5.4 centimetres long and an operating cylinder diameter of approximately 3.5 centimetres. The combustion engine used for the experiments and tests was a six-cylinder diesel engine with an output of around 380 hp with a cylinder volume of 12 litres.

[0043] For the implementation of the invention, the relative values of the control pressure should be within the range defined below, where the primary, secondary and third control pressures are denoted by P_1 , P_2 and P_3 respectively.

$$P_1 < P_2 < 0.85 \cdot P_1$$

$$\bullet P_1 < P_3 < 0.5 \bullet P_1.$$

[0044] It is advantageous that the second control pressure be around 80% of the primary pressure and that the third control pressure for white-smoke limitation be around 40% of the primary pressure.

[0045] The embodiment described with eccentric throttle may be replaced by an exhaust pipe of non-circular cross-section in which the axis of rotation of the exhaust throttle divides the throttle into two portions with unequal areas.

[0046] It is also possible to use a centric throttle which is acted on by two operating devices, one of them exerting the control force on the throttle and the other exerting on the throttle a force proportional to the exhaust backpressure.

[0047] The invention is not limited to an embodiment with successive decrease of the primary control pressure to the lower secondary control pressure corresponding to the control illustrated in Figure 3. The primary higher control pressure may be activated for at least one or a few seconds, with a relatively rapid reduction to the lower secondary control pressure. The period over which the reduction takes place may be from a few tenths of a second to more than a second.

[0048] The invention is not limited to an embodiment in which the control pressure in an operating cylinder is controlled, it may also be implemented in embodiments with other operating devices whereby mechanical force transfer mechanisms change gear-ratio from a first phase acting on the exhaust brake throttle to a secondary phase after a second or a few. According to the embodiments referred to above, the control pressure is stated, since it is proportional to the control force acting on the throttle. In other embodiments or with other dimensions there may be other pressures or entirely different parameters. The essential point is that the control force acting on the throttle can have at least two different selectable values.

Claims

1. Method for controlling an exhaust brake (5) including a throttle (6) arranged in the exhaust pipe (3) of a combustion engine (1), where the throttle (6) is rotatable between an open position and a closed position, and where force exerted by at least one operating device (9) urges the throttle towards a closed position, and where, on activation of the exhaust brake (5), the throttle (6) is acted on by a first force (P_1) and thereafter acted on by a second force (P_2) which is smaller than the first force (P_1), and where the throttle (6) is acted on by the second force (P_2) during the remaining time that the throttle (6) is in its closed position, *characterised* in that the throttle (6) is acted on by the respective first and

second forces (P_1, P_2) in dependency on a time-dependent device (13, 19; 22, 23).

2. Method according to claim 1, *characterised* in that the throttle (6) is acted on by the second force (P_2) 1-4 seconds after the commencement of the application of the first force (P_1).
3. Method according to any one of claims 1-2, *characterised* in that the force applied to the throttle (6) changes successively from the first force (P_1) to the second (P_2).
4. Method according to any one of claims 1-3, *characterised* in that the second force (P_2) amounts to 65-85% of the first force (P_1).
5. Method according to any one of claims 1-4, *characterised* in that the operating device is activated in response to signals from an electronic control unit (13).
6. Method according to claim 5, where the throttle (6) is mounted on a spindle (7) arranged at a distance (E) from the centre (CC) of the exhaust pipe, the throttle comprising a larger area (6a) and a smaller area (6b) each situated on its side of the spindle (7), and where the exhaust flow direction (4) is opposite to the closing direction of the larger throttle area (6a), *characterised* in that the electronic control unit 13 receives input signals from state-detecting sensors (15-15^x) and in response to those signals delivers output signals to a pneumatic valve (11) which thereafter supplies an operating cylinder (10) with compressed air from a pressure source (12), where the pressure level depends on said output signals, and where a pull-rod arranged in the operating cylinder (10) acts on the throttle (6), preferably via a lever (17), with a force proportional to the aforesaid pressure level.
7. Method according to either of claims 5 or 6, *characterised* in that the electronic control unit 13 receives input signals from state-detecting sensors (15-15^x) which indicate cold starting, that the control unit (13) gives signals to the operating device (9) to apply to the throttle a third force which is considerably smaller than the first force (P_1) and that the application of this force continues until a predetermined value of a predetermined parameter is reached.
8. Arrangement for an exhaust brake (5) including a throttle (6) connected to a pneumatic operating cylinder (10) which throttle (6) is arranged in an exhaust pipe (3) of a combustion engine (1), where the throttle (6) is rotatable between an open position and a closed position and the application of force from the pneumatic operating cylinder (10) urges the throttle

towards a closed position, where the operating cylinder (10) is connected to a pressure source (12) via a connection (18;21,37) and connected to at least one control device (11;22-26) which is in its turn connected to a control unit (13) connected to state-detecting sensors (15-15^x) from which the control unit (13) is arranged to receive input signals, the control device (11,22-26) consists of a valve arrangement (11,22-26) arranged at the connection (18;21,37) and is connected to at least one time-dependent device (19;22,23), which control device (11;22-26) is arranged to control the force applied to the throttle in response to input signals from the control unit (13) and the time-dependent device (19;22,23), *characterised* in that the valve arrangement includes a valve (11) connected at the connection (18) between the pressure source (12) and the operating cylinder (10), that the valve includes means for pressurising the operating cylinder (10) with at least two selectable pressure levels between the pressure of the pressure source (12) and atmospheric pressure and that the valve is preferably a proportional valve which is current-controlled by the control unit (13) by means of a current regulator (29) incorporated in the control unit (13).

9. Arrangement according to claim 8 *characterised* in that, the exhaust brake throttle (6) is mounted on a spindle (7) arranged at a distance (E) from the centre (CC) of the exhaust pipe, the throttle comprising a larger area (6a) and a smaller area (6b) each situated on its side of the spindle (7) and where the exhaust flow direction (4) is opposite to the closing direction of the larger throttle area (6a).

Patentansprüche

1. Verfahren zum Steuern einer Auspuffbremse (5) mit einer im Auspuffrohr (3) eines Verbrennungsmotors (1) angeordneten Drosselklappe (6), bei dem die Drosselklappe (6) zwischen einer offenen Stellung und einer geschlossenen Stellung drehbar ist, und bei dem eine von wenigstens einer Betätigungsvorrichtung (9) aufgebrachte Kraft die Drosselklappe in eine geschlossene Stellung drängt, und bei dem auf die Drosselklappe (6) bei Betätigen der Auspuffbremse (5) eine erste Kraft (P_1) wirkt und danach eine zweite Kraft (P_2) wirkt, die kleiner als die erste Kraft (P_1) ist, und bei dem die zweite Kraft (P_2) auf die Drosselklappe (6) während der verbleibenden Zeit wirkt, in der die Drosselklappe (6) in ihrer geschlossenen Stellung ist, dadurch gekennzeichnet, daß die erste bzw. zweite Kraft (P_1, P_2) in Abhängigkeit eines zeitabhängigen Geräts (13,19;22,23) auf die Drosselklappe (6) wirkt.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet,

net, daß die zweite Kraft (P_2) auf die Drosselklappe (6) 1-4 Sekunden nach dem Beginn der Aufbringung der ersten Kraft (P_1) wirkt.

3. Verfahren nach einem der Ansprüche 1-2, dadurch gekennzeichnet, daß sich die auf die Drosselklappe (6) aufgebrachte Kraft aufeinanderfolgend von der ersten Kraft (P_1) in die zweite Kraft (P_2) ändert.
4. Verfahren nach einem der Ansprüche 1-3, dadurch gekennzeichnet, daß die zweite Kraft (P_2) 65-85% der ersten Kraft (P_1) beträgt.
5. Verfahren nach einem der Ansprüche 1-4, dadurch gekennzeichnet, daß die Betätigungsvorrichtung als Antwort auf Signale eines elektronischen Steuergeräts (13) aktiviert wird.
6. Verfahren nach Anspruch 5, bei dem die Drosselklappe (6) an einer in einem Abstand (E) von der Mitte (CC) des Auspuffrohrs angeordneten Welle (7) angebracht ist, die Drosselklappe einen größeren Bereich (6a) und einen kleineren Bereich (6b) umfaßt, die je auf ihrer Seite der Welle (7) angeordnet sind, und bei dem die Abgasstromrichtung (4) der Schließrichtung des größeren Bereichs (6a) der Drosselklappe entgegengesetzt ist, dadurch gekennzeichnet, daß das elektronische Steuergerät (13) von zustandserkennenden Sensoren (15-15^x) Eingangssignale erhält und, als Antwort auf diese Signale, Ausgangssignale an ein Pneumatikventil (11) liefert, das danach einen Betätigungszyylinder (10) mit verdichteter Luft aus einer Druckquelle (12) versorgt, wobei der Druckpegel von den genannten Ausgangssignalen abhängt, und wobei eine im Betätigungszyylinder (10) angeordnete Zugstange, vorzugsweise über einen Hebel (17), mit einer zum obengenannten Druckpegel proportionalen Kraft auf die Drosselklappe (6) wirkt.
7. Verfahren nach Anspruch 5 oder 6, dadurch gekennzeichnet, daß das elektronische Steuergerät (13) von zustandserkennenden Sensoren (15-15^x) Eingangssignale erhält, die ein Kaltstarten anzeigen, daß das Steuergerät (13) an die Betätigungsvorrichtung (9) Signale abgibt, um auf die Drosselklappe eine dritte Kraft aufzubringen, die erheblich kleiner als die erste Kraft (P_1) ist, und daß das Aufbringen dieser dritten Kraft anhält, bis ein vorbestimmter Wert eines vorbestimmten Parameters erreicht ist.
8. Anordnung für eine Auspuffbremse (5) mit einer an einen pneumatischen Betätigungszyylinder (10) angeschlossenen Drosselklappe (6), die in einem Auspuffrohr (3) eines Verbrennungsmotors (1) angeordnet ist, bei der die Drosselklappe (6) zwischen einer offenen Stellung und einer geschlossenen

Stellung drehbar ist, und die Aufbringung einer Kraft des pneumatischen Betätigungszyinders (10) die Drosselklappe in eine geschlossene Stellung drängt, bei der der Betätigungszyinder (10) durch eine Verbindung (18;21,37) an eine Druckquelle (12) und wenigstens eine Steuervorrichtung (11; 22-26) angeschlossen ist, die ihrerseits mit einem Steuergerät (13) verbunden ist, das mit zustands-erkennenden Sensoren (15-15^x) verbunden ist, von denen das Steuergerät (13) Eingangssignale zu empfangen vermag, die Steuervorrichtung (11; 22-26) eine an der Verbindung (18;21,37) angeordnete Ventilanordnung (11;22-26) umfaßt und mit wenigstens einem zeitabhängigen Gerät (19;22,23) verbunden ist und als Antwort auf Eingangssignale des Steuergeräts (13) und des zeitabhängigen Geräts (19;22,23) die auf die Drosselklappe aufgebraachte Kraft zu steuern vermag, dadurch gekennzeichnet, daß die Ventilanordnung ein an die Verbindung (18) zwischen der Druckquelle (12) und dem Betätigungszyinder (10) angeschlossenes Ventil (11) umfaßt, daß das Ventil Mittel zum Unterdrücken des Betätigungszyinders (10) mit wenigstens zwei wählbaren Druckpegeln zwischen dem Druck der Druckquelle (12) und Atmosphärendruck umfaßt, und daß das Ventil vorzugsweise ein Proportionalventil ist, daß durch das Steuergerät (13) mittels eines im Steuergerät (13) enthaltenen Stromreglers (29) stromgesteuert ist.

9. Anordnung nach Anspruch 8, dadurch gekennzeichnet, daß die Drosselklappe (6) der Auspuffbremse an einer in einem Abstand (E) von der Mitte (CC) des Auspuffrohrs angeordneten Welle (7) angebracht ist, die Drosselklappe einen größeren Bereich (6a) und einen kleineren Bereich (6b) umfaßt, die je an ihrer Seite der Spindel (7) liegen, und bei der die Abgasstromrichtung (4) der Schließrichtung des größeren Bereichs (6a) der Drosselklappe entgegengesetzt ist.

Revendications

1. Procédé pour commander un frein moteur (5) comprenant un clapet d'étranglement (6) disposé dans le tuyau d'échappement (3) d'un moteur à combustion (1), le clapet d'étranglement (6) pouvant être déplacé par pivotement entre une position ouverte et une position fermée et une force exercée par au moins un dispositif d'actionnement (9) sollicitant le clapet d'étranglement vers une position fermée, procédé selon lequel, lors de la mise en action du frein moteur (5), on fait agir, sur le clapet d'étranglement (6), une première force (P₁) et, ensuite, une deuxième force (P₂), qui est plus faible que la première force (P₁), et selon lequel on fait agir la deuxième force (P₂) sur le clapet d'étranglement (6)

pendant le temps qui reste jusqu'à ce que le clapet d'étranglement (6) soit dans sa position fermée, caractérisé en ce que chacune des première et deuxième forces (P₁, P₂) agit sur le clapet d'étranglement (6) sous la dépendance d'un dispositif agissant en fonction du temps (13, 19; 22, 23).

2. Procédé selon la revendication 1, caractérisé en ce que la deuxième force (P₂) agit sur le clapet d'étranglement (6) 1 à 4 secondes après le début de l'application de la première force (P₁).
3. Procédé selon l'une quelconque des revendications 1 et 2, caractérisé en ce que la force appliquée au clapet d'étranglement (6) passe successivement de la première valeur de force (P₁) à la deuxième (P₂).
4. Procédé selon l'une quelconque des revendications 1 à 3, caractérisé en ce que la deuxième force (P₂) représente de 65 à 85% de la première force (P₁).
5. Procédé selon l'une quelconque des revendications 1 à 4, caractérisé en ce que le dispositif d'actionnement est activé en réponse à des signaux provenant d'une unité de commande électronique (13).
6. Procédé selon la revendication 5, selon lequel le clapet d'étranglement (6) est monté sur un axe (7) disposé à une certaine distance (E) du centre (CC) du tuyau d'échappement, le clapet d'étranglement comportant une partie de grande surface (6a) et une partie de plus petite surface (6b) chacune située sur un côté respectif de l'axe (7), et selon lequel le sens de circulation (4) des gaz d'échappement est opposé au sens de fermeture de la partie de grande surface (6a) du clapet d'étranglement, caractérisé en ce que l'unité de commande électronique (13) reçoit des signaux d'entrée provenant de capteurs de détection d'état (15 à 15^x) et, en réponse à ces signaux, délivre des signaux de sortie à une soupape pneumatique (11), qui assure ensuite l'alimentation d'un vérin d'actionnement (10) en air comprimé depuis une source de pression (12), le niveau de pression étant fonction desdits signaux de sortie et une tige de traction, disposée dans le vérin d'actionnement (10), agissant sur le clapet d'étranglement (6), de préférence par l'intermédiaire d'un levier (17), avec une force proportionnelle audit niveau de pression.
7. Procédé selon l'une ou l'autre des revendications 5 et 6, caractérisé en ce que l'unité de commande électronique (13) reçoit des signaux d'entrée provenant de capteurs de détection d'état (15 à 15^x) qui indiquent un démarrage à froid, en ce que l'unité de commande (13) fournit des signaux au dispositif d'actionnement (9) pour qu'il applique, au clapet d'étranglement, une troisième force, qui est très

nettement plus faible que la première force (P_1), et en ce que l'application de cette force se poursuit jusqu'à ce qu'une valeur prédéterminée d'un paramètre prédéterminé soit atteinte.

5

8. Structure pour la réalisation d'un frein moteur (5) comprenant un clapet d'étranglement (6) relié à un vérin d'actionnement pneumatique (10), lequel clapet d'étranglement (6) est disposé dans un tuyau d'échappement (3) d'un moteur à combustion (1), le clapet d'étranglement (6) pouvant être déplacé par pivotement entre une position ouverte et une position fermée et l'application d'une force par le vérin d'actionnement pneumatique (10) sollicitant le clapet d'étranglement vers une position fermée, structure dans laquelle le vérin d'actionnement (10) est raccordé à une source de pression (12), au travers d'un élément de raccordement (18; 21, 37), et est raccordé à au moins un dispositif de commande (11; 22 à 26) qui, à son tour, est relié à une unité de commande (13) reliée à des capteurs de détection d'état (15 à 15*) à partir desquels l'unité de commande (13) est destinée à recevoir des signaux d'entrée, le dispositif de commande (11, 22 à 26) est constitué par un système de soupapes (11, 22 à 26) disposé sur l'élément de raccordement (18; 21, 37) et est relié à au moins un dispositif agissant en fonction du temps (19; 22, 23), le dispositif de commande (11; 22 à 26) étant conçu pour commander la force appliquée au clapet d'étranglement en réponse à des signaux d'entrée provenant de l'unité de commande (13) et du dispositif agissant en fonction du temps (19; 22, 23), caractérisée en ce que le système de soupapes comprend une soupape (11) montée sur l'élément de raccordement (18) entre la source de pression (12) et le vérin d'actionnement (10), en ce que la soupape comprend des moyens pour alimenter en pression le vérin d'actionnement (10), avec au moins deux niveaux de pression sélectionnables entre la pression de la source de pression (12) et la pression atmosphérique, et en ce que la soupape est, de préférence, une soupape à action proportionnelle, qui est commandée en courant par l'unité de commande (13) au moyen d'un régulateur de courant (29) intégré dans l'unité de commande (13).

9. Structure selon la revendication 8, caractérisée en ce que le clapet d'étranglement (6) du frein moteur est monté sur un axe (7) disposé à une certaine distance (E) du centre (CC) du tuyau d'échappement, le clapet d'étranglement comportant une partie de grande surface (6a) et une partie de plus petite surface (6b) chacune située sur un côté respectif de l'axe (7), le sens de circulation (4) des gaz d'échappement étant opposé au sens de fermeture de la partie de grande surface (6a) du clapet d'étranglement.

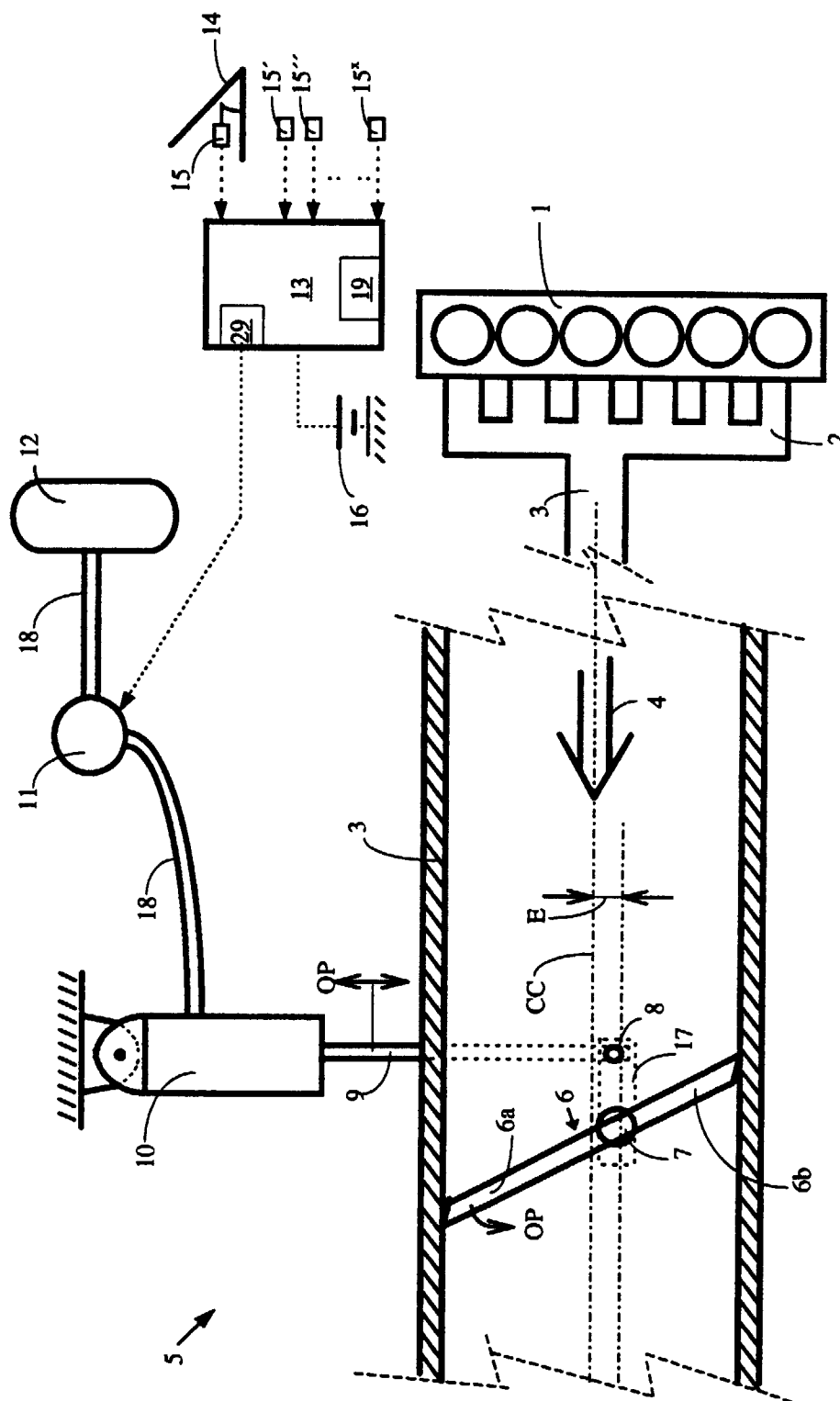


FIG.1

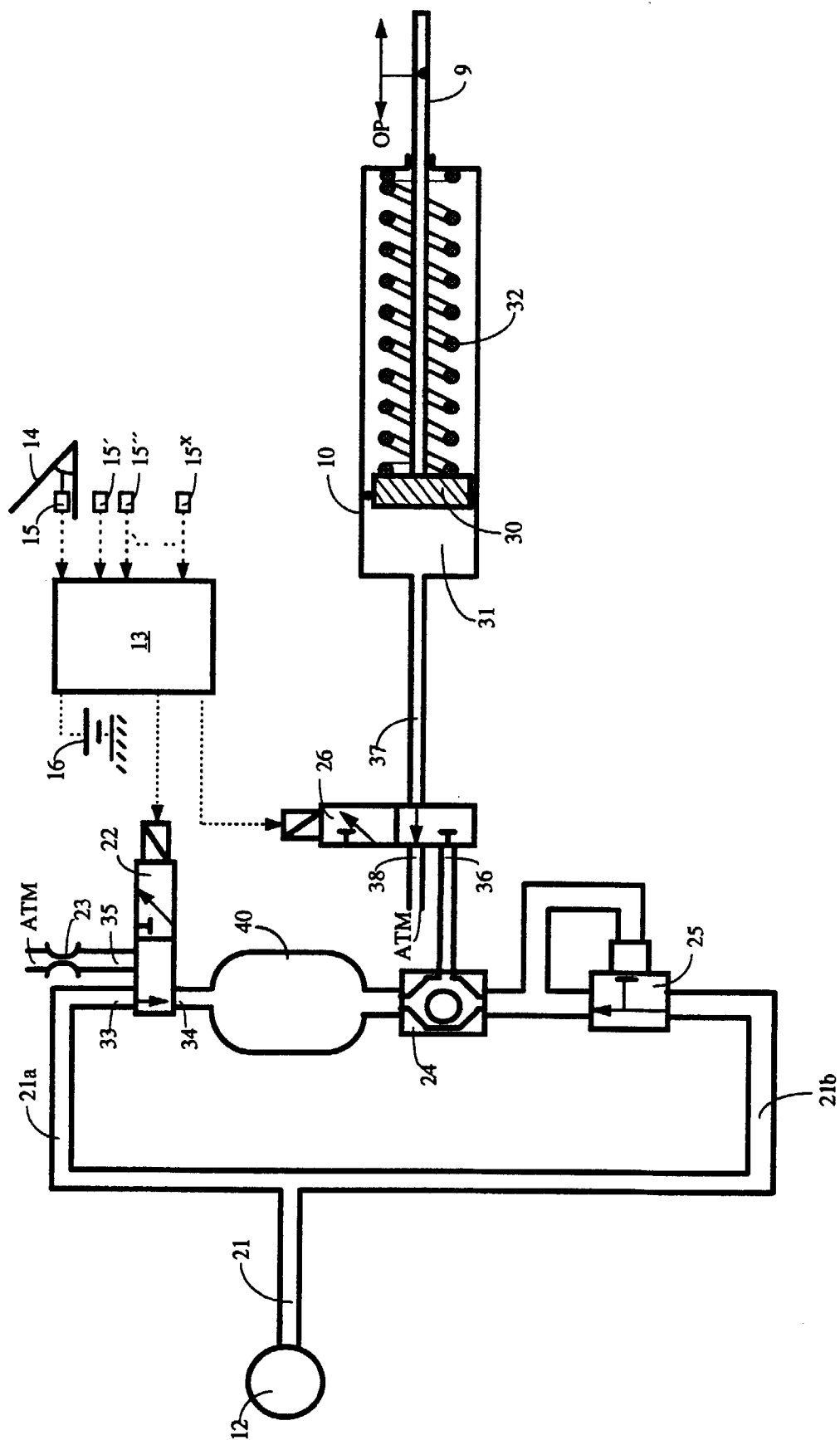


FIG.2

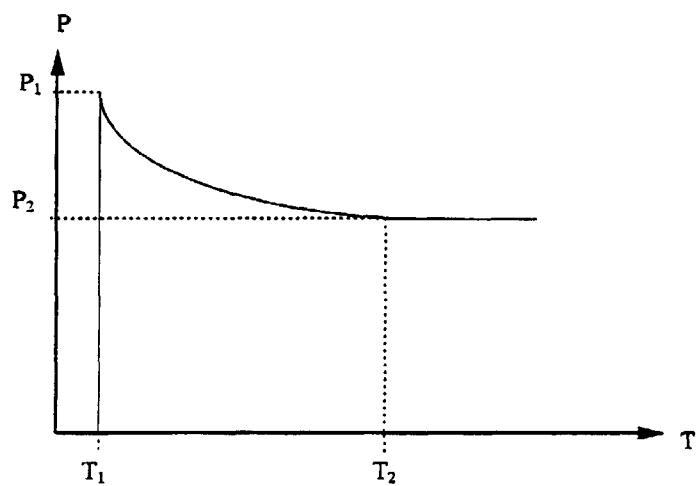


FIG.3

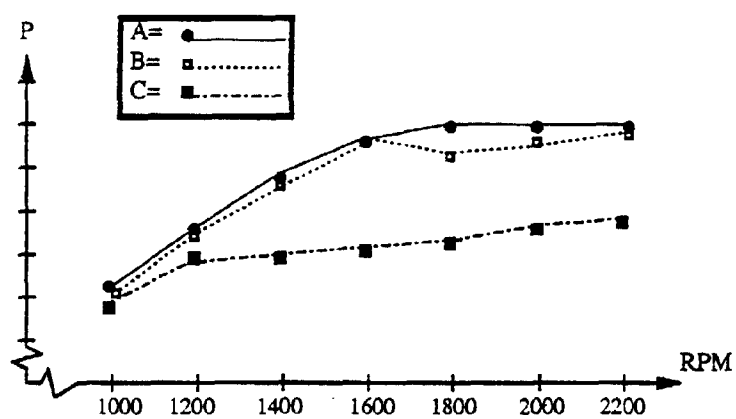


FIG.4

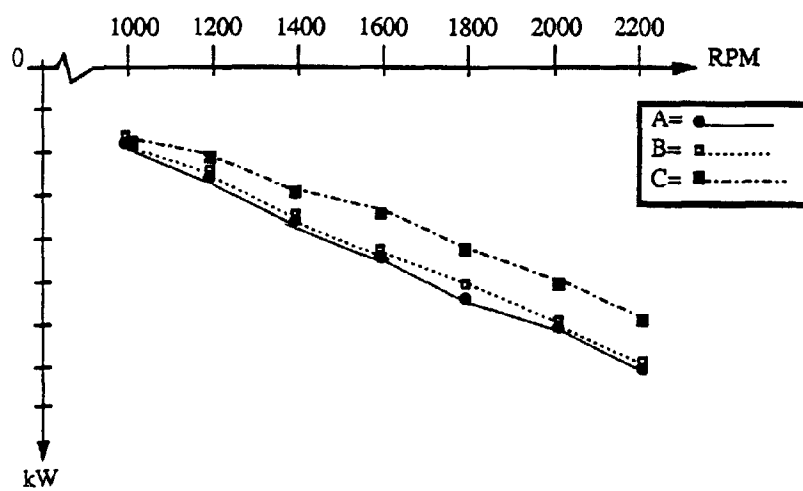


FIG.5