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(54) KINETIC ENERGY CONSUMER MODE CONTROL

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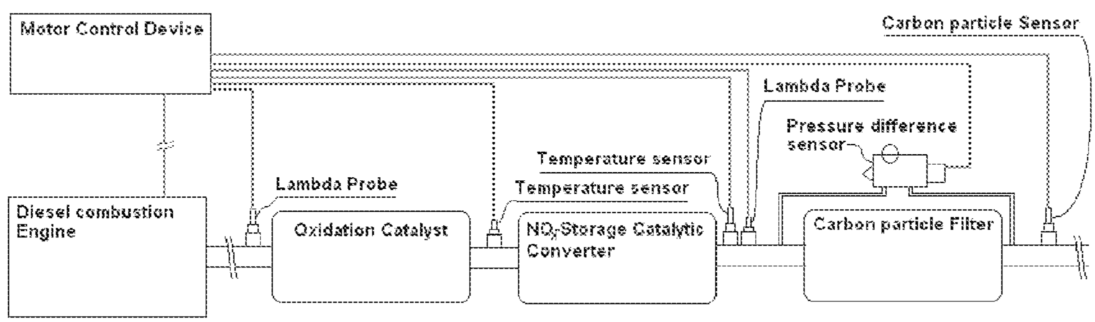
(57) **ABSTRACT**

A system for providing a set point increase for a vehicle combustion engine includes a control that is operable to control vehicle secondary systems to control the power consumption of the vehicle secondary systems to increase a mechanical load to the vehicle combustion engine. The load increase of the combustion engine may be for increasing the lost heat, which enhances the filtering of exhaust gases of the vehicle combustion engine. The lost heat may be utilized to increase the heat of a carbon particle filter, through which exhaust gases flow.



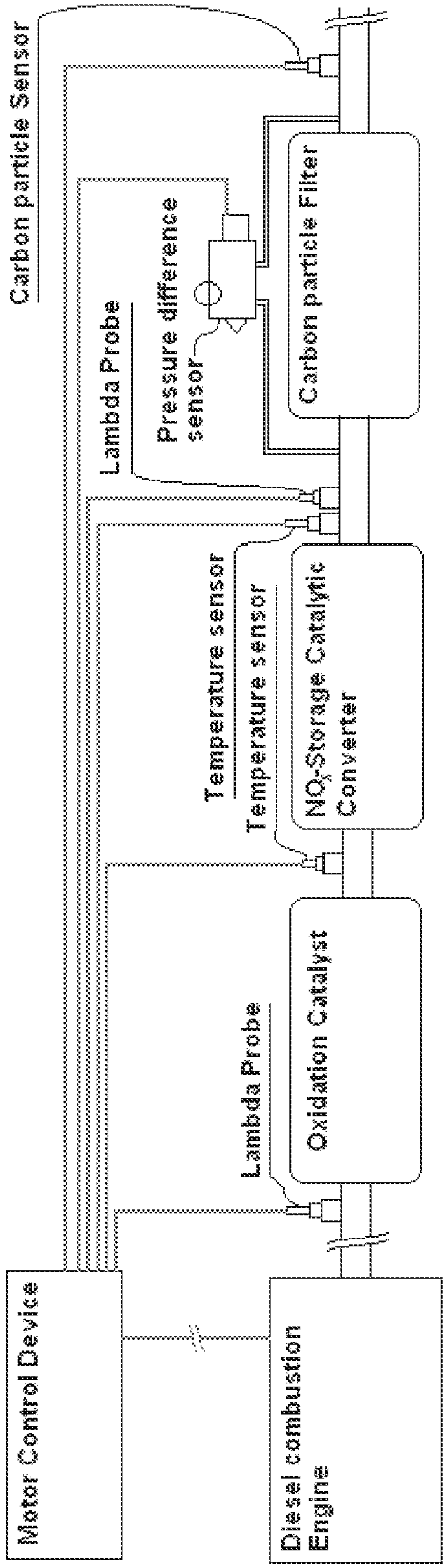

Carbon particle Sensor
Pressure difference sensor
Carbon particle Filter
Lambda Probe
Temperature sensor
Temperature sensor
NOx-Storage Catalytic Converter
Oxidation Catalyst
Lambda Probe
Motor Control Device
Diesel combustion Engine

FIG. 1

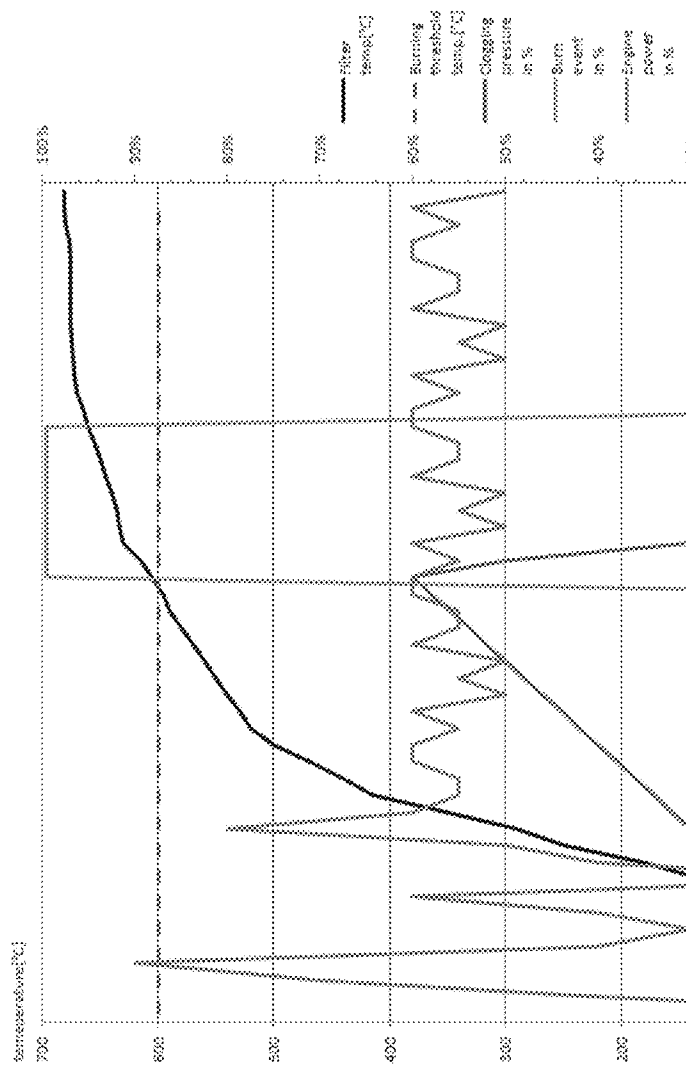


FIG. 2A

Sample time [min]	Clogging pressure in %	Filter temp. [°C]	Burning threshold temp.[°C]	Burn event in %	Engine power in %
0	10	-10	600	0	0
1	10	-10	600	0	40
2	12	-2	600	0	70
3	14	8	600	0	90
4	16	16	600	0	40
5	18	30	600	0	30
6	20	60	600	0	40
7	22	90	600	0	60
8	24	130	600	0	10
9	26	180	600	0	40
10	28	250	600	0	50
11	30	290	600	0	80
12	32	350	600	0	60
13	34	415	600	0	55
14	36	440	600	0	55
15	38	470	600	0	60
16	40	500	600	0	60
17	42	520	600	0	55
18	44	530	600	0	60
19	46	540	600	0	50
20	48	550	600	0	55
21	50	560	600	0	50
22	52	570	600	0	60
23	54	580	600	0	55
24	56	590	600	0	55
25	58	595	600	0	60
26	60	605	600	100	60
27	50	615	600	100	55
28	30	630	600	100	60
29	20	633	600	100	50
30	15	635	600	100	55
31	10	640	600	100	50
32	7	645	600	100	60
33	5	650	600	100	55
34	3	655	600	100	55
35	1	660	600	100	60
36	0	665	600	0	60
37	2	670	600	0	55
38	4	672	600	0	60
39	6	673	600	0	50
40	8	674	600	0	55
41	9	675	600	0	50
42	11	676	600	0	60
43	13	676	600	0	55
44	15	676	600	0	55
45	17	676	600	0	60
46	19	677	600	0	60
47	20	680	600	0	55
48	23	681	600	0	60
49	24	681	600	0	50

FIG. 2B

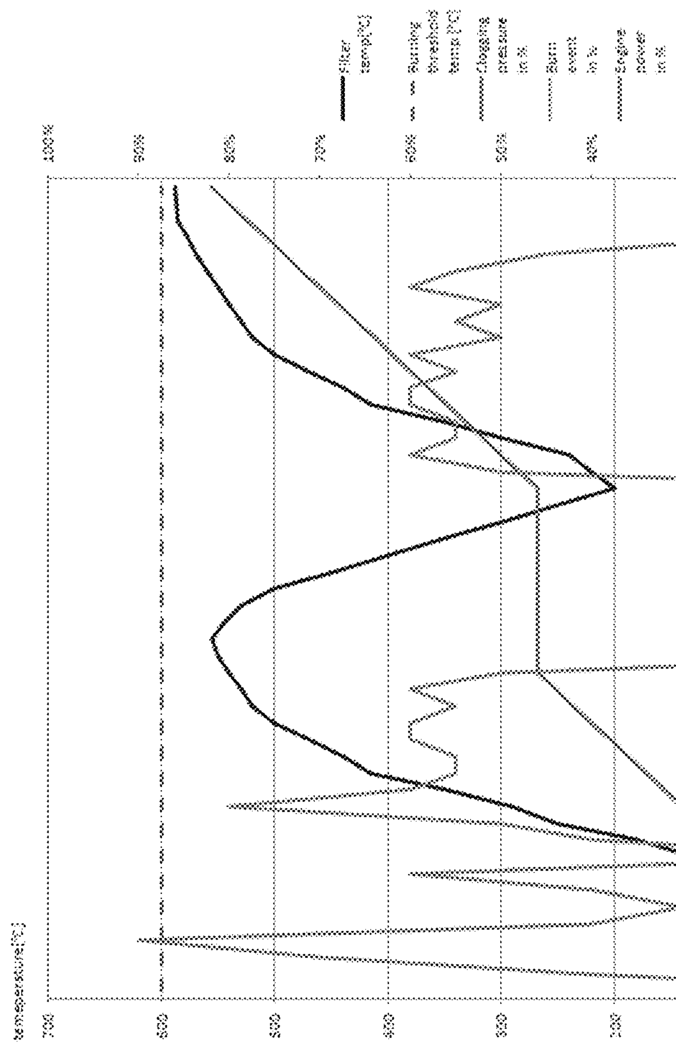


FIG. 3A

Sample time [min]	clogging pressure in %	Filter temp. [°C]	Burning threshold temp.[°C]	Burn event in %	Engine power in %
0	10	-10	600	0	0
1	10	-10	600	0	40
2	12	-2	600	0	70
3	14	8	600	0	90
4	16	16	600	0	40
5	18	30	600	0	30
6	20	60	600	0	40
7	22	90	600	0	60
8	24	130	600	0	10
9	26	180	600	0	40
10	28	250	600	0	50
11	30	290	600	0	80
12	32	350	600	0	60
13	34	415	600	0	55
14	36	440	600	0	55
15	38	470	600	0	60
16	40	500	600	0	60
17	42	520	600	0	55
18	44	530	600	0	60
19	46	540	600	0	50
20	46	550	600	0	0
21	46	555	600	0	0
22	46	545	600	0	0
23	46	530	600	0	0
24	46	500	600	0	0
25	46	450	600	0	0
26	46	400	600	0	0
27	46	350	600	0	0
28	46	300	600	0	0
29	46	250	600	0	0
30	46	200	600	0	0
31	48	220	600	0	50
32	50	240	600	0	60
33	52	300	600	0	55
34	54	350	600	0	55
35	56	415	600	0	60
36	58	440	600	0	60
37	60	470	600	0	55
38	62	500	600	0	60
39	64	520	600	0	50
40	66	530	600	0	55
41	68	540	600	0	50
42	70	550	600	0	60
43	72	560	600	0	55
44	74	570	600	0	55
45	76	577	600	0	60
46	78	586	600	0	60
47	80	587	600	0	55
48	82	588	600	0	60
49	84	587	600	0	50

FIG. 3B

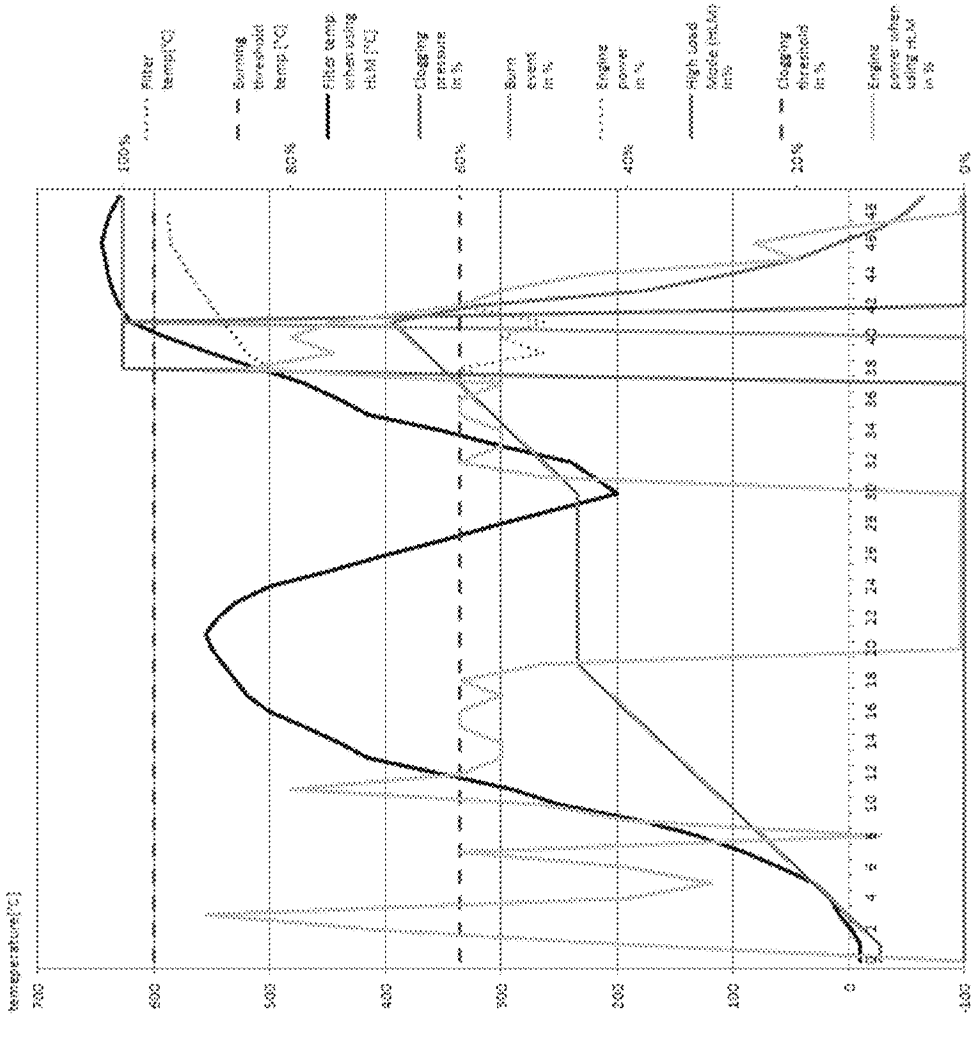


FIG. 4A

Sample time [min]	Clogging pressure in %	Clogging threshold in %	Filter temp [°C]	Filter temp. when using HLM [°C]	Burning threshold temp.[°C]	Burn event in %	High Load Mode (HLM) in%	Engine power in %	Engine power when using HLM in %
0	10	60	-40	-40	600	0	0	0	0
1	10	60	-10	-10	600	0	0	40	40
2	12	60	-2	-2	600	0	0	70	70
3	14	60	8	8	600	0	0	90	90
4	16	60	16	16	600	0	0	40	40
5	18	60	30	30	600	0	0	30	30
6	20	60	60	60	600	0	0	40	40
7	22	60	90	90	600	0	0	60	60
8	24	60	130	130	600	0	0	10	10
9	26	60	180	180	600	0	0	40	40
10	28	60	250	250	600	0	0	50	50
11	30	60	290	290	600	0	0	80	80
12	32	60	350	350	600	0	0	60	60
13	34	60	415	415	600	0	0	55	55
14	36	60	480	480	600	0	0	55	55
15	38	60	470	470	600	0	0	60	60
16	40	60	500	500	600	0	0	60	60
17	42	60	520	520	600	0	0	55	55
18	44	60	530	530	600	0	0	60	60
19	46	60	540	540	600	0	0	50	50
20	46	60	550	550	600	0	0	0	0
21	46	60	555	555	600	0	0	0	0
22	46	60	545	545	600	0	0	0	0
23	46	60	530	530	600	0	0	0	0
24	46	60	500	500	600	0	0	0	0
25	46	60	450	450	600	0	0	0	0
26	46	60	400	400	600	0	0	0	0
27	46	60	350	350	600	0	0	0	0
28	46	60	300	300	600	0	0	0	0
29	46	60	250	250	600	0	0	0	0
30	46	60	200	200	600	0	0	0	0
31	48	60	220	220	600	0	0	50	50
32	50	60	280	280	600	0	0	60	60
33	52	60	300	300	600	0	0	55	55
34	54	60	380	380	600	0	0	55	55
35	56	60	415	415	600	0	0	60	60
36	58	60	440	440	600	0	0	60	60
37	60 A	60 B	470	470	600	0	C 0	55	55
38	62	60	500 —E→	518	600	0	100	60 —D→	85
39	64	60	520 —E→	550	600	0	100	60 —D→	75
40	66	60	530 —E→	580	600	0	100	55 —D→	80
41	68	60	540 —E→	625 E	F 600	G 100	100	50 —D→	75
42	58	60	550	630	600	100	H 0	60	60
43	38	60	563	635	600	100	0	55	55
44	28	60	575	640	600	100	0	45	45
45	20 I	60	577	642	600	100	0	20	20
46	15	60	584	645	600	100	0	25	25
47	10	60	587	642	600	100	0	15	15
48	7	60	588	638	600	100	0	0	0
49	5	60	587	630	600	100	0	0	0

As soon the clogging A exceeds the clogging threshold B, the HLB engagesC.
By that the engine output D becomes elevated by 25%
The filter temperature E increases faster by that.
As soon the filter temperature E exceeds its threshold F,
a filter burn starts G.
The HLB disengages H
The clogging pressure decreases I

FIG. 4B

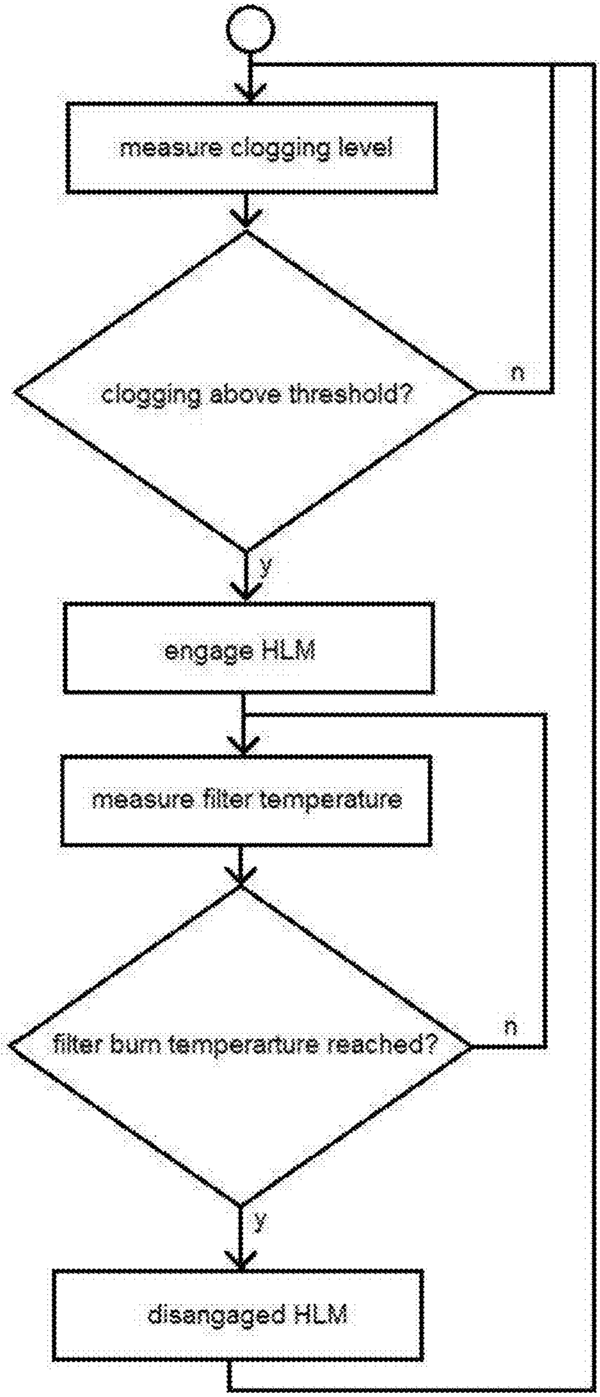

measure clogging level
clogging above threshold?
n
y
engage HLM
measure filter temperature
filter burn temperarture reached?
n
y
disangaged HLM

FIG. 5

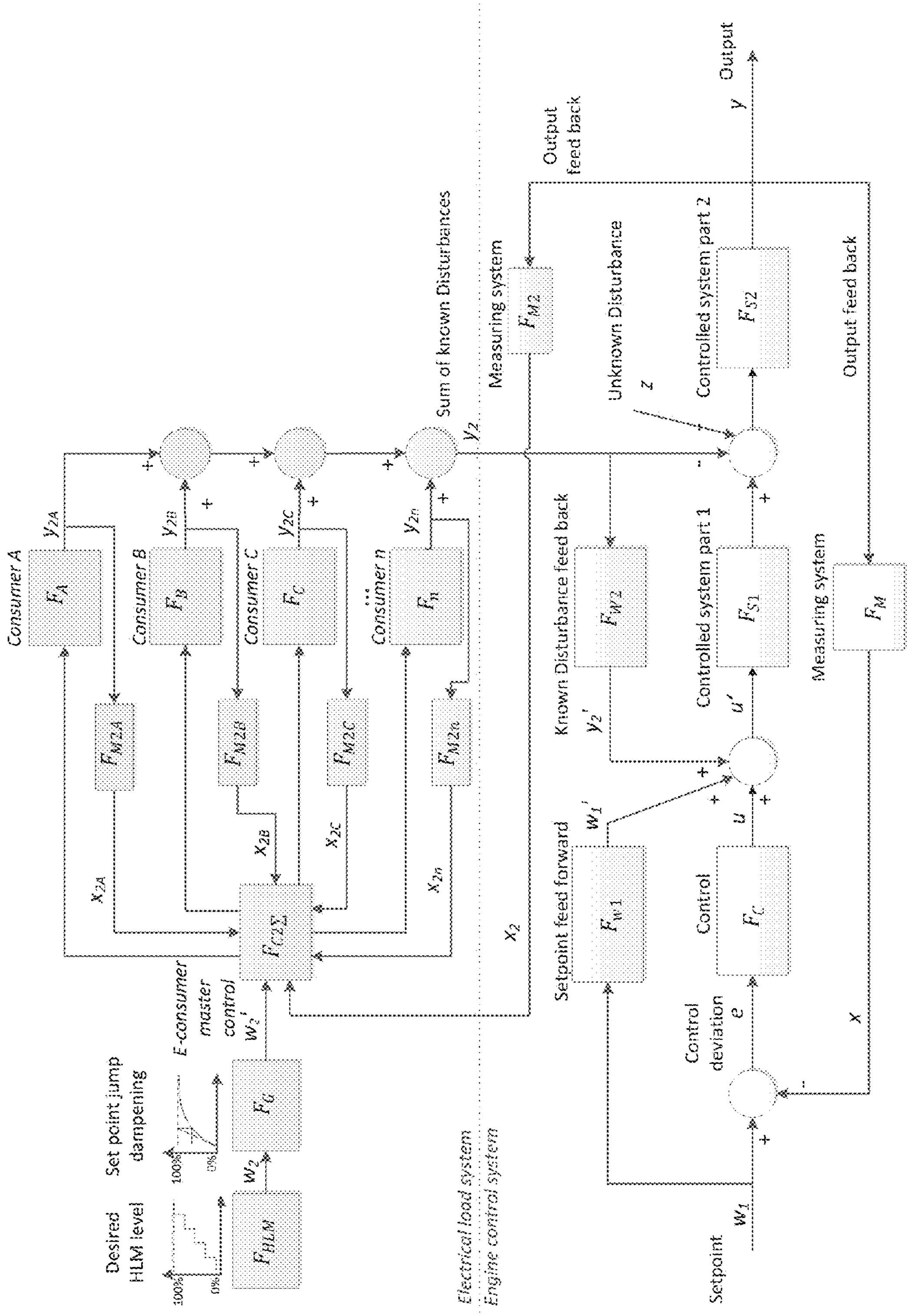

Desired HLM level
Set point jump dampening
E-consumer master control
Consumer A
Consumer B
Consumer C
Consumer n
Sum of known Disturbances
Measuring system
Output feed back
Output
Unknown Disturbance
Controlled system part 2
Known Disturbance feed back
Controlled system part 1
Measuring system
Output feed back
Setpoint feed forward
Control
Control deviation
Setpoint
Electrical load system
Engine control system

FIG. 6

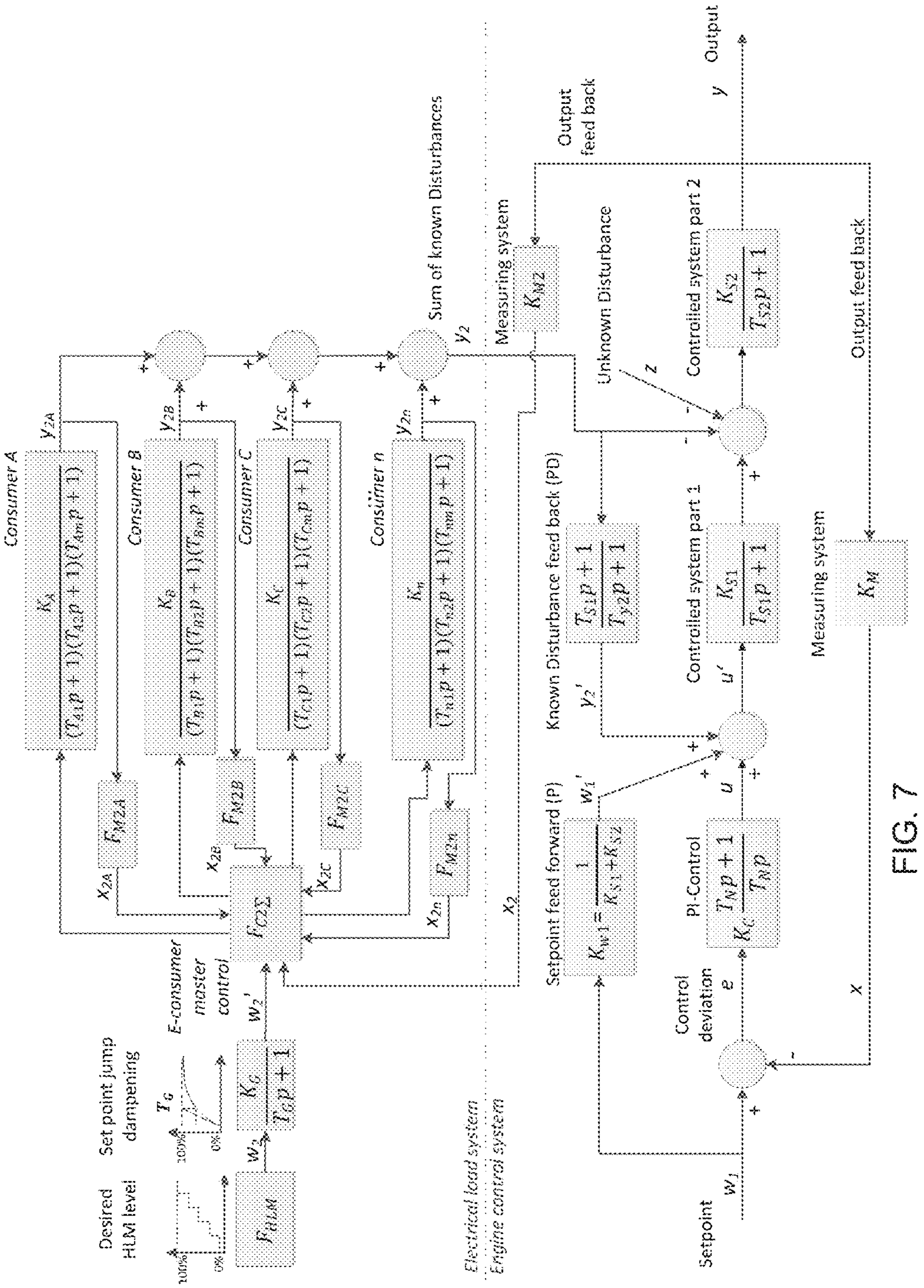

Desired HLM level
Set point jump dampening
E-consumer master control
Consumer A
Consumer B
Consumer C
Consumer n
Sum of known Disturbances
Measuring system
Output feed back
Electrical load system
Engine control system
Setpoint
Control deviation
PI-Control
Setpoint feed forward (P)
Known Disturbance feed back (PD)
Controlled system part 1
Unknown Disturbance
Controlled system part 2
Output

FIG. 7

KINETIC ENERGY CONSUMER MODE CONTROL

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the filing benefits of U.S. provisional applications, Ser. No. 61/837,369, filed Jun. 20, 2013; Ser. No. 61/793,558, filed Mar. 15, 2013; and Ser. No. 61/673,010, filed Jul. 18, 2012, which are hereby incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

[0002] The present invention relates to power controls for vehicles and, more particularly, to a power for a diesel powered vehicle.

BACKGROUND OF THE INVENTION

[0003] It is common to use diesel combustion engines in various types of vehicles.

[0004] Presently, there is the desire to reduce the amount of carbon particles which come with the diesel exhaust when the diesel fuel is not entirely burned. Typically, the amount of carbon particles is engine load and engine RPM dependent. The fuel quality typically also has an influence, especially the sulfur percentage. Diesel engines are often already optimized to boost the entire burning of the diesel fuel by burning room design of the pistons and barrel heads. Nevertheless, there is often an amount of carbon particles in the exhaust which are coped with by additional means. Typically, there are carbon particle filters in use. The filter systems often employ several stages for archiving chemical modifications to the exhaust gases. The filters may also serve to reduce other undesired chemicals or to alter these to harmless chemical fumes. Solid remainings are undesired but may occur in these filter systems.

[0005] Two main classes of diesel carbon particle filter systems are in common use: deep bed filtering ("DBF"), which works by the principal of CRT (Continuously Regeneration Trap), and Wall-Flow ("WF") principal. On WF the gases have to pass a porous material in which pores of carbon particles get stuck until becoming burned to a gas. A common material for these particle filters is silicium carbide. The main aspects are that the DBF does not add such high back pressure over run time of the filter of the WF type, but the efficiency of WF is typically greater. Since the WF is more complicated, it mostly becomes installed by OEMs during assembly, while DBF is a good choice for after market assembly. Especially on WF, the back pressure is caused by the particles choking the pores.

[0006] The burning of the particles (filter regeneration) can only take place when a certain temperature is given or certain chemical gases are increasingly present. Typically, the temperature, the presence of carbon particles accumulated in the filter and the presence of carbon burning gases act substitutional. When NO_2 is present the carbon burning starts at lower temperatures such as around 250 degrees C. The burning produces NO and CO mainly and CO_2 in parts. When using higher temperatures, O_2 burning takes place. There the carbon burns to CO and CO_2. NO, CO and CO_2 are all gases which can pass the pores of the filters. Typically, the burning is controlled by the motor control system, which is supervising the exhaust gases by several temperature and lambda sensors and the pressure loss over the carbon particle filter.

[0007] FIG. **1** shows an exemplary known system. The example is showing an NO_x storage catalytic converter which mainly produces NO_2 out of NO_x (by catalytic oxidation) for enabling the filter regeneration on (comparably) low temperatures by NO_2 reduction as referred above. In storage catalytic converters, the NO_2 becomes stored over time until a state is given (such as a threshold engine RPM and/or exhaust gas composition and/or temperature) in which the filter reduction is advantaged. In different solutions, fuel additives may come into use which change the composition of the exhaust gases in a way that carbon particle filter reduction is enhanced. These are reducing the carbon particles within the filter in a consistent manner. Other solutions add additive chemicals like Urea (CH_4N_2O) together with water to the exhaust gases behind oxidation catalysts and before the carbon particle filter as an aerosol to the exhaust stream for reducing the filter regeneration temperature (from about 650 degrees C. to about 450 degrees C.). Again others inject fuel into the exhaust way to increase the exhaust heat. Also, others have electrical heating elements within the exhaust path or at or in the carbon filter itself.

SUMMARY OF THE INVENTION

[0008] The present invention provides a system that utilizes and controls vehicle inherent secondary systems to increase the mechanical load to the combustion engine for increasing the lost heat.

[0009] The system of the present invention thus may enhance filtering of exhaust gases of a vehicle combustion engine, such as via a control that is operable to utilize and control vehicle inherent secondary systems to increase a mechanical load to the combustion engine for increasing the lost heat.

[0010] Optionally, the lost heat may be mainly released to the exhaust gases, and/or the lost heat may be utilized to increase the heat of a carbon particle filter, and/or exhaust gases may flow through a carbon particle filter, which may be heated to its functional temperature, such as a temperature that is between about 250 degrees C. and about 800 degrees C.

[0011] The system may function in operation modes so that the inherent secondary systems are controlled in a manner/mode that it is substantially not perceptible to the vehicle occupants and/or bystanders.

[0012] The combustion engine may be controlled in a manner such that emitted torque is increased by the same amount as the torque discharged by the utilized or activated secondary systems. The secondary systems may be controlled in the operation manner/mode to maximize electrical power consumption, and/or to maximize mechanical discharged torque from the vehicle drivetrain. The secondary systems may be supervised by a master control to control the combined torque consumption and to prevent the secondary systems from damaging due to overload.

[0013] The secondary systems may comprise electrical switched or commuted current driver stages and driver controls and relays switched consumer or alternator (or commutator) driven actuators. The electrical commuted current driver stages may be controlled in opposite directions in short time durations so that the resulting force or momentum is near zero over time. The electrical commuted current driver stages may be controlled in a short cut mode.

[0014] These and other objects, advantages, purposes and features of the present invention will become apparent upon review of the following specification in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. **1** is a schematic of a known prior art system;

[0016] FIG. **2**A shows a chart of parameters of a diesel engine of a vehicle and its carbon particle filter, wherein the vehicle has no ejection stroke diesel injection system or additive injection system, and with a driving cycle without driving pause shown;

[0017] FIG. **2**B is a table according to the chart in FIG. **2**A;

[0018] FIG. **3**A shows a chart of similar vehicle as such in FIG. **2**A, with a driving cycle having driving pause shown;

[0019] FIG. **3**B is a table according to the chart in FIG. **3**A;

[0020] FIG. **4**A shows similar charts as in FIGS. **2**A and **3**A, with the vehicle equipped with a control for controlling a High Load Mode (HLM) according to the present invention;

[0021] FIG. **4**B is a table according to the chart in FIG. **4**A;

[0022] FIG. **5** is a flow chart of the general logic of engaging and disengaging conditions for the HLM;

[0023] FIG. **6** shows a loop control of the engine output torque with feed forward control and load compensating rearward path according the invention, and also shown is a master control for a switchable or tunable electrical consumer which adds dedicated load to the engine, with the transfer functions shown generally; and

[0024] FIG. **7** shows a specific example of the engine torque loop control and electrical load system of FIG. **6**, with specific transfer functions inserted.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] Engines, and in particular automotive diesel engines, produce as immediate exhaust a mixture of hot gases and solid particles, particularly solid carbon particles and the like. Passage of such particles out through a vehicle exhaust system is undesirable for a variety of environmental and health reasons. Thus, it is conventional to incorporate a particle filter or particle filtering means into a diesel vehicle exhaust system. The particle filter or screen functions to capture the particles so as to stop them from being exhausted out through the vehicle tail pipe. Of course, over a period of time (such as, for example, days or so), the particle filter or screen will begin to fill up or clog. Naturally, unless intervening means are provided, the screen or filter will become permanently clogged and cease to be useful. However, as the particle filter begins to fill up so as to be clogged with particles, the passage of gases therethrough is progressively impeded and thus a back pressure develops that impacts the operation/efficiency of the engine itself, leading to an increase in temperature of the exhaust gases up to a point that the exhaust gases can reach a temperature sufficient to burn off and thus de-clog the filter or screen.

[0026] During this period, however, the engine is not operating most efficiently and so automakers desire to have this out-of-normal operation mode be minimized. For example, automakers conventionally utilize catalytic materials/convertors in the formation/structure of the screen or filter so as to reduce the temperature at which the clogged material, such as carbon, can burn off to be converted to gas that can then exhaust through the tailpipe. Others, particularly in the after market, may spray the likes of additives and/or diesel fuel itself into the exhaust system between the engine and the clogged filter to enhance and accelerate burn off of clogged material.

[0027] A problem however can arise when the likes of city driving means that there can be a relatively short period between two sequential ignition cycles. A screen or filter may be nearly or fully clogged at the end of a particular urban journey. After sitting overnight in the cold during the likes of a winter night, the engine experiences a double inefficiency. Startup of the engine is from cold and the back pressure due to the presence of the clogged filter or screen adds to the inefficiency of the engine itself.

[0028] Thus, it would be desirable for the engine to work harder immediately on startup so that it correspondingly heats up faster and so that its exhaust gases immediately exiting the engine itself rise in temperature faster so as all the faster to get to the burn off temperature of the, for example, carbon particles, stuck at and clogging the screen or filter. Thus, in accordance with the present invention, and on occasions when this clogged filter situation is sensed or detected, electrical systems/accessories/loads of the vehicle are actuated so that they derive power from the engine itself and by so powering, the engine will rapidly heat up or get hot. Plainly, appropriate decisions need be made as to what items to so power. For example, an electrical horn would not be an appropriate item or system, nor would an electrical power window or electrical door lock/unlock be an appropriate system (these would either act unexpectedly or, when driven into a stall direction, disengage after about 0.5 seconds to limit or prevent electrical motor overload). A list of appropriate systems are discussed below.

[0029] Such electrical powered cooling fans typically use an electrical motor. However, to simply electrically actuate and turn on the electrical fan would be counter productive when trying to heat the engine. Thus, in accordance with the present invention, and as described below, the electrical motor of the fan may be powered in a non-synchronous manner such that the vanes or blades of the electrical motor generally stay stationary or at least minimally rotate. By so doing, the electrical motor of the cooling fan (that may be 200-1500 Watts) can help the rapid heat up of the engine in accordance with the present invention. These principles can be applied to any asynchronous motor, and preferably synchronous motor, utilized in the vehicle, such as, for example, a second motor, a pump unit or system, or the like. The accessory/system that is electrically powered during this special mode should not cause concern or bother to the occupant or driver of the vehicle (for example, actuation of an alarm or horn or audible accessory or actuation of a visual accessory that is viewable by the occupant or driver may not be appropriate during this heat up mode). The present invention thus provides a master system for controlling motors or accessories or the like to rapidly heat or increase the temperature of the engine during certain driving conditions to limit filter clogging and the like.

[0030] The overall power consumption of the electrical secondary systems may be in a range of from about 4 kW to about 8 kW or thereabouts for passenger vehicles or cars and from about 10 kW to about 25 kW or thereabouts for larger vehicles or trucks when controlled to maximum load. The maximum electrical load may be higher when using additional (uncommon) consumers such as extra resistors or the like. The consumer may be limited by the maximum power of the vehicles generator. Hybrid motors can produce up to about 200 kW in a generator mode. Typically, the short term (such as about 0.5 minutes to about 3 minutes or thereabouts) peak load of electrical commutated motors/generators may be up to about five times higher than the nominal (long term) load, limited by it's heat capacity and magnetic properties.

[0031] On engines with low NO_x emissions or short range used vehicles, a self-evident method for carbon filter regeneration is to increase the exhaust gas temperature periodically. Often, this may be controlled by the engine control, triggered by an increased pressure loss over the carbon particle filter. It is known to inject and burn additional diesel fuel during the emission stroke. However, this adds to fuel consumption and since the fuel does not burn very efficient (no combustion) the temperature gain to the exhaust is not optimal.

[0032] The system of the present invention provides an enhanced filtering system that is efficient. To simplify the known systems by reducing the components and the complexity and to achieve a higher gain of the exhaust temperature by the additional used up fuel, the present invention or solution is to add the load to the combustion engine and to burn a higher amount of fuel preferably within a minimal period of time to increase the exhaust temperature called High Load Mode (HLM). The benefit will be that the fuel will be burned at a higher efficiency than injecting fuel during the exhaust stroke. Thus, the amount of fuel needed for a carbon particle filter regeneration cycle will be less. Another benefit of the present invention is that the diesel engine does not need to have a special mode for burning fuel during the exhaust phase (such as described in German Patent application DE1020005035168, which is hereby incorporated herein by reference in its entirety), which frees up engine and exhaust design limitations and eases the motor control.

[0033] FIGS. **2**A, **3**A and **4**A show charts and FIGS. **2**B, **3**B and **4**B show tables according to the respective charts of FIGS. **2**A, **3**A and **4**A for exemplary vehicle driving periods, the filter (carbon particle-) clogging accumulation and alleviation of the clogging by burn (oxidation-) events (or periods or cycles). It may be assumed the vehicle would have no past stroke diesel injection system and no additional systems for lowering the filter burning threshold temperature (such as an injection system for additive chemicals or the like). In all examples, a threshold temperature of about 600 degrees C. is assumed at which a burn cycle starts (by itself) until the clogging is fully gone (not reflected in the examples: with an aging system some clogging may remain due to adding non-burnable particles collected from the air, the fuel, motor and exhaust abrasion). It may be assumed that the vehicle is not driven at full power but, for example, about half power such as may occur during a drive through city traffic. Due to this assumption, the "Engine power in %" remains widely in the average of around 55 percent or thereabouts. The assumed rate of clogging (about 1.4 percent/minute) may be somewhat heavier than in real usage situations, but this is more for illustration of the principle. Also, the burning rate during a "burn event" may be different from reality.

[0034] FIGS. **2**A, **2**B show the relevant parameters of a vehicle changing during an unintermittent ride. Due to the normal load to the engine (no High Load Mode) due to city driving {about 55 percent}, the carbon filter temperature increases steadily. The clogging increases as well during that time starting at 10 percent. At the time the filter temperature reaches or exceeds the 600 degrees C. threshold (the "burning threshold temp."), a burn cycle of about ten minutes starts eliminating all clogging pressure (0 percent). During continuous further driving, the clogging starts adding up again. In comparison of FIGS. **2**A, **2**B to FIGS. **3**A, **3**B, a bad case scenario of a vehicle without HLM functionality according the invention is shown.

[0035] Depart from FIGS. **2**A, **2**B in FIGS. **3**A, **3**B there may be an intermittent driving behavior also with about **55** percent average engine load. In this example it is assumed that the driver will stop driving (the engine) after about twenty minutes. At that time the filter temperature may not have reached the burning threshold temperature of 600 degrees C. (but may reach a temperature of about 550 degrees C.). The driver may resume driving after another ten minutes, at that time the filter temperature may have fallen to about 200 degrees C. The clogging may have stayed continuing to adding up by further driving. The vehicle engine may become inoperable at a filter clogging pressure of greater than about 80 percent already before reaching a sufficient filter carbon particle burning temperature (of about 600 degrees C. but just shortly below in this example). This is a fatal scenario which is urgently to be avoided.

[0036] FIGS. **4**A, **4**B show an alternative scenario, showing the same driving (and pause) behavior as the example in FIGS. **3**A, **3**B, but the vehicle may have a high load mode or HLM application according to the present invention installed. In real applications, the HLM may be triggered by a plurality of parameters. In the general HLM engage logic shown in FIG. **5** and in the scenario shown in FIGS. **4**A, **4**B, the triggering parameter may be limited to just one, the clogging pressure. The clogging pressure (HLM triggering-) threshold may be assumingly set to about 60 percent (this may differ from requirements or selections for real application). In the example of FIGS. **4**A, **4**B, the clogging pressure reaches 60 percent after 37 minutes. The engaging of the HLM may assumingly add 25 percent of engine load ("Engine power when using HLM in percent"). The lower assumed engine load without HLM ("Engine power in percent") according the example in FIGS. **3**A, **3**B is shown in dotted lines for comparison. Due to the elevated engine load, it is assumed that the filter temperature may increase in an elevated rate (as desired): The temperature curve ("Filter temp. when using HLM") exceeds the 600 degrees C. threshold after four minutes of HLM. As can be seen with reference to FIG. **4**B, as soon as the clogging pressure percentage exceeds the clogging threshold (see A and B in FIG. **4**B), the HLM engages (see C in FIG. **4**B). By such engagement, the engine output (D) is elevated by about 25 percent or thereabouts and the filter temperature increases faster (see E in FIG. **4**B). As soon as the filter temperature (E(exceeds its burning threshold temperature (see E and F at row 41 of FIG. **4**B), a filter burn starts (see G in FIG. **4**B), and the HLM disengages (H) and the clogging pressure decreases. For comparison, the temperature curve ("Filter temp [degrees C]") out of the example in FIGS. **3**A, **3**B is shown in dotted line. In the scenario of FIGS. **4**A, **4**B, the carbon filter burn event starts early enough to prevent the diesel filter from clogging to high so that the engine maintains being operable.

[0037] The additional load to the engine may be achieved by switching on electrical power consumers. Preferably, these will not become noticed by the driver and will not influence the driving properties of the vehicle. The electromagnetic (back-) force (momentum) of the electrical power generator increases, when the electrical consumption increases. Both powertrain consumers as well as interior and exterior vehicle accessories come into consideration. There may be different power and driving conditions that may limit the choice of consumer systems. Different modes may be necessary to match certain driving conditions.

[0038] For example, the system of the present invention may switch on or control or modulate one or more of the following secondary systems:

- **[0039]** EC (electrical commutated) hydraulic pumps (oil, fuel and the like)
- **[0040]** EC cooling fan(s)
- **[0041]** EC pneumatic pumps (air suspension, turbo chargers, and the like)
- **[0042]** EC actuators (maybe in stall mode)
- **[0043]** EC steering help
- **[0044]** EC engine (starter) glow plugs
- **[0045]** Music amplifier
- **[0046]** Electrical windshield washer water heating
- **[0047]** Electrical mirror defroster heating
- **[0048]** Electrical backlight defroster heating
- **[0049]** Electrical windshield heaters
- **[0050]** Compartment ventilation (blower)
- **[0051]** Air conditioning system
- **[0052]** Electrical seat heating/ventilation/cooling (optionally both at a time)
- **[0053]** Electrical window (with advanced) control
- **[0054]** Electrical door lock actuator (with advanced control)
- **[0055]** Electrical windshield wiper
- **[0056]** ESP system
- **[0057]** ASR system
- **[0058]** Driver Assistant Systems (such as using cameras, radar, LI DAR and/or the like)
- **[0059]** Lighting systems (such as compartment, front and/or back lights)
- **[0060]** Other luxury systems such as an umbrella dryer or refrigerator or the like.

[0061] Additionally, known art electrical powered exhaust gas heating elements or heating elements in or at the carbon filter (such as, for example, resistors or coils or the like) may be switched on as additional electrical load in accordance with the present invention, with the side effect that it's consumed electrical power also adds to the heating of the Diesel filter, and it's heating power may be reflected in the loop control (-model) as well.

[0062] Additionally, systems may be known that are capable to add load to the combustion engine indirectly (or directly). In applications for hybrid vehicles (combustion engine plus electrical engine), the electrical engine may be controlled in a generator mode (known systems may control the generator highest at times when the engine is in a coasting mode (such as, for example, BMW's Efficient Dynamics system or the like), but unlike such systems, the system according to the present invention may work at times when the engine is on at a high load to peak load) or in a short cut mode (if it sustains that). Thus, it consumes mechanical energy from the drivetrain. The same can be done with combined starter generators, where its mechanical consumption is maximized when the maximal electrical generation is controlled.

[0063] Optionally, a more complex system of the present invention may additionally or alternatively use the vehicle's wheel brakes (such as at times when the clutch is closed) to add mechanical load to the combustion engine. In such an application, the brake temperature should be considered in a way that at all times a full brake application is still possible.

[0064] Optionally, a more complex system of the present invention may additionally or alternatively use a fly wheel of the vehicle which may also be capable to consume (or store) mechanical load from the combustion engine, typically in an area of about 20 KW to about 100 KW. The fly wheel may be coupled mechanically or electro-mechanically.

[0065] In order to not unsettle the driver, it is preferred that in all cases above and in any combinations thereof, the combustion engine is controlled in a way to balance the higher torque the vehicle's own systems consume in a way that the torque output to the vehicle's wheels is identical or substantially identical, so that, when the load is applied, it is not readily discernible to the driver of the vehicle so that it is as is no additional load has been switched on.

[0066] In FIG. **6**, such a (HLM-) control is laid out in full extension. When the HLM is inactive, w_2 may be zero percent and by that y_2 may be zero. That means the motor runs generally normal (non HLM mode or no HLM installed; F_{W1}, F_{W2} may have some beneficial influence to the setpoint response). This signal path layout is optimized for the accurate set point w_1 following. The set point signal w_1 may be the throttle (in degree, percentage or unitless) of the vehicle's accelerator or gas pedal. The 'controlled system part **1**' may be the transfer function (or relation in case of a discontinuous function or delay) F_{S1} of the Diesel combustion engine system behavior (which may include the turbo speed as longest system time constant). 'Controlled system part **2**' may be the transfer function (or relation in case of a discontinuous function or delay) F_{S2} of the accelerating masses (inertia of the drivetrain). Unknown influences 'unknown Disturbances' z may comprise multiple factors which may decrease (or more seldom increase) the torque output of the Diesel engine, such as the drag of the oil due to oil quality and temperature, the fuel quality, the quality of the simmer rings, the intake air temperature and/or the like. To complete the loop control there is a backward loop of the current effective output torque y detected by the 'Measuring system' F_M providing the value x in the same unit as like w_1. The difference ('Control deviation') e between the desired output (setpoint w_1) and the measured output x is fed into the 'Control' transfer function F_C which can be chosen independently but typically is chosen in a manner to control the system stable, accurate and as fast as possible. The (loop) control signal u then act to or on the system (as a throttle signal amplified and altered in timely fashion).

[0067] As an optional feature, this loop control may have an additional 'Setpoint feed forward' Function or Factor which acts to the system without delay. Typically, the ratio between 'Setpoint feed forward' signal w_1' and Control signal u is about 80 percent to 90 percent, by that the control has just to control 20 percent to 10 percent of the control deviation depending on the accuracy of the system description of F_{S1}, F_{S2} and F_M. In result the system's deviation, due to dynamically set point changes, is mostly eliminated. According to the invention, a controlled load caused by tuning electrically/electronically consumers may be applied to the engine system. The torque increase caused by (intentionally and non intentionally) applied 'Electrical loads' ($y_2=y_{2A}+y_{2B}+y_{2C}+\ldots+y_{2n}$) act as additional mechanically drag on the electrical generator shaft, which diminishes the engines total torque output y by the drags total amount of momentum y_2. That's why the 'Electrical load' acts subtractive to the sum point between Controlled system part one and two.

[0068] It may be enough to let the 'Control' react to torque decrease and increase over the output deviation e but the deviation and later compensation may be slightly noticeable (or hearable). Since that there is another optional path inserted to the control: The 'Known disturbance feed back' y_2' acts direct positively to the fuel throttle u for at least partially eliminating the consumed torque caused by the 'Electrically load system' before it comes to an output torque deviation. This is possible since the electrically load momentum y_2 caused by the known amounts of consumer currents in the generator measured via the optional measuring systems (F_{M2A}, F_{M2B}, F_{M2C}, . . . , F_{M2n}) is well calculatable and/or modelable by its 'n' system's descriptions (F_A, F_B, F_C, . . . , F_n) of any order (T1, T2 . . . Tm of Consumers A to n of FIG. **7**).

[0069] In the suggested control model of FIGS. **6** and **7**, every consumer current (x_{2A}, x_{2B}, x_{2C}, . . . , x_{2n}) and by this every portion of the generated drag momentum (y_{2A}, y_{2B}, y_{2C}, . . . , y_{2n}) is fed back to a 'Electrically/Electronically Consumer master control' $F_{w2\Sigma}$. By that the master control is able to add up the total load torque and increase one in situations where another one may decrease in current consumption. Since the total of drag momentum ('Sum of known Disturbances') $y_2$is widely free in choice by the master control, its desired value (total load) 'Desired HLM level' w_2' may change step by step, ramp like or preferably in a PT_1 shape curve as shown in FIG. **6** 'Set point jump dampening' with the dampening near to 1. The set point for the master control w_2' is given by the HLM percentage, which may change it's control signal stepwise between 0 and 100 percent (before set point jump dampening).

[0070] FIG. **7** shows a specific example of the engine torque loop control and electrical load system of FIG. **6** with specific transfer functions inserted. For the engine control a PI control behavior (P:=proportional; I:=integrating) was chosen. Time constants 'T' and Factors 'K' of controls, feed back and feed forward loops are chosen in a way to eliminate controlled system time constants in certain extend for suppressing swing tendencies. T_G of the set point jump dampening may be chosen to be lower or smaller than the highest time constant of the engine control system (T_{S1} or T_{S2}) for not stimulating swing waves caused by set point changes w_2. The 'Setpoint feed forward' may be chosen or selected in a way to eliminate the amplifying factors of the system (K_{S1} and K_{S2}). The feed back loop may have a PD-behavior (D=differentiating) for fast pre-tuning of the first part of the controlled system when y_2 changes.

[0071] Changes and modifications to the specifically described embodiments may be carried out without departing from the principles of the present invention, which is intended to be limited only by the scope of the appended claims as interpreted according to the principles of patent law.

1. A system for providing a set point increase for a vehicle combustion engine, said system comprising:

a control operable to control vehicle secondary systems to control the power consumption of said vehicle secondary systems to increase a mechanical load to the vehicle combustion engine.

2. The system of claim **1**, wherein said load increase of the vehicle combustion engine is for increasing the lost heat.

3. The system of claim **2**, wherein at least one of (i) said lost heat increase enhances the filtering of exhaust gases of the vehicle combustion engine and (ii) said lost heat is principally released to the exhaust gases.

4. The system of claim **2**, wherein said lost heat is utilized to increase the heat of a carbon particle filter, and wherein exhaust gases of the vehicle combustion engine flow through the said carbon particle filter.

5. The system of claim **4**, wherein said carbon particle filter is heated up to its functional temperature.

6. The system of claim **5**, wherein said carbon particle filter functional temperature is between about 250 degrees C. and about 800 degrees C.

7. The system of claim **1**, wherein said control is operable to increase power consumption by one of said secondary systems when another of said secondary systems experiences a decrease in power consumption.

8. The system of claim **1**, wherein said control uses operation modes in which said secondary systems are controlled in a manner that is substantially not perceptible to the vehicle occupants or bystanders.

9. The system of claim **8**, wherein said control controls the combustion engine in a manner such that emitted torque is increased by the same amount as the torque discharged by said secondary systems.

10. The system of claim **8**, wherein said control is operable to control said secondary systems in said operation mode to maximize electrical power consumption.

11. The system of claim **10**, wherein said control of said secondary systems is supervised by a master control to control the combined torque consumption and to prevent said secondary systems from damaging due to overload.

12. The system of claim **11**, wherein said secondary systems comprise electrical commuted current driver stages and driver controls.

13. The system of claim **12**, wherein at least one of (i) said electrical commuted current driver stages are controlled in opposite directions in short time duration so that the resulting force or momentum is near zero over time, (ii) said electrical commuted current driver stages are controlled in a short cut mode and (iii) said secondary system comprises one of a starter generator and a hybrid motor generator.

14. The system of claim **8**, wherein said control is operable to control said secondary systems in said operation mode to maximize mechanical discharged torque from a drivetrain of the vehicle.

15. The system of claim **14**, wherein at least one of (i) said secondary system comprises a brake system of the vehicle and (ii) said secondary system comprises a fly wheel of the vehicle.

16. A system for enhancing filtering of exhaust gases of a vehicle combustion engine, said system comprising:

a control operable to control vehicle secondary systems to control the power consumption of said vehicle secondary systems to increase a mechanical load to the vehicle combustion engine;

wherein said load increase of the vehicle combustion engine is for increasing the lost heat, and wherein said lost heat increase enhances the filtering of exhaust gases of the vehicle combustion engine; and

wherein said control is operable to increase power consumption by one of said secondary systems when another of said secondary systems experiences a decrease in power consumption.

17. The system of claim **16**, wherein said control is operable to control said secondary systems to at least one of (i) maximize electrical power consumption and (ii) maximize mechanical discharged torque from a drivetrain of the vehicle.

18. A system for enhancing filtering of exhaust gases of a vehicle combustion engine, said system comprising:

a control operable to control vehicle secondary systems to control the power consumption of said vehicle secondary systems to increase a mechanical load to the vehicle combustion engine;

wherein said load increase of the vehicle combustion engine is for increasing the lost heat, and wherein said lost heat increase enhances the filtering of exhaust gases of the vehicle combustion engine;

wherein said lost heat is utilized to increase the heat of a carbon particle filter, through which the exhaust gases flow; and

wherein said control is operable to increase power consumption by one of said secondary systems when another of said secondary systems experiences a decrease in power consumption.

19. The system of claim **18**, wherein said control is operable to control said secondary systems to at least one of (i) maximize electrical power consumption and (ii) maximize mechanical discharged torque from a drivetrain of the vehicle.

20. The system of claim **18**, wherein said carbon particle filter is heated up to a temperature between about 250 degrees C. and about 800 degrees C.

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