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(54) **Exhaust control system and vehicle provided with it**

Abgasregelsystem und Kraftfahrzeug ausgerüstet damit

Système de commande d'échappement et véhicule équipé avec celui-ci

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Description

[0001] The present invention relates to an exhaust control system that controls flow path area in an exhaust pipe connected to an internal combustion engine and a vehicle provided with such an exhaust control system.

[0002] Heretofore, it is known that pulsation caused by the intermittent driving of an exhaust valve of an internal combustion engine and inertia current are generated in an exhaust pipe that conducts exhaust gas exhausted from the internal combustion engine of a vehicle such as a motorcycle. To prevent the torque characteristic of the internal combustion engine from being changed by such pulsation and inertia current in the exhaust pipe, an exhaust control system for controlling the flow path area of the exhaust pipe is developed (for example, refer to Japanese published patent application No. 2516768, pp. 2 and 3, Figs. 2 and 5).

This known exhaust control system controls the exhaust gas of a motorcycle and controls an angle of a valve that opens or closes an opening of an expansion chamber of an exhaust pipe depending upon engine speed. The exhaust control system selects any of angle characteristics according to engine speed, determines a target angle of the valve and controls a motor for turning the valve so that the target angle and the current angle of the valve are coincident.

[0003] In a vehicle provided with this type of exhaust control system, in case a transmission is a continuously variable transmission, engine speed and a load characteristic of an engine may be not coincident. Therefore, when the exhaust control system controls based upon only engine speed, an exhaust device such as the above-mentioned valve may be driven in an unnecessary area and a desired torque characteristic may be not acquired.

[0004] The invention is made to solve such a problem and the object is to provide an exhaust control system which can also acquire a desired torque characteristic in all velocity ranges in a vehicle provided with a continuously variable transmission.

[0005] EP 0 831 219 relates to a method for controlling the operation of an internal combustion engine. Said engine comprises an air intake system having a throttle valve, an exhaust system having an exhaust control valve, a fuel injection means, an accelerator means, and a control device for controlling engine components in response to engine operating conditions detected. Such engine operating conditions maybe engine speed and/or engine load. The method comprises the steps of: detecting an engine operating state, determining whether said engine operating state is a stationary operating state or a transient state, controlling an opening degree of said exhaust control valve toward an opening degree corresponding to the engine speed and/or engine load responsive opening degree of the exhaust control valve during the stationary operating state, and controlling said opening degree of said exhaust control valve to a different opening degree during said transient operating state, compared to the stationary operating state conditions, for the same engine speed and/or engine load.

[0006] The above-outlined object is achieved by means of the features of the independent claims. The dependent claims develop further the central idea of the present invention.

[0007] A preferred embodiment relates to an exhaust control system that controls the flowpath area of an exhaust pipe (for example, an exhaust pipe 5 in an embodiment) connected to an internal combustion engine (for example, an engine 1 in the embodiment) by an exhaust control valve (for example, an exhaust control valve 6 in the embodiment) and is characterized in that the exhaust control system is provided with an actuator (for example, an actuator 14 in the embodiment) for driving the exhaust control valve, angle sensing means (for example, a valve angle sensor 15 in the embodiment) that senses an angle (for example, a valve angle θEX in the embodiment) of the exhaust control valve, throttle angle sensing means (for example, a throttle angle sensor 12 in the embodiment) that senses a throttle angle (for example, a throttle angle θTH in the embodiment) of the internal combustion engine, vehicle speed sensing means (for example, vehicle speed sensing means 16 in the embodiment) that senses the vehicle speed (for example, vehicle speed V win the embodiment) of a vehicle and storage means (for example, an exhaust control unit 8 in the embodiment) that stores a target angle of the exhaust control valve set based upon the vehicle speed and the throttle angle and the actuator is driven so that the target angle of the exhaust control valve acquired from the storage means and an angle of the exhaust control valve sensed by the angle sensing means are coincident.

[0008] The exhaust control system configured as described above retrieves a target angle of the exhaust control valve stored in correspondence with a throttle angle and vehicle speed in the storage means based upon a throttle angle actually sensed by the throttle angle sensing means and vehicle speed sensed by the vehicle speed sensing means and acquires the target angle of the exhaust control valve at that time. The exhaust control system outputs a control signal for driving the exhaust control valve so that the target angle and an angle of the exhaust control valve sensed by the angle sensing means are coincident to the actuator.

[0009] In a preferred embodiment, a target angle of the exhaust control valve set based upon the engine speed (for example, engine speed Ne in an embodiment) of the internal combustion engine is stored in the storage means and the actuator is driven so that the target angle of the exhaust control valve acquired based upon the engine speed and an angle of the exhaust control valve sensed by the angle sensing means are coincident in ascending or when a large load is applied.

[0010] The exhaust control system also stores a target angle related to the engine speed of the internal combustion engine in addition to a target angle set based upon a throttle angle and vehicle speed. When a vehicle

is ascending or when a large load is applied to the internal combustion engine, a desired value of flow path area is set according to the engine speed of the internal combustion engine. An inclination sensor that senses an inclined angle of the vehicle can be used for determining that the vehicle is ascending. Besides, a sensor that senses intake quantity in the internal combustion engine and an internal pressure sensor that senses internal pressure in an intake pipe can be used for determining that a large load is applied.

[0011] In a preferred mode, the exhaust control system is characterized in that a mode in which a target angle of the exhaust control valve is acquired based upon the throttle angle and the vehicle speed and a mode in which a target angle of the exhaust control valve is acquired based upon the engine speed can be selected manually.

[0012] The exhaust control system configured as described above is provided with configuration that a parameter when a target angle of the exhaust control valve is set is not automatically determined based upon the behavior of a vehicle but is selected by the operation of a rider. For means which the rider selects manually, a switch or a lever attached to a handlebar can be given.

[0013] The vehicle according to an aspect of the invention is a motorcycle, a three-wheeled buggy or a four-wheel buggy respectively runwhen a rider sits and operates a handlebar, is provided with configuration that after driving force generated in an internal combustion engine is shifted by a continuously variable transmission, the driving force is transmitted to a driving wheel and the flow path area of an exhaust pipe that conducts exhaust gas from the internal combustion engine is controlled by the above-mentioned process.

Brief Description of the Drawings

[0014]

Fig. 1 shows the configuration of a vehicle and an exhaust control system in an embodiment of the invention;

Fig. 2 is a top sectional view showing an engine and a belt-type continuously variable transmission in each embodiment of the invention;

Fig. 3 shows a map of target angles of an exhaust control valve in case a throttle angle and vehicle speed are used as parameters;

Fig. 4 shows an exhaust control system equivalent to a second embodiment of the invention;

Fig. 5 is a graph showing target angles of an exhaust control valve in case the engine speed of an engine is used as a parameter; and

Fig. 6 shows an exhaust control system equivalent to a third embodiment of the invention.

[0015] Referring to the drawings, a first embodiment of the invention will be described in detail below.

[0016] A vehicle 2 provided with an engine 1 which is an internal combustion engine shown in Fig. 1 (a block diagram) and Fig. 2 (a top sectional view) is such a motorcycle, a three-wheeled buggy or a four-wheel buggy that the rotation of a crankshaft 27 of the engine 1 drives a driving wheel Wr via a belt-type continuously variable transmission 3. As shown in Fig. 1, an intake pipe 4 for taking in air-fuel mixture and an exhaust pipe 5 for exhausting the air-fuel mixture after combustion are connected to the engine 1 of the vehicle 2, and the exhaust pipe 5 is provided with an exhaust control valve 6 as an exhaust device that controls the conduction of exhaust gas exhausted from the engine 1 by changing its flow path area and an actuator 14. The operation of the engine 1 is controlled by an engine control unit 7 and the exhaust control valve 6 is controlled by an exhaust control unit 8.

[0017] A throttle valve 9 which is an intake throttle valve for adjusting the intake air quantity of the engine 1 and an injector 10 that injects fuel to intake air are arranged around the intake pipe 4 that provides intake air to the engine 1 in order in a direction in which air is taken in. The opening and closing movement of the throttle valve 9 is controlled by an actuator 11 such as a motor and an angle of its opening is sensed by a valve angle sensor 12 which is throttle angle sensing means. An internal pressure sensor 13 that senses pressure in the intake pipe 4 is attached between a position in which the throttle valve 9 is arranged to a position in which the injector 10 is arranged.

[0018] The exhaust control valve 6 for adjusting the flow path area of the exhaust pipe 5 is provided to the exhaust pipe 5 that conducts exhaust gas from the engine 1 between the engine 1 and a muffler (not shown). For the exhaust control valve 6, a butterfly valve supported in the exhaust pipe 5 so that the butterfly valve can be turned can be used for example. The flow path area in this case continuously varies from zero to a predetermined maximum value depending upon the angle θEX of the exhaust control valve 6. It is desirable in case the engine 1 is a multiple cylinder engine, the exhaust control valve 6 is arranged in a part in which exhaust gas from each cylinder joins. The opening and closing movement of the exhaust control valve 6 is controlled by the actuator 14 such as a motor and an angle of its opening is sensed by a valve angle sensor 15 which is angle sensing means.

[0019] The engine control unit 7 that controls the engine 1 controls the throttle valve 9 and the injector 10 on the intake side and is also an electrically controlled unit (ECU) that ignites air-fuel mixture composed of air and fuel. For information input to the engine control unit 7, there are pressure Pb in the intake pipe 4 sensed by the internal pressure sensor 13, a throttle angle θTH sensed by the valve angle sensor 12 of the throttle valve 9, vehicle speed Vw sensed by vehicle speed sensing means 16,

an angle θEX acquired via the exhaust control unit 8 of the exhaust control valve 6, and in addition, there are the temperature TW sensed by a coolant temperature sensor 17 of cooling water of the engine 1 and the turning angle CLK sensed by a crank angle sensor 18 of a crankshaft 27 shown in Fig. 2.

[0020] For information output from the engine control unit 7, there are a control signal for injecting fuel from the injector 10 to the engine 1 according to intake air quantity, a throttle angle θTH and vehicle speed Vw respectively output to the exhaust control unit 8. In addition, a control signal for discharging an ignition plug 19 and igniting air-fuel mixture in the engine 1 is also output. Various information of an angle and temperature may be also the information of an angle and temperature respectively operated by the sensors and may be also such signals as an angle and temperature are acquired by operation in the engine control unit 7 and the exhaust control unit 8.

[0021] The exhaust control unit 8 which is an electronically controlled unit for controlling the flow path area of the exhaust pipe 5 is composed of CPU, ROM, RAM and a predetermined electric circuit and controls the angle θEX of the exhaust control valve 6. For information input to the exhaust control unit 8, there are an angle θEX of the exhaust valve, a throttle angle θTH and vehicle speed Vw respectively acquired via the engine control unit 7. For information output from the exhaust control unit 8, there are a control signal for driving the actuator 14 that turns the exhaust control valve 6 and an angle θEX output to the engine control unit 7 of the exhaust control valve 6.

[0022] The exhaust control unit 8 sets a target angle of the exhaust control valve 6 based upon a throttle angle θTH and vehicle speed Vw and executes feedback control over the actuator 14 so that the target angle and an actual valve angle θEX are coincident. At this time, the exhaust control unit 8 uses desired value set information stored in storage means such as ROM beforehand. For the desired value set information, there is a map 20 the configuration of which is shown in Fig. 3. In the map 20, vehicle speed Vw values are arrayed every predetermined speed in a direction of a row and throttle angle θTH values are arrayed every predetermined angle in a direction of a column so that the target angle of the exhaust control valve 6 can be specified based upon vehicle speed Vw in the direction of a row and a throttle angle θTH in the direction of a column. In an example shown in Fig. 3, when vehicle speed Vw is 50 km and a throttle angle θTH is 50°, a value of 50% is acquired as the target angle of the exhaust control valve 6. As the flow path area is determined according to the target angle, the target angle is equivalent to a desired value of the flow path area. For the target angle, a target angle rate that the maximum value of a valve angle θEX is equivalent to 100% is used and in addition, a numeric value which can uniquely determine flow path area such as an angle and the driven quantity of the actuator 14 can be used.

[0023] The exhaust control unit 8 that executes such processing can be said a device provided with storage means for storing the map 20, angle operating means for operating an angle θEX of the exhaust control valve 6 based upon a value output from the valve angle sensor 15 of the exhaust control valve 6, retrieval means for retrieving the map and acquiring a target angle based upon a throttle angle θTH and vehicle speed Vw and drive control means for executing feedback control over the actuator 14 according to the acquired target angle and driving the exhaust control valve 6.

[0024] The exhaust control system in this embodiment includes the exhaust control valve 6, its actuator 14, the valve angle sensor 15, the throttle angle sensor 12, vehicle speed sensing means 16 and the exhaust control unit 8.

[0025] Next, referring to Fig. 2, the engine 1 in this embodiment and the belt-type continuously variable transmission 3 for transmitting the rotation of the crankshaft 27 of the engine 1 to the driving wheel Wr will be described. Fig. 2 is a top sectional view showing the engine 1 and the belt-type continuously variable transmission 3 and they shall be fixed to a body frame (not shown).

[0026] The engine 1 shown in Fig. 2 is provided with a cylinder block 22 in which two cylinders 21 are extended in a substantially horizontal direction on the front side of the driving wheel Wr, and a cylinder head 23 and a cylinder head cover 24 are fixed to the cylinder block so that they cover the front end of the cylinder block 22. A piston 25 is housed in each cylinder 21 in the cylinder block 22 so that the piston can be slid. Each piston 25 is coupled to the crankshaft 27 via a connecting rod 26. The crankshaft 27 is supported by a crankcase 28 fixed to the cylinder block 22. In the cylinder head 23, an intake valve 29 opened when air-fuel mixture is taken in from the intake pipe 4 (see Fig. 1), an exhaust valve 30 opened when the mixture after combustion is exhausted into the exhaust pipe 5 (see Fig. 1) and an ignition plug 31 that ignites the taken mixture at predetermined timing are arranged in positions opposite to the piston 26. In Fig. 3, the intake valve 29 and the exhaust valve 30 are shown in one cylinder and in the other cylinder, the ignition plug 31 is shown, however, in each cylinder, the intake valve 29, the exhaust valve 30 and the ignition plug 31 shall be arranged.

[0027] The intake valve 29 and the exhaust valve 30 are opened or closed by a valve train. The valve train includes a camshaft 32 in the cylinder head 23 and cams 32a integrated with the camshaft in accordance with positions in which the valves 29, 30 are attached. The camshaft 32 is rotated in synchronization with the crankshaft 27 via a timing chain 33 tying a cam chain sprocket 32b provided to one end side of the camshaft and a drive chain sprocket 27a provided to one end side protruded from the crankcase 28 of the crankshaft 27. An outer rotor 34a forming a part of a generator 34 is installed on one end side provided with the drive chain sprocket 27a of the crankshaft 27 and converts the rotation of the crankshaft 27 to electric energy in cooperation with an inner stator 34b fixed on the side of the crankcase 28 of

the generator 34 so that a battery not shown can be charged.

[0028] The other end of the crankshaft 27 provided with the generator 34 at one end is protruded from the crankcase 28 and a driving pulley 41 of the belt-type continuously variable transmission 3 is attached to the other end. The belt-type continuously variable transmission 3 is provided with a transmission case 42 continuously covering from the other end of the crankshaft 27 to the axle 51 of the driving wheel Wr and is attached to the engine 1 by a bearing 43 and others so that the continuously variable transmission can be rocked. The transmission case 42 is provided with a base 42a and a base 42b respectively arranged so that the crankcase 28 is put between them. A fork 42c that supports the other end of the axle 51 is extended from the base 42a arranged on the other end side of the crankshaft 27 and a fork 42d that supports one end of the axle 51 is extended from the base 42b opposite to the base 42a. Further, the bases 42a, 42b are coupled by coupling parts 42e, 42f.

[0029] The belt-type continuously variable transmission 3 is provided with configuration that a V-belt without an end 46 is laid between the driving pulley 41 attached to the crankshaft 27 in the base 42a of the transmission case 42 and a driven pulley 45 provided to a driven shaft 44 supported on the side of the fork 42c of the transmission case 42 and the rotation of the crankshaft 27 is transmitted to the axle 51 supported in parallel with the crankshaft 27 via the V-belt 46, the driven pulley 45 and a deceleration mechanism composed of a gear train 47a, 47b, 47c respectively interlocked with the driven shaft and an intermediate shaft 48.

[0030] The driving pulley 41 is provided with a fixed pulley half 41a fixed to the crankshaft 27 and a movable pulley half 41b which can be slid in the axial direction of the crankshaft 27 by a centrifugal mechanism 49, and the V-belt 46 is wound on a groove formed by the opposite fixed pulley half 41a and movable pulley half 41b. In the meantime, the driven pulley 45 is composed of a fixed pulley half 45a attached to the driven shaft 44 via a centrifugal clutch 50 for a start and a movable pulley half 45b pressed toward the fixed pulley half 45a by a spring 52, and the V-belt 46 is wound on a groove formed by the fixed pulley half 45a and the movable pulley half 45b. When the rotating speed of the crankshaft 27 is increased, centrifugal force acts on a centrifugal weight of the centrifugal mechanism 49 in the driving pulley 41 and the movable pulley half 41b is slid to the side of the fixed pulley half 41a. As the width of the groove of the driving pulley 41 is reduced because the movable pulley half approaches the fixed pulley half 41a by quantity in which the movable pulley half 41b is slid, a position in which the driving pulley 41 and the v-belt 46 are touched is displaced outside in the radial direction of the driving pulley 41 and a diameter in which the v-belt 46 is wound increases. Accordingly, the width of the groove between the fixed pulley half 45a and the movable pulley half 45b of the driven pulley 45 increases. The gear ratio of the belt-type continuously variable transmission 3 is automatically and continuously varied by continuously changing the diameter in which the V-belt 46 is wound according to the rotating speed of the crankshaft 27 as described above.

[0031] The action of the exhaust control system in this embodiment will be described below.

[0032] First, when a rider starts the engine 1 of the vehicle 2, power is supplied to the engine control unit 7, the exhaust control unit 8 and other equipment. The engine control unit 7 acquires internal pressure Pb in the intake pipe 4, a throttle angle θTH, vehicle speed Vw, the valve angle θEX of the exhaust control valve 6, the temperature TW of cooling water and the turning angle CLK of the crankshaft 27, operates the injection quantity of fuel and the timing of ignition and respectively outputs a control signal to the injector 10 and the ignition plug 19. The intake valve 29 of the engine 1 is opened or closed at predetermined timing by the camshaft 32 rotated in interlock with the crankshaft 27 shown in Fig. 2 by the start of the engine 1, and air-fuel mixture is supplied to a combustion chamber of the engine 1. After the air-fuel mixture is burned, the exhaust valve 30 is opened by the rotation of the camshaft 32 and the burned air-fuel mixture is exhausted into the exhaust pipe 5 shown in Fig. 1 as exhaust gas. When running is started, the belt-type continuously variable transmission 3 transmits the rotat ion of the crankshaft 27 to the driving wheel Wr, changing the diameter in which the V-belt 46 is wound according to engine speed Ne and the number of revolutions of the driving wheel Wr and turns the driving wheel Wr at predetermined gear ratio.

[0033] In the meantime, the exhaust control unit 8 retrieves the map 20 (see Fig. 3) using the throttle angle θTH and vehicle speed Vw respectively acquired via the engine control unit 7 as parameters and acquires the target angle of the exhaust control valve 6. The exhaust control unit operates deviation between the target angle and an actual angle θEX of the exhaust control valve 6 and drives the actuator 14 so that the deviation is zero. For example, in case the acceleration of the vehicle 2 is tried when the vehicle runs at immediate speed or at low speed and the engine speed Ne and the gear ratio are small, that is, when vehicle speed Vw is low or intermediate (for example, 20 to 70 km/h) and a throttle angle θTH is relatively large (for example, 50° or more), an intermediate value at which so-called exhaust pulsation effect is produced is stored in the map 20 as the target angle of the exhaust control valve 6. Therefore, the angle of the exhaust control valve 6 is kept intermediate, the quantity of exhaust gas flowing reversely in the exhaust pipe 5 is reduced, the engine 1 can easily take in unburned air-fuel mixture by the quantity and the output of the engine 1 can be increased. As exhaust gas from the engine 1 is little in case a throttle angle θTH is small (for example, 20° or below it) though vehicle speed Vw is low, a large value (for example, 80%) is stored in the map 20 as the target angle of the exhaust control valve 6. In case

vehicle speed Vw is high (for example, 70 km/h or higher), a large value (for example, 80%) is stored in the map 20 as the target angle of the exhaust control valve 6.

[0034] As the exhaust control unit 8 is provided with desired value set information (the map 20) in which the target angle of the exhaust control valve 6 at which optimum engine output is acquired, vehicle speed Vw and a throttle angle θTH are related based upon a throttle angle θTH showing the operational will of the rider and vehicle speed Vw which is a result of control over the body and the angle of the exhaust control valve 6 is controlled referring the map 20 as described above, the exhaust control valve 6 can be prevented from being greatly driven in an unnecessary area and from being not driven in a necessary area and a desired torque characteristic can be acquired even if engine speed Ne is not coincident with a load characteristic of the engine 1 in the vehicle 2 provided with the belt-type continuously variable transmission 3.

[0035] Next, referring to the drawings, a second embodiment of the invention will be described. Fig. 4 mainly shows components related to control over an exhaust control valve in this embodiment. The same reference number is allocated to the same component as that in the first embodiment and the same description as that in the first embodiment is omitted.

[0036] As shown in Fig. 4, the vehicle 2 is provided with an inclination sensor 61 that senses an inclined angle of the vehicle 2 and has configuration that an exhaust control unit 8 controls over an angle of an opening of the exhaust control valve 6 according to an inclined angle θS. Therefore, an exhaust control system equivalent to this embodiment includes the exhaust control valve 6 and its actuator 14, a valve angle sensor 15, a throttle angle sensor 12, vehicle speed sensing means 16, the inclination sensor 61 and the exhaust control unit 8.

[0037] An engine control unit 7 acquires the information of an inclined angle θS in addition to internal pressure Pb in an intake pipe 4 (see Fig. 1), the temperature TW of cooling water, the turning angle CLK of a crankshaft 27 (see Fig. 2), a throttle angle θTH, vehicle speed Vw and an angle θEX of the exhaust control valve 6, executes required control over an engine 1 and outputs engine speed Ne, vehicle speed Vw, a throttle angle θ TH and an inclined angle θS respectively operated based upon the turning angle CLK of the crankshaft 27 to the exhaust control unit 8.

[0038] The exhaust control unit 8 acquires the engine speed Ne, the throttle angle θTH, the vehicle speed Vw and the inclined angle θS in addition to an angle θEX of the exhaust control valve 6 and controls over the actuator 14 for turning the exhaust control valve 6. When it is determined based upon the inclined angle θS that the vehicle 2 is ascending (in an ascending mode), a target angle is set using a graph 62 shown in Fig. 5 and in a case except it (in a normal running mode), a target angle is set using the map 20 shown in Fig. 3. Such an exhaust control unit 8 can be said a device provided with storage means, angle operation means, mode selection means for selecting the ascending mode or the normal running mode according to an inclined angle and an inclined direction, retrieval means for retrieving a target angle according to the selected mode and driving control means.

[0039] In the graph 62 used in ascending shown in Fig. 5, a target angle rate as a target angle of the exhaust control valve 6 is set using a turning angle Ne of the engine as a parameter. The graph 62 shows a tendency that the target angle of the exhaust control valve 6 increases so that required engine output is acquired as engine speed Ne increases in a low-speed area of the engine 1 (for example, 1000 to 3000rpm), an intermediate-speed area (for example, 3000 to 5000 rpm) and a high-speed area (for example, 5000 to 8000 rpm), and in the high-speed area, the target angle reaches an angle equivalent to a full throttle. For a rate of the variation of the target angle having the increasing tendency, the rate is the largest in the high-speed area, next, it is larger in the intermediate-speed area and it is the smallest in the low-speed area. This characteristic shall be suitably selected depending upon the displacement and the number of cylinders of the engine 1 of the vehicle 2, the shape and the length of the exhaust pipe 5.

[0040] Next, the action of the second embodiment will be described.

First, when the engine 1 is started, the exhaust control unit 8 determines a running mode of the vehicle 2 based upon an inclined angle θS. In case the inclined angle θS is a predetermined value or more and an inclined direction is a direction in which the front side of the body is higher than the rear side, the exhaust control unit regards the running mode as an ascending mode. In the meantime, in case the inclined angle θS is below the predetermined value and in case the vehicle is inclined in a direction in which the front side of the body is lower than the rear side, the exhaust control unit determines that the vehicle is running on a flat road, an irregular road or a descending slope and regards the running mode as a normal running mode.

[0041] When it is determined the running mode is the ascending mode, the exhaust control unit 8 retrieves the graph 62 based upon engine speed Ne acquired from the engine control unit 7 and executes feedback control over the actuator 14 so that an angle θEX of the exhaust control valve 6 is coincident with an acquired target angle. When it is determined that the running mode is the normal running mode, the exhaust control unit retrieves a target angle based upon vehicle speed Vw and a throttle angle θTH in the map as in the first embodiment and executes feedback control so that an angle θEX of the exhaust control valve 6 is coincident with the target angle.

[0042] As described above, the exhaust control system equivalent to this embodiment sets an optimum value as a target angle of the exhaust control valve 6 based upon vehicle speed Vw and a throttle angle θTH in the normal running mode and sets the target angle of the exhaust control valve 6 according to engine speed Ne in ascend-

ing. This reason is that in ascending, the gear ratio of a belt-type continuously variable transmission 3 is set to a small value because a large load is applied and engine speed Ne approaches a load characteristic of the engine 1. Further, this reason is that as vehicle speed Vw may be not increased, compared with that in normal running even if a throttle angle θTH is increased in ascending, desired engine output is more easily acquired when the exhaust control valve 6 is controlled using engine speed Ne as a parameter than when the exhaust control valve 6 is controlled using the map 20 prepared on the supposition of normal running.

[0043] Next, referring to the drawings, a third embodiment of the invention will be described in detail. Fig. 6 mainly shows components related to control over an exhaust control valve in this embodiment. The same reference number is allocated to the same component as that in each embodiment and the same description as that in each embodiment is omitted.

[0044] As shown in Fig. 6, a vehicle 2 is provided with a switch 71 which is selection means for switching a normal running mode and an ascending mode manually to a handlebar (not shown) which a rider operates. An exhaust control system equivalent to this embodiment includes the above-mentioned exhaust control valve 6, its actuator 14 and the above-mentioned valve angle sensor 15, a throttle angle sensor 12, the switch 71 and an exhaust control unit 8.

[0045] The exhaust control unit 8 acquires an output signal Sw from the switch 71 in addition to an angle θEX of the exhaust control valve 6, engine speed Ne, a throttle angle θTH and vehicle speed Vw and controls the actuator 14 for turning the exhaust control valve 6. In case the output signal Sw from the switch 71 is a signal equivalent to the ascending mode, the exhaust control unit sets a target angle of the exhaust control valve 6 using the graph 62 shown in Fig. 5. In the meantime, in case the output signal Sw from the switch 71 is a signal equivalent to the normal running mode, the exhaust control unit sets a target angle of the exhaust control valve 6 using the map 20 shown in Fig. 3. Such an exhaust control unit 8 can be said a device provided with storage means, angle operation means, mode selection means for selecting the ascending mode or the normal running mode according to selection by the rider, retrieval means for retrieving a target angle according to the selected mode and driving control means.

[0046] As for control by the exhaust control system, map retrieval is made using a throttle angle θTH and vehicle speed Vw as parameters in the map 20 shown in Fig. 3 as initial setting, a target angle of the exhaust control valve 6 is set and an angle of the exhaust control valve 6 is controlled according to the target angle. When the rider operates the switch 71 and switches to the ascending mode, graph retrieval is made using engine speed Ne as a parameter in the graph 62 shown in Fig. 5, a target angle of the exhaust control valve 6 is set and an angle of the exhaust control valve 6 is controlled according to the target angle. When the switch 71 is switched to the normal running mode while an angle of the exhaust control valve 6 is controlled in the ascending mode according to selection by the rider, control over an angle of the exhaust control valve 6 in the normal running mode is made.

[0047] Such a vehicle 2 can acquire suitable engine output in ascending as in the second embodiment even if the vehicle is not provided with the inclination sensor. As the ascending mode can be also regarded as a mode in which a large load is applied to an engine 1, control over an angle of the exhaust control valve 6 based upon engine speed Ne is enabled according to selection by the rider in case a large load is applied to the engine 1 except in ascending. Further, the change of the output characteristic of the engine 1 is enabled according to selection by the rider.

[0048] The invention is not limited to each embodiment described above and can be widely applied. In the second embodiment, internal pressure Pb in the intake pipe 4 is input from the engine control unit 7 to the exhaust control unit 8 in place of the inclined angle θS, the normal running mode and the large load mode equivalent to the ascending mode are selected based upon the magnitude of the internal pressure Pb, and in the case of the large load mode, control over an angle of the exhaust control valve 6 based upon engine speed Ne using the graph 62 shown in Fig. 5 may be also made. The reason why the internal pressure Pb is used is that as the internal pressure Pb varies depending upon the quantity of gas taken in the engine 1, intake air quantity, that is, output required for the engine 1 can be estimated by monitoring the internal pressure Pb.

[0049] The engine control unit 7 and the exhaust control unit 8 may be also configured by one electronic controlled unit.

Further, in place of the belt-type continuously variable transmission 3, a toroidal continuously variable transmission and a cone-type continuously variable transmission can be also used. Besides, a hydrostatic continuously variable transmission may be also used.

[0050] As described above as an angle of the exhaust control valve can be adjusted using a throttle angle and vehicle speed as parameters, the exhaust control valve can be suitably operated, a desired torque characteristic can be acquired even if engine speed and the number of revolutions of the driving wheel are not necessarily coincident and a load characteristic can be specified based upon the engine speed, and a running characteristic can be enhanced. This effect is remarkable when the vehicle runs at low speed and at immediately speed.

[0051] Further, as the control over an angle of the exhaust control valve in ascending and when a large load is applied to the internal combustion engine can be made based upon engine speed, the exhaust control valve can be also suitably operated under a specific condition and a desired torque characteristic can be acquired.

[0052] In addition, in case a parameter cannot be uni-

formly selected using an inclined angle and other sensor, suitable control is also enabled and a torque characteristic according to the preference of a rider can be realized.

[0053] Moreover, as an angle of the exhaust control valve can be controlled according to a running state of the vehicle and the preference of a rider, the vehicle provided with a satisfactory running characteristic can be acquired.

Description of Reference Numbers

[0054]

1.	Engine (Internal combustion engine)
2.	Vehicle
3.	Belt-type continuously variable transmission
5.	Exhaust pipe
6.	Exhaust control valve
8.	Exhaust control unit
12.	Throttle angle sensor (Throttle angle sensing means)
14.	Actuator
15.	Valve angle sensor (Angle sensing means)
16.	Vehicle speed sensing means
20.	Map
62.	Graph
θEX.	Valve angle
θTH.	Throttle angle
Vw.	Vehicle speed
Ne.	Engine speed

Claims

1. An exhaust control system that controls the flow path area of an exhaust pipe (5) connected to an internal combustion engine (1) by an exhaust control valve (6), comprising:

   an actuator (14) that drives the exhaust control valve (6);
   angle sensing means (15) that senses an angular position of the exhaust control valve (6); and
   throttle angle sensing means (12) that senses a throttle angle of the internal combustion engine (1);
   vehicle speed sensing means (16) that senses the vehicle speed of a vehicle; **characterized in that**
   the system further comprises storage means (8) that stores a target angle of the exhaust control valve (6) set based upon the vehicle speed and the throttle angle, wherein:

      the actuator (14) is driven so that the target angle of the exhaust control valve (6) acquired from the storage means (8) or acquired based upon an engine speed and the angle of the exhaust control valve (6) sensed by the angle sensing means (15) are coincident, and
      wherein a mode in which a target angle of the exhaust control valve (6) is acquired based upon the throttle angle and the vehicle speed and a mode in which a target angle of the exhaust control valve (6) is acquired based upon the engine speed can be selected manually.

2. An exhaust control system according to Claim 1, wherein in the mode in which a target angle of the exhaust control valve (6) is acquired based upon the engine speed,
   a target angle of the exhaust control valve (6) set based upon the engine speed of the internal combustion engine (1) is stored in the storage means (8).

3. A vehicle provided with an exhaust control system, comprising:

   an exhaust control system according to Claim 1 or 2; and
   a continuously variable transmission.

Patentansprüche

1. Abgassteuersystem, das den Strömungsbereich eines Abgasrohrs (5) steuert, welches über ein Abgassteuerventil (6) mit einem Verbrennungsmotor (1) verbunden ist, mit:

   einem Stellglied (14), das das Abgassteuerventil (6) antreibt;
   einer Winkelerfassungseinrichtung (15), die eine Winkelstellung des Abgassteuerventils (6) erfasst; und
   einer Drosselklappenwinkel-Erfassungseinrichtung (12), die einen Drosselklappenwinkel des Verbrennungsmotors (1) erfasst;
   einer Fahrzeuggeschwindigkeitserfassungseinrichtung (16), die die Fahrzeuggeschwindigkeit eines Fahrzeugs erfasst; **dadurch gekennzeichnet, dass** das System weiterhin eine Speichereinrichtung (8) umfasst, die einen Zielwinkel des Abgassteuerventils (6) speichert, welcher auf der Grundlage der Fahrzeuggeschwindigkeit und des Drosselklappenwinkels eingestellt ist, wobei:

      das Stellglied (14) derart angetrieben wird, dass der Zielwinkel des von der Speichereinrichtung (8) erhaltenen oder auf der Grundlage einer Motorgeschwindigkeit erhaltenen Abgassteuerventils (6) und der Winkel des von der Winkelerfassungsein-

richtung (15) erfassten Abgassteuerventils (6) übereinstimmen, und
wobei eine Betriebsart, in der ein Zielwinkel des Abgassteuerventils (6) auf der Grundlage des Drosselklappenwinkels und der Fahrzeuggeschwindigkeit erhalten wird und eine Betriebsart, in der ein Zielwinkel des Abgassteuerventils (6) auf der Grundlage der Motorgeschwindigkeit erhalten wird, manuell ausgewählt werden können.

2. Abgassteuersystem gemäß Anspruch 1, wobei in der Betriebsart, in der ein Zielwinkel des Abgassteuerventils (6) auf der Grundlage der Motorgeschwindigkeit erhalten wird, ein Zielwinkel des auf der Grundlage der Motorgeschwindigkeit des Verbrennungsmotors (1) eingestellten Abgassteuerventils (6) in der Speichereinrichtung (8) gespeichert wird.

3. Mit einem Abgassteuersystem versehenes Fahrzeug, mit:

einem Abgassteuersystem gemäß Anspruch 1 oder 2; sowie einem stufenlos verstellbaren Getriebe.

Revendications

1. Système de commande d'échappement qui commande l'aire de chemin d'écoulement d'un tuyau d'échappement (5) raccordé à un moteur à combustion interne (1) par une soupape de commande d'échappement (6), comprenant :

un actionneur (14) qui entraîne la soupape de commande d'échappement (6) ;
un moyen de détection d'angle (15) qui détecte une position angulaire de la soupape de commande d'échappement (6) ; et
un moyen de détection d'angle de papillon (12) qui détecte un angle de papillon du moteur à combustion interne (1) ;
un moyen de détection de vitesse de véhicule (16) qui détecte la vitesse de véhicule d'un véhicule ; **caractérisé en ce que**
le système comprend en outre un moyen de stockage (8) qui stocke un angle cible de la soupape de commande d'échappement (6) établi en fonction de la vitesse de véhicule et de l'angle de papillon, dans lequel :

l'actionneur (14) est entraîné de sorte que l'angle cible de la soupape de commande d'échappement (6) acquis à partir du moyen de stockage (8) ou acquis en fonction d'une vitesse de moteur et l'angle de la soupape de commande d'échappement (6) détecté par le moyen de détection d'angle (15) soient coïncidents, et
dans lequel un mode dans lequel un angle cible de la soupape de commande d'échappement (6) est acquis en fonction de l'angle de papillon et de la vitesse de véhicule et un mode dans lequel un angle cible de la soupape de commande d'échappement (6) est acquis en fonction de la vitesse de moteur peuvent être choisis manuellement.

2. Système de commande d'échappement selon la revendication 1, dans lequel, dans un mode dans lequel un angle cible de la soupape de commande d'échappement (6) est acquis en fonction de la vitesse de moteur, un angle cible de la soupape de commande d'échappement (6) établi en fonction de la vitesse de moteur du moteur à combustion interne (1) est stocké dans le moyen de stockage (8).

3. Véhicule muni d'un système de commande d'échappement, comprenant :

un système de commande d'échappement selon la revendication 1 ou 2 ; et
une transmission à variation continue.

Fig. 1

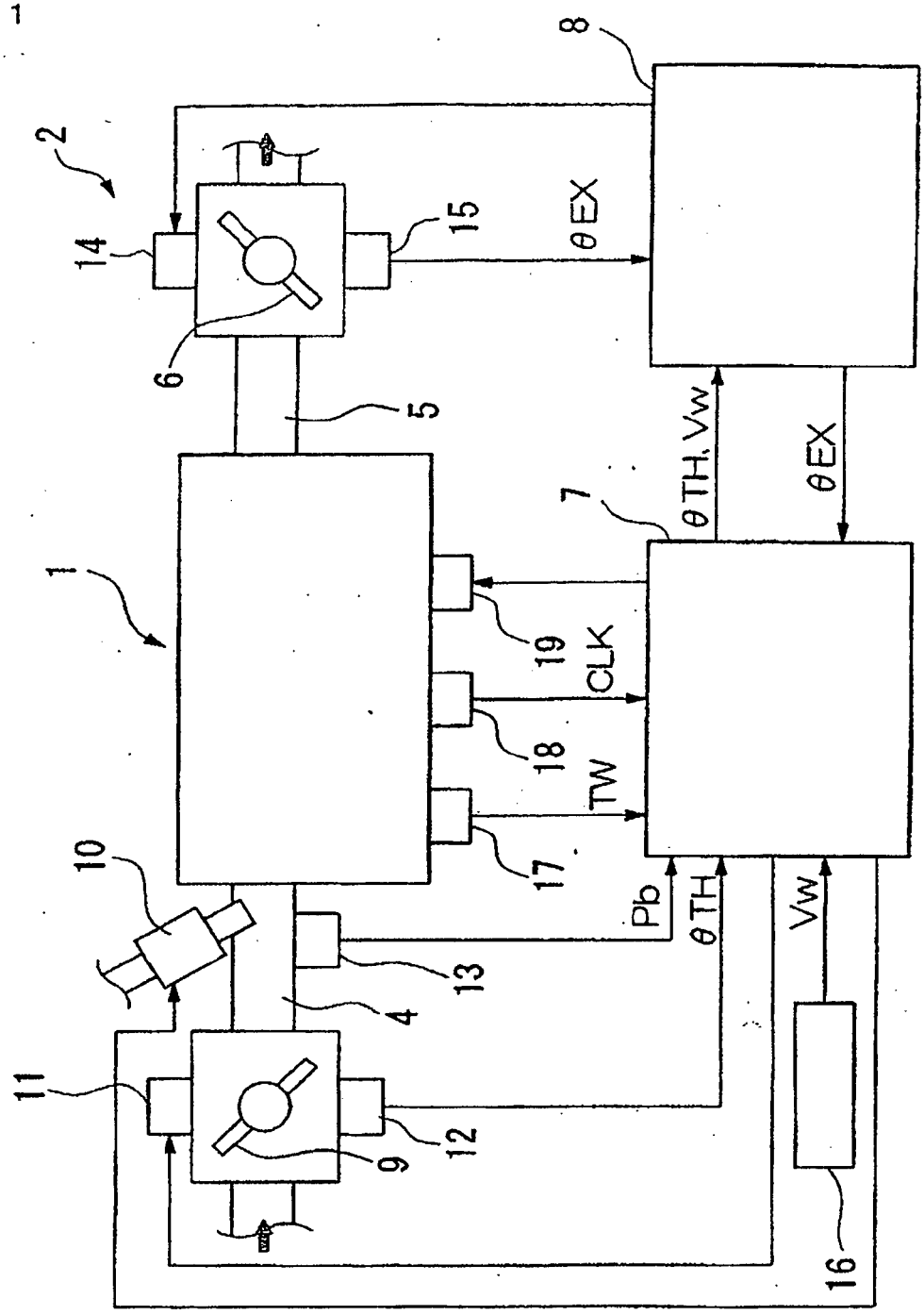

8
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θEX
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θTH, Vw
θEX
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CLK
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10
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16

Fig. 2

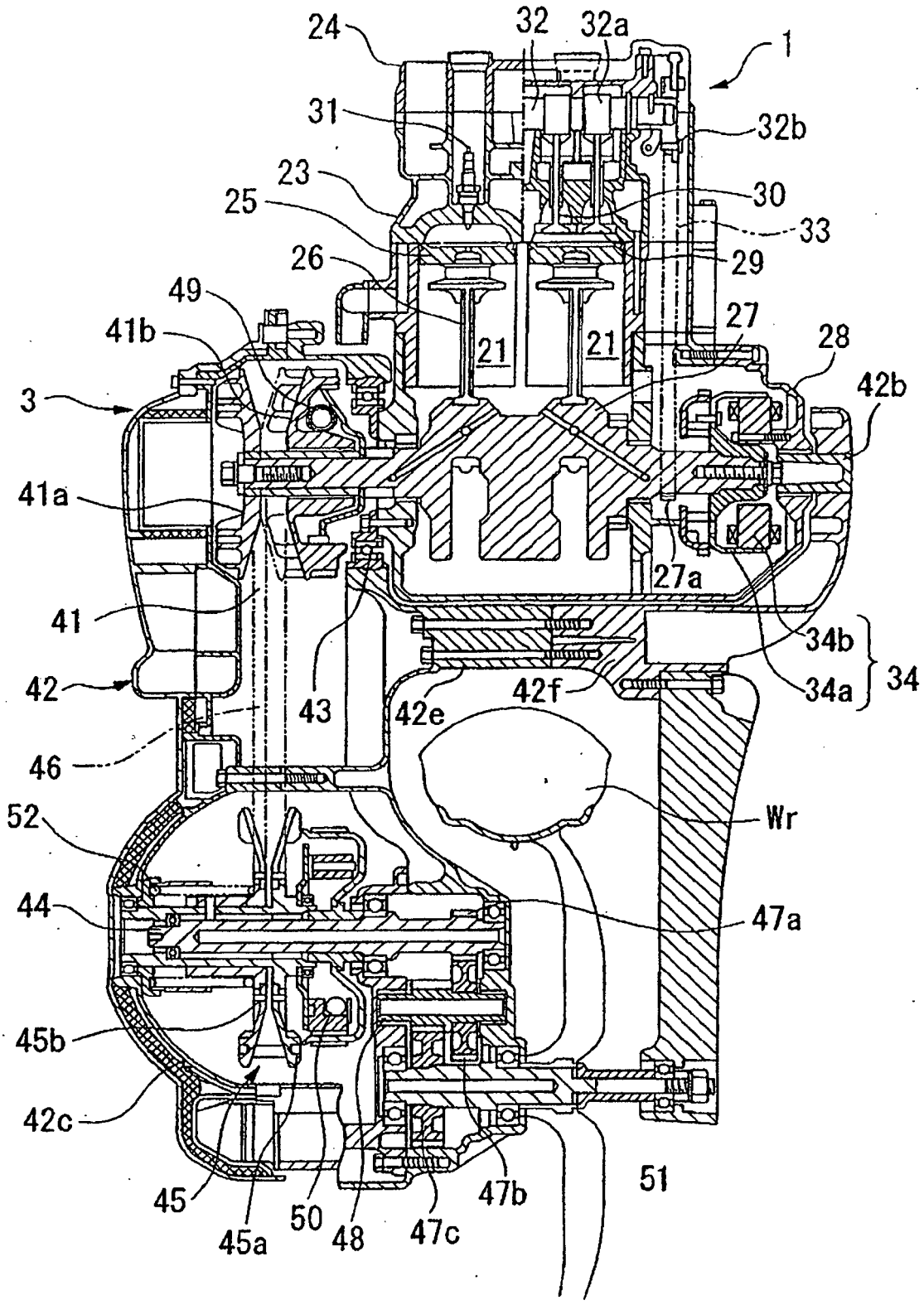

24
32
32a
1
31
32b
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33
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29
49
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41b
21
21
28
3
42b
41a
27a
41
34b
34
42
43
42e
42f
34a
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Wr
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44
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45b
42c
45
45a
50
48
47c
47b
51

Fig. 3

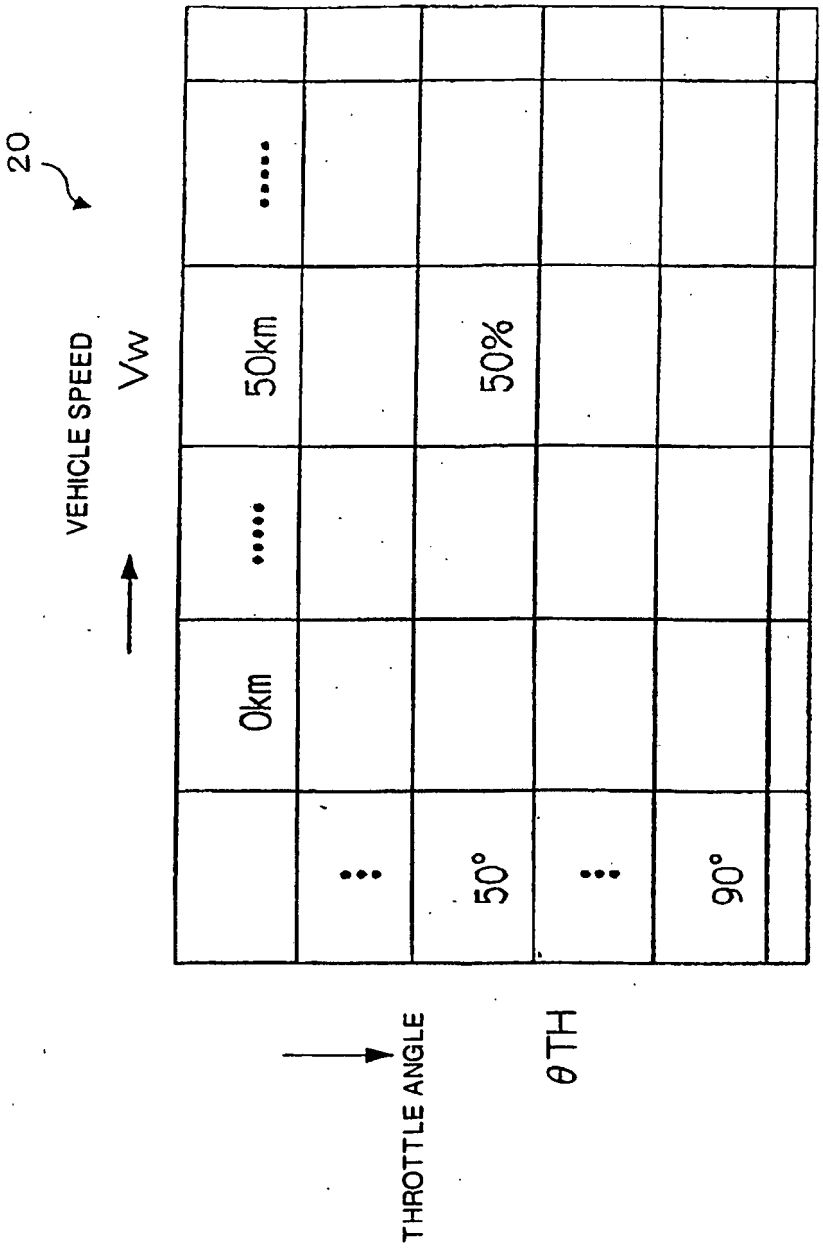


Fig. 4

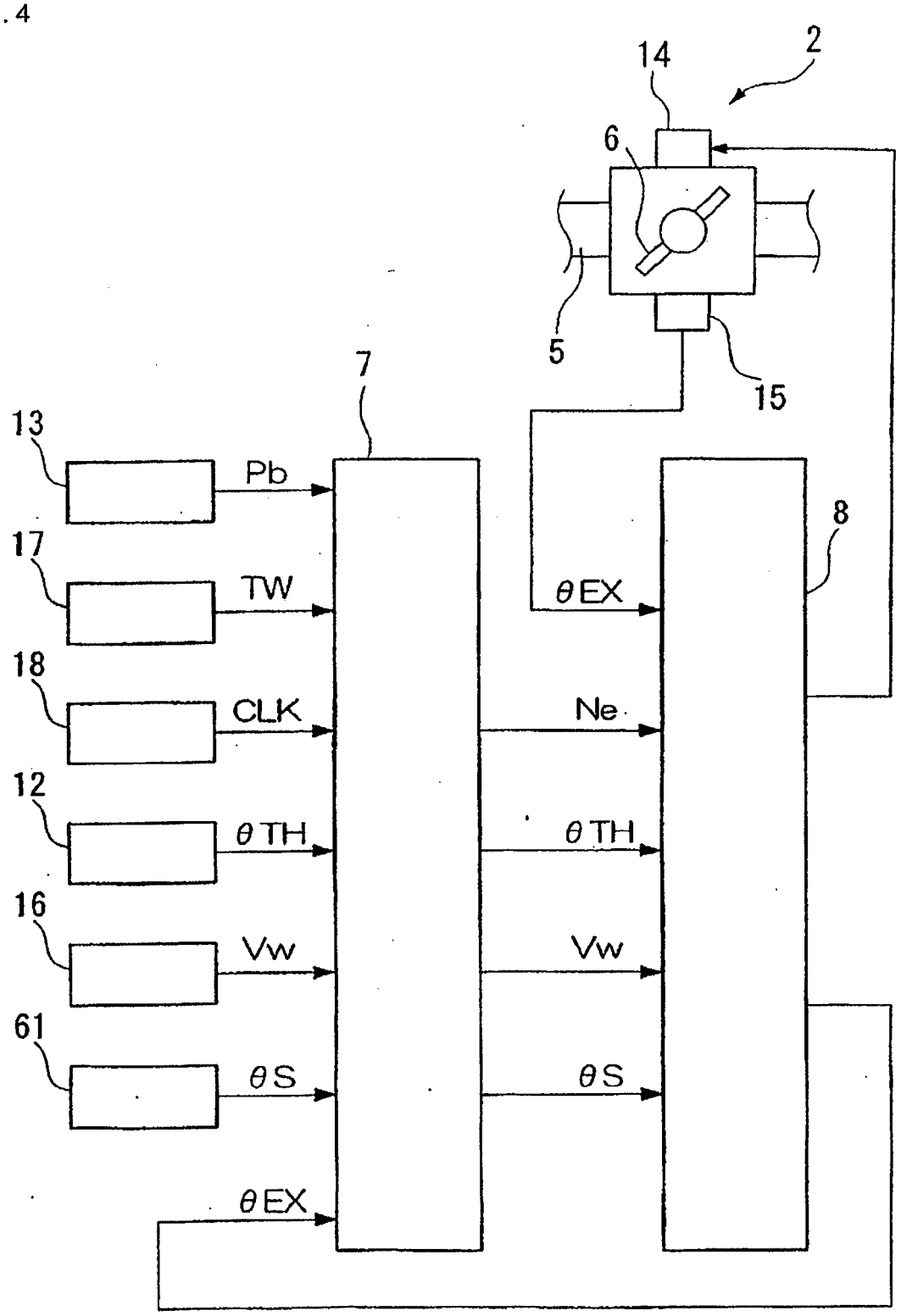

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Fig. 5

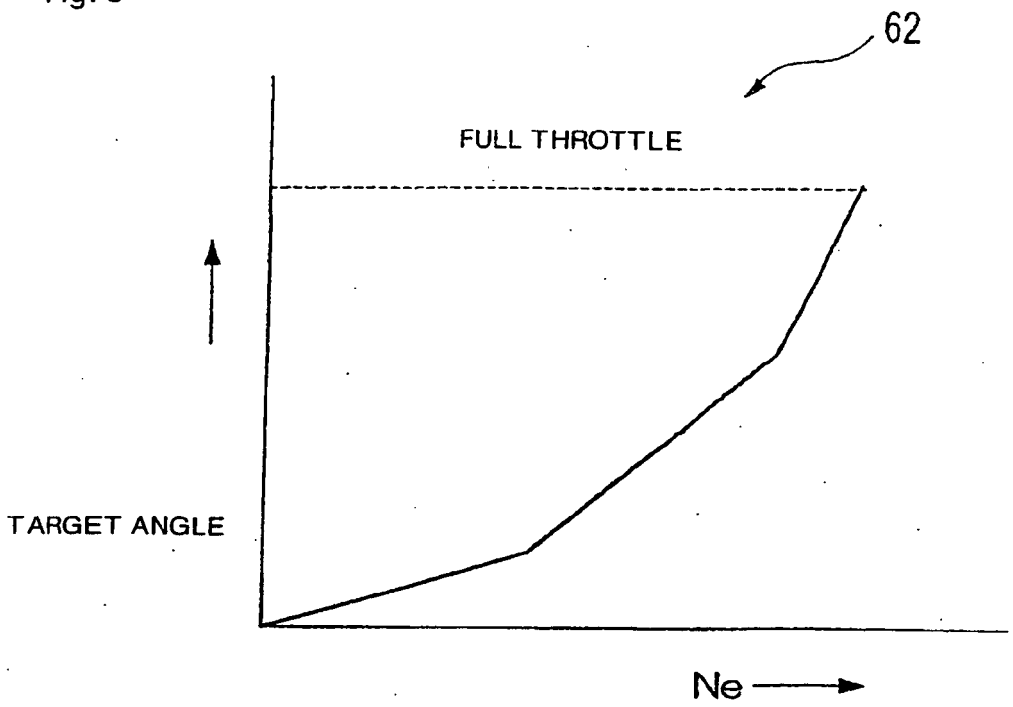
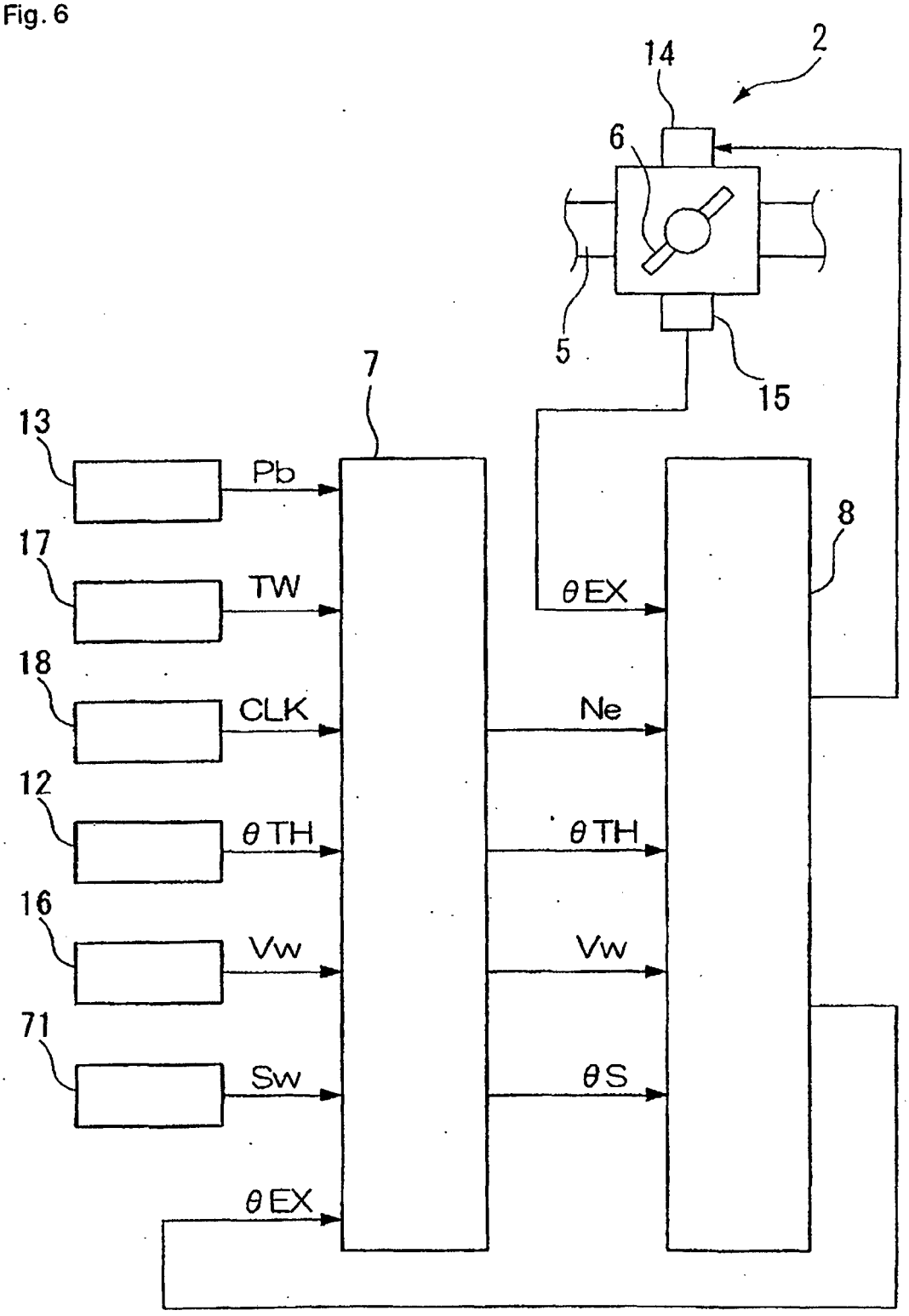


Fig. 6


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Pb
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TW
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CLK
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θTH
16
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71
Sw
θEX
8
θEX
Ne
θTH
Vw
θS

REFERENCES CITED IN THE DESCRIPTION

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