

DIRECCIÓN DE NUEVAS CREACIONES

Bogotá, D.C.,

Abogado(a)/Señor(a)
NELSON JAVIER ROLDAN CASTRO

Asunto:	Radicación:	12-171484- -3
	Trámite:	3
	Evento:	1
	Actuación:	519
	Oficio:	13285
	Folios:	5

Patente de Invención				Patente de Modelo de Utilidad	X
Vía Nacional	X				
Vía PCT (Fase Nacional)		Capítulo I		Capítulo II	
No. Solicitud Internacional					
Fecha de Presentación Internacional					

Como resultado del Examen de Fondo realizado, con fundamento en el artículo 85 y en concordancia con el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica:

1. Documentos estudiados

Descripción:	Rad. N° 12-171484-00000-0000	01/Octubre/2012
Reivindicaciones:	Rad. N° 12-171484-00000-0000	01/Octubre/2012
Dibujos:	Rad. N° 12-171484-00000-0000	01/Octubre/2012

2. Objeto de la invención

En el presente documento se aplicará lo establecido en la Circular Única en su Título X, con respecto a que cuando la solicitud contenga más de diez (10) reivindicaciones y no se haya pagado la tasa complementaria, sólo se estudiarán las cubiertas por la tasa pagada al momento de realizar el examen de patentabilidad consagrado en el artículo 45 de la Decisión 486.

Título de la solicitud: “Carro eléctrico con autogeneración de energía” (Fl. 1).

El problema planteado en esta solicitud consiste en la necesidad de aprovisionamiento de energía eléctrica a un vehículo, la cual podría ser generada por medio de dispositivos eólicos.

Para resolver este problema técnico, la solicitud en estudio propone que en la parte frontal interna del vehículo se dispongan dos turbinas eólicas, las cuales aprovecharán la energía del viento que entra por dos aberturas frontales, el cual, posteriormente es evacuado por dos aberturas que están a lado y lado del vehículo.

El objeto de la presente Solicitud se relaciona con la Clasificación Internacional de Patentes (CIP): B60L8/00.

3. De la Solicitud de Patente

Reivindicaciones (Art 30 D 486, Art 22 PCT)

El capítulo reivindicatorio no es claro porque:

- 1- Las expresiones “trabajan intercaladas entre sí” (reivindicación 3) y “que permiten que las turbinas giren de forma sincronizada” (reivindicación 4); describen funciones, efectos, ventajas o resultados a alcanzar de los elementos del carro eléctrico reclamado. Para mayor claridad, el producto reclamado se debe definir técnicamente mediante sus características estructurales. Se sugiere al solicitante eliminar la expresiones citadas.
- 2- El término “sistema” (reivindicación 4) no está incluido dentro del marco legal que define un modelo de utilidad. De acuerdo con el artículo 81 de la decisión 486, se debe caracterizar “un artefacto, herramienta, instrumento, mecanismo u otro objeto”. En este caso particular, se sugiere reemplazar el término “sistema” por “conjunto”.

4. Determinación del Estado de la Técnica

El estado de la técnica se determinó con base en la fecha de presentación de la solicitud de patente nacional: octubre 1 de 2012, y se encontraron los siguientes documentos que anticipan el objeto de esta solicitud:

Item	Documento	Título	Fecha de Publicación
D1	US 5'680,032	'Wind-Powered battery charging system'	21/Octubre/1997
D2	US 5'850.108	'Fluid flow power generation system with foil'	15/Diciembre/1998
D3	US 2011/0280709	'Wind-gas engine assembly and motor vehicle with the same'	17/Noviembre/2011
D4	US 8'240,416	'Motor vehicles'	14/Agosto/2012

El documento D1¹ divulga un vehículo que utiliza turbinas eólicas (23) (Col. 4, línea 27) para el aprovisionamiento de energía eléctrica. El viento es encausado por un conducto que tiene entradas (17) en la parte frontal del vehículo y dos salidas (29'a) y (29''a) dispuestas a cada lado del mismo (Col. 4, líneas 62 a 67; Col. 5, líneas 1 a 7; Figs. 1 y 4).

1 https://www.google.com/patents/US5680032?dq=5680032&hl=en&sa=X&ei=_2fgUbX1POSzygH8nYGYDA&ved=0CDYQ6AEwAA

El documento D2² divulga unas turbinas eólicas (12) dispuestas en la parte frontal interior del vehículo, que aprovechan la energía del viento que ingresa por entradas frontales y sale por aberturas (20) dispuestas a lado y lado del mismo (Col. 2, líneas 57 a 60; Fig. 1).

El documento D3³ divulga un vehículo con dos turbinas eólicas (57) dispuestas en la parte frontal interior del vehículo, las cuales están acopladas a un conjunto de engranajes (53) y (54) (Párr. [0057], Figs. 1 y 5).

El documento D4⁴ divulga un vehículo con dos turbinas eólicas (6) dispuestas en la parte frontal de un vehículo, las cuales están acopladas a los engranes (7), (15) y (32) (Col. 5, líneas 14 a 19; Fig. 9)

5. Examen de Patentabilidad (Art 14 D486)

Novedad (Art 16 D486)

La reivindicación 1 consiste en un carro eléctrico *“caracterizado por tener dos entradas de aire en su parte frontal (1) y (2) y las respectivas salidas de aire a los costados del vehículo (3) y (4).”* (ver página 10 incluida bajo el radicado N° 12-171484-00000-0000).

Comparación de las características técnicas **esenciales**, con las del Estado de la Técnica:

Características esenciales	D1	D2
Carro eléctrico caracterizado por:	Carro eléctrico caracterizado por:	Carro eléctrico caracterizado por:
Entradas en su parte frontal.	Entradas en su parte frontal (17) (Col. 4, líneas 62 a 67; Col. 5, líneas 1 a 7; Figs. 1 y 4).	Entradas en su parte frontal (Col. 2, líneas 57 a 60; Fig. 1).
Salidas a los costados del vehículo.	Salidas a los costados del vehículo (29'a) y (29''a) (Col. 4, líneas 62 a 67; Col. 5, líneas 1 a 7; Figs. 1 y 4).	Salidas a los costados del vehículo (20) (Col. 2, líneas 57 a 60; Fig. 1).

Las características **esenciales** del carro eléctrico de la reivindicación 1 habían sido divulgadas previamente en D1 y D2. En consecuencia, la reivindicación 1 no es nueva.

La reivindicación 2 consiste en un carro eléctrico *“caracterizado por tener un par de turbinas eólicas (5) y (6) alojadas en el interior de la parte frontal del auto”* (ver página 10 incluida bajo el radicado N° 12-171484-00000-0000).

Comparación de las características técnicas **esenciales**, con las del Estado de la Técnica:

Características esenciales	D1	D2
Carro eléctrico caracterizado por:	Carro eléctrico caracterizado por:	Carro eléctrico caracterizado por:
Un par de turbinas alojadas en el interior de la parte frontal del auto.	Un par de turbinas (23) alojadas en el interior de la parte frontal del auto (Col. 4, línea 27).	Un par de turbinas (12) alojadas en el interior de la parte frontal del auto (Col. 2, líneas 57 a 60; Fig. 1).

2 [https://www.google.com/patents/US5850108?](https://www.google.com/patents/US5850108?pg=PA1&dq=5850108&hl=en&sa=X&ei=KGjgUamQDMaRyAGJ3oGoBQ&ved=0CDYQ6AEwAA)
pg=PA1&dq=5850108&hl=en&sa=X&ei=KGjgUamQDMaRyAGJ3oGoBQ&ved=0CDYQ6AEwAA

3 [https://www.google.com/patents/US20110280709?](https://www.google.com/patents/US20110280709?pg=PA20&dq=20110280709&hl=en&sa=X&ei=R2jgUZCJHanOyQGkzYHYCQ&ved=0CDYQ6AEwAA)
pg=PA20&dq=20110280709&hl=en&sa=X&ei=R2jgUZCJHanOyQGkzYHYCQ&ved=0CDYQ6AEwAA

4 [https://www.google.com/patents/US8240416?pg=PA13&dq=8240416&hl=en&sa=X&ei=YWjgUZekl-](https://www.google.com/patents/US8240416?pg=PA13&dq=8240416&hl=en&sa=X&ei=YWjgUZekl-m4yAGPq4DoBA&ved=0CDYQ6AEwAA)
m4yAGPq4DoBA&ved=0CDYQ6AEwAA

D3	D4
Carro eléctrico caracterizado por: Un par de turbinas (57) alojadas en el interior de la parte frontal del auto (Párr. [0057], Figs. 1 y 5).	Carro eléctrico caracterizado por: Un par de turbinas (6) alojadas en el interior de la parte frontal del auto (Col. 5, líneas 14 a 19; Fig. 9).

Las características **esenciales** del vehículo de la reivindicación 2 habían sido divulgadas previamente en D1 a D4. En conclusión, la reivindicación 2 carece de novedad.

Por su parte, la reivindicación 4 tampoco contiene características novedosas, debido a que los documentos D3 y D4 también divulgan conjuntos de engranajes (D3: Párr. [0057], Figs. 1 y 5; D4: Col. 5, líneas 14 a 19; Fig. 9).

De igual manera, la reivindicación dependiente 3 no menciona características técnicas tangibles adicionales que puedan brindarle novedad al objeto de la reivindicación 1, puesto que ésta se encuentra redactada en términos de resultados a alcanzar.

6. Conclusión

Los requisitos de Patentabilidad de la presente Solicitud están afectados así:

Item	Documento	Reivindicaciones afectadas	Requisito que afecta
D1	US 5'680,032	1 a 4	Novedad
D2	US 5'850.108	1 a 4	Novedad
D3	US 2011/0280709	2 a 4	Novedad
D4	US 8'240,416	2 a 4	Novedad

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de treinta (30) días contados a partir de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Se invita al solicitante se sirva indicar, si así lo considera, su renuncia al término faltante de treinta (30) días para dar respuesta a este requerimiento y presentarla por escrito.

Finalmente, se le recuerda al solicitante que si como respuesta a este requerimiento llegara a modificar el capítulo reivindicatorio y éste contenga más de diez (10) reivindicaciones, no pagará la tasa de modificación voluntaria pero sí la correspondiente al pago por reivindicación adicional.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única No. 10 de 2001.



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El anterior requerimiento fue notificado por fijación en lista, de fecha 2013-07-30

Elaboró: Monica Andrea Gutierrez Almonacid
Revisó: Rosa Patricia Tellez Chavarro



US005680032A

United States Patent [19]

Pena

[11] Patent Number: **5,680,032**[45] Date of Patent: **Oct. 21, 1997**[54] **WIND-POWERED BATTERY CHARGING SYSTEM**[75] Inventor: **Mario Pena**, Houston, Tex.[73] Assignee: **Spinmotor, Inc.**, Houston, Tex.[21] Appl. No.: **574,521**[22] Filed: **Dec. 19, 1995**[51] Int. Cl.⁶ **H02J 7/32**[52] U.S. Cl. **320/61; 290/55; 322/2 R**[58] Field of Search 320/5, 61, 62,
320/63; 322/2 R, 35; 290/55, 44, 1 R[56] **References Cited****U.S. PATENT DOCUMENTS**

757,800	4/1904	Williams .	
3,248,967	5/1966	Lewis	74/572
3,444,946	5/1969	Waterbury	180/65
3,556,239	1/1971	Sparks	180/65
3,672,244	6/1972	Nasvytis	74/899
3,878,913	4/1975	Lions et al.	180/65 R
3,970,409	7/1976	Luchuk	416/145
4,002,218	1/1977	Horvat	180/165
4,012,163	3/1977	Baumgartner et al.	415/2
4,075,545	2/1978	Haberer	320/61
4,141,425	2/1979	Treat	180/65
4,168,759	9/1979	Hull et al.	180/65
4,254,843	3/1981	Han et al.	180/165
4,314,160	2/1982	Boodman et al.	290/55
4,423,368	12/1983	Bussiere	322/35
4,498,015	2/1985	Gottfried	290/15
4,632,205	12/1986	Lewis	180/165
5,214,333	5/1993	Kawamura	310/153
5,269,197	12/1993	Yang	74/572
5,280,827	1/1994	Taylor et al.	180/165

FOREIGN PATENT DOCUMENTS

877563 7/1941 France .

2498532	1/1981	France .
2665413	8/1990	France .
2820628	11/1979	Germany .
58-56943	4/1983	Japan .
572826	1/1976	Switzerland .
2013597	2/1979	United Kingdom .

OTHER PUBLICATIONS

Paul Gipe, Wind Power for Home & Business, Real Goods Book Co., 1993 pp. 102-105, 108-109, 115.

Frank R. Eldridge, Wind Machine (2nd ed.) 1980, Van Nostrand Reinhold Company, pp. 40, 137, 139.

Paul Rosenberg, Alternative Energy Handbook 1993, The Fairmont Press, Inc. p. 231.

Paul G. Hewitt, Conceptual Physics, 1978, Addison-Wesley Publishing Co. pp. 300-302, 318, 22.

Nicholes P. Cheremisinoff, Fundamentals of Wind Energy, Ann Arbor Science Publishers, Inc. (1979), pp. 61, 62.

Primary Examiner—Edward Tso

Attorney, Agent, or Firm—Madan & Morris, PLLC

[57] **ABSTRACT**

During forward motion of an electrically-powered vehicle, air is captured at the front of the vehicle and channeled to one or more turbines. The air from the turbines is discharged at low pressure regions on the sides and/or rear of the vehicle. The motive power of the air rotates the turbines, which are rotatably engaged with a generator to produce electrical energy that is used to recharge batteries that power the vehicle. The generator is rotatably engaged with a flywheel for storing mechanical energy while the vehicle is in forward motion. When the vehicle slows or stops, the flywheel releases its stored energy to the generators, thereby enabling the generator to continue recharging the batteries. The flywheel enables the generators to provide a more stable and continuous current flow for recharging the batteries.

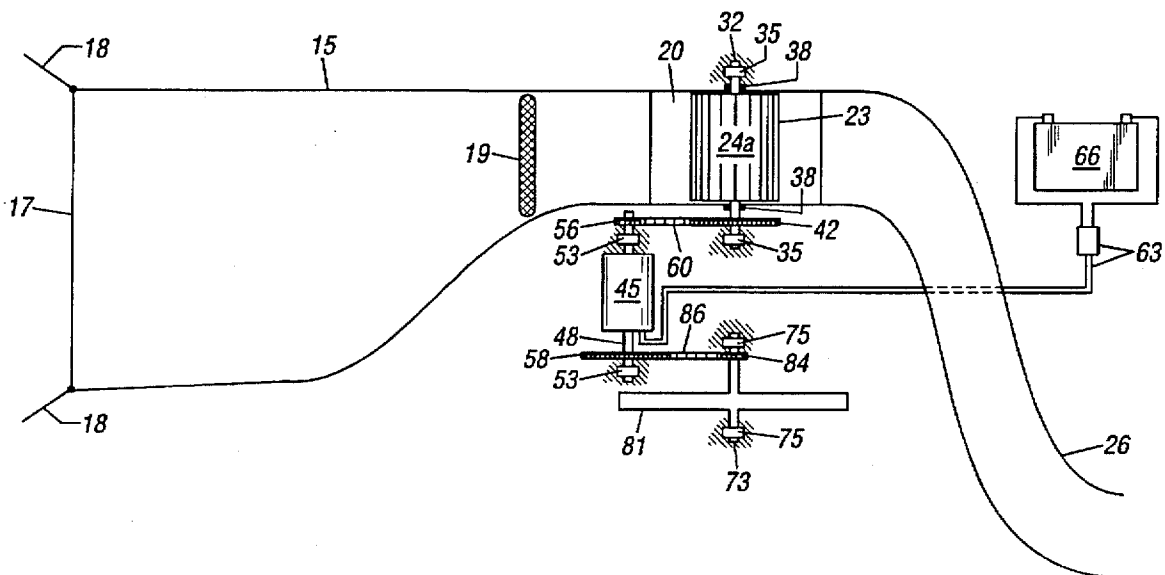
30 Claims, 3 Drawing Sheets

FIG. 1

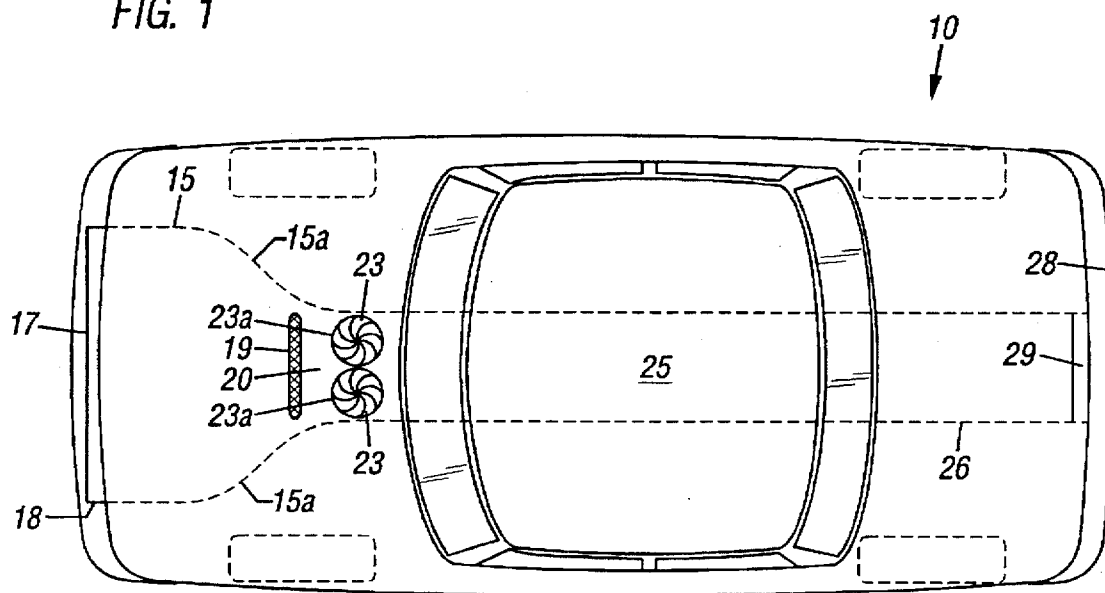


FIG. 2

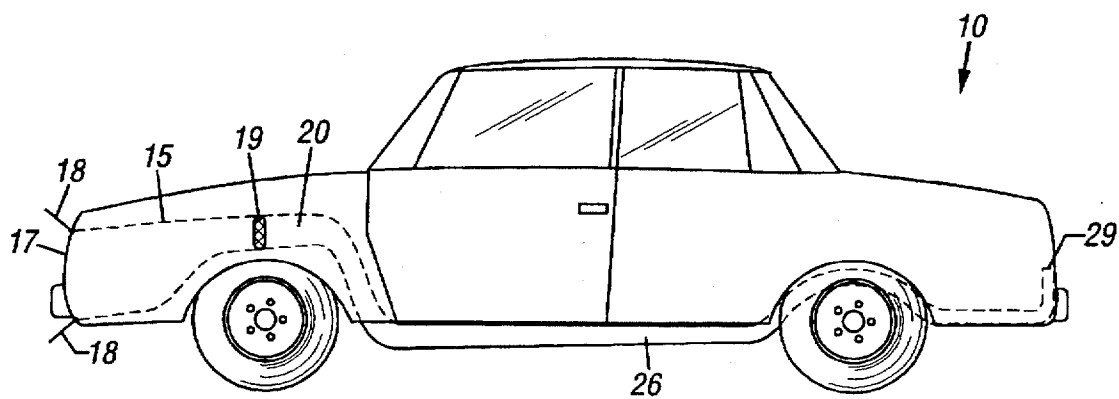


FIG. 3

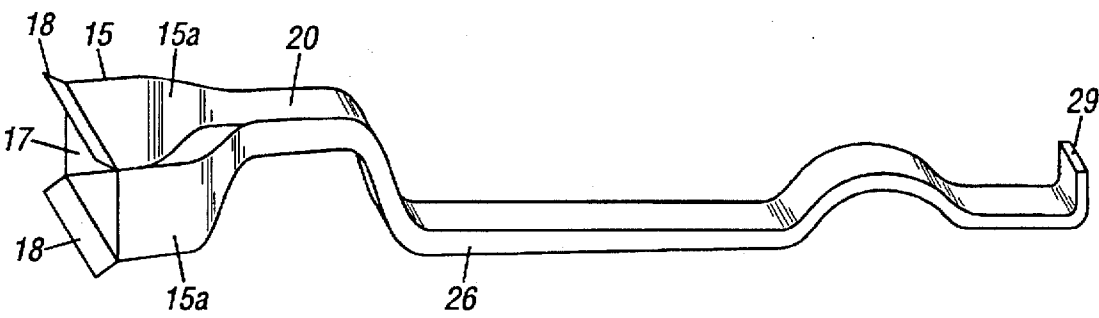


FIG. 4

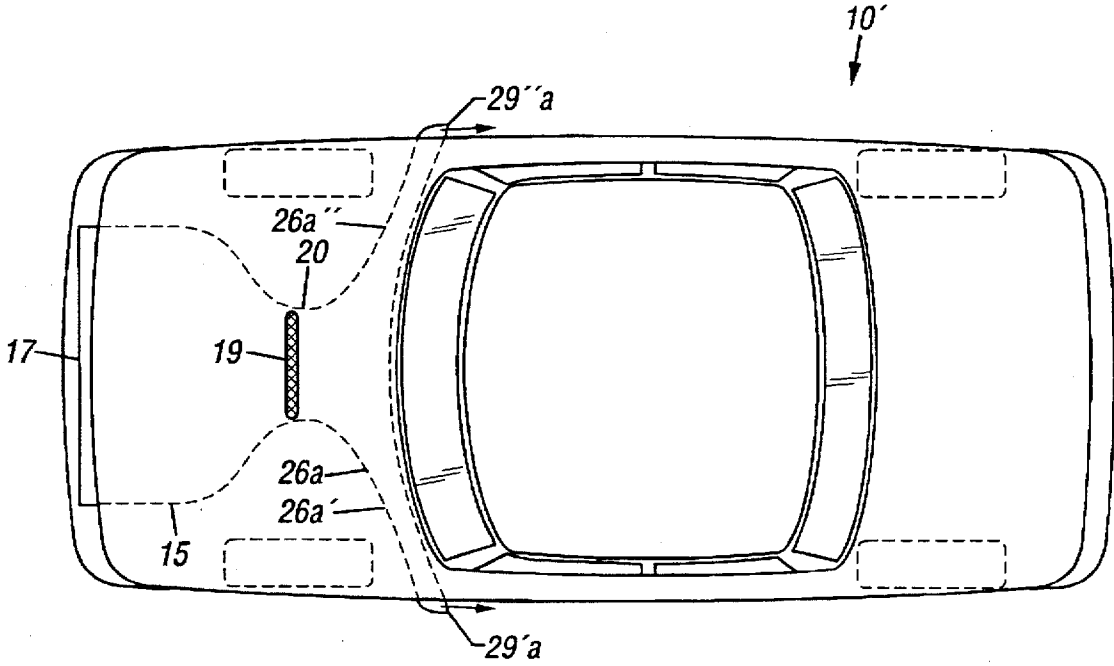


FIG. 5

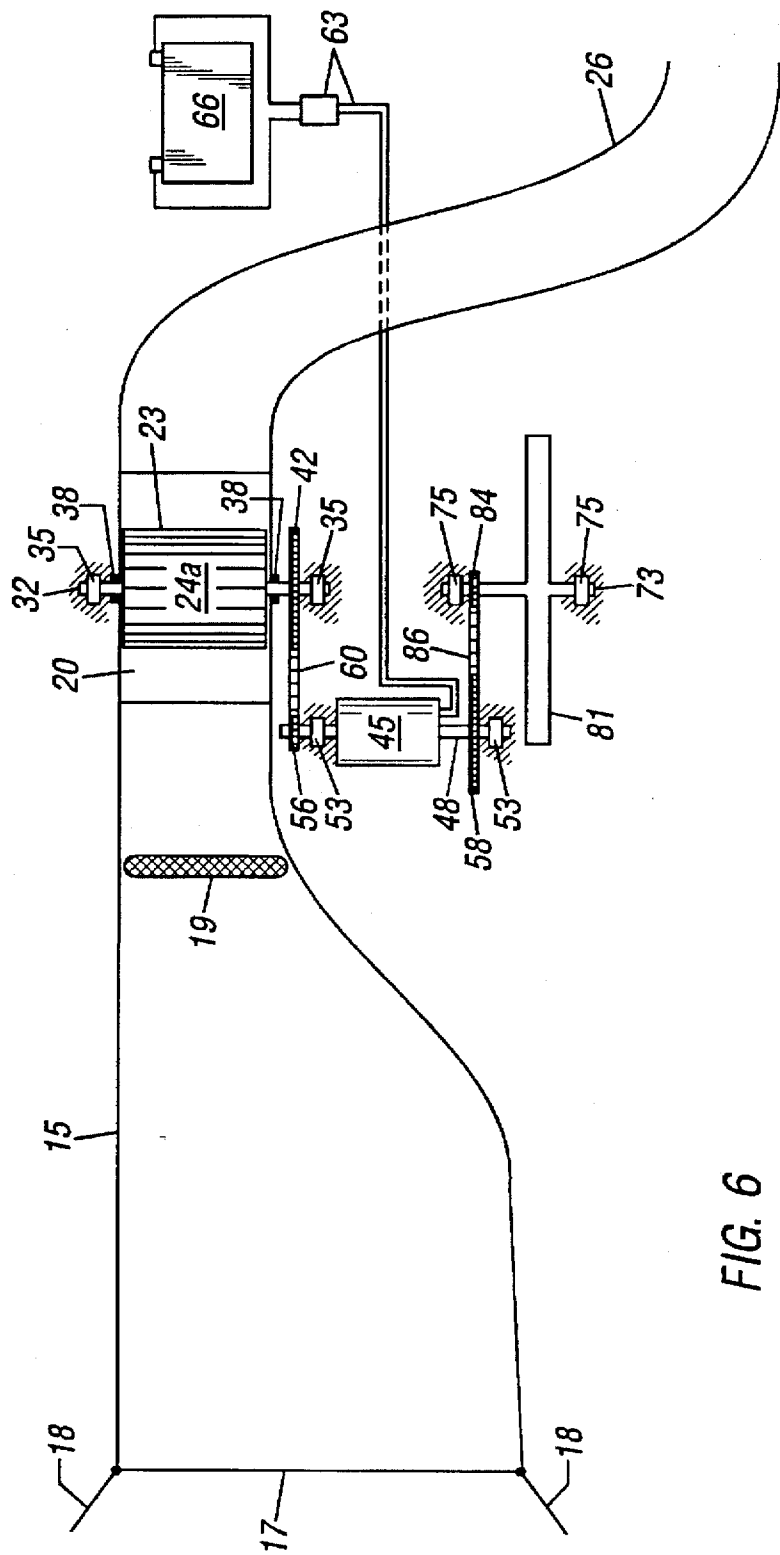
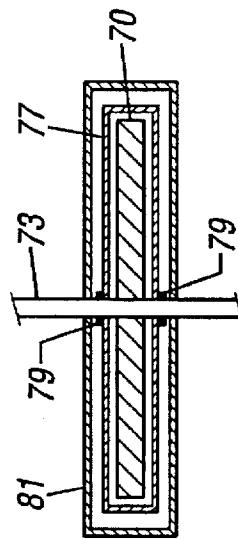


FIG. 6



WIND-POWERED BATTERY CHARGING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to an electrically powered vehicle and more particularly to a system for charging batteries which utilizes a wind-operated turbine and generator for charging the batteries while the vehicle is in motion and a flywheel for charging the batteries when the vehicle slows down or is stopped.

2. Description of the Related Art

Environmental pollution, noise and depletion of crude oil reserves due to the increasing use of gasoline-powered vehicles continue to be of significant concern. Electrically-powered vehicles are known to solve some of the problems associated with the gasoline-powered vehicles, but such vehicles are not yet in widespread use. Electrically-powered vehicles have certain drawbacks as compared to vehicles powered by conventional gasoline engines. Significant drawbacks include limited travel range between battery recharging and excessive time required for recharging the batteries. The average travel distance between battery recharging for currently available electrically powered vehicles is considerably less than the gasoline powered vehicles. Also, it usually takes several hours to recharge the batteries while the vehicle remains inoperative.

Increasing the travel range of electrically-powered vehicles between downtimes for battery recharging can significantly increase the use of electrically-powered vehicles. The range of electrically-powered vehicles can be increased by charging the batteries while the vehicle is in motion. This has typically been accomplished by utilizing air currents as a motive power.

For example, U.S. Pat. No. 5,280,827 issued to Taylor et. al. discloses a long Venturi tube extending along an upper portion of a vehicle that directs air flow from the front of the vehicle to a large wind turbine mounted at the rear of the vehicle. The wind turbine rotates about an axis perpendicular to the axis of the vehicle body. A pair of elongated lower screw-type turbines are contained in separate lower venturi effect tubes extending along the lower side of the vehicle below the passenger cab and discharge so as to aid in the rotation of the large, rear-mounted wind turbine.

U.S. Pat. No. 4,423,368 issued to Bussiere discloses an air duct extending from an inlet along the roof section of a vehicle body above the windshield and over the passenger compartment to air outlets located in the rear fender wells of the vehicle. Air turbines, operatively connected to electric generators, are positioned at the air outlets and are driven by air currents flowing from the duct. Additionally, U.S. Pat. No. 4,254,843 issued to Han et. al. teaches a whirl ventilator system to produce a whirling air flow that rotates a fan to drive an alternator such that air flow from the movement of the vehicle generates electricity to charge batteries. The batteries are connected to an electric motor which rotates a drive shaft, which is coupled to a driven shaft through a clutch mechanism. The driven shaft rotates an axle via a conventional differential mechanism. The clutch mechanism has a flywheel mounted about it, and the flywheel is rotatively engaged with an electric generator.

U.S. Pat. No. 4,168,759 issued to Hull, deceased et. al. discloses an impeller mounted nearly horizontal in a chamber above the passenger compartment of an automobile. The chamber has an opening in its front for receiving air and a

rear exit vent. The impeller is rotated by air forced through the chamber and mechanically coupled to a generator to provide auxiliary power for the automobile.

Although, the above-noted and other patents have contributed to the art of electrically-powered vehicles, significant improvements are needed to solve the short travel distance problems associated with such vehicles. The present invention addresses the above-noted problem and provides a system for efficiently charging batteries while the vehicle is in motion and when the vehicle is intermittently stopped.

SUMMARY OF THE INVENTION

The present invention provides a wind-powered battery charging system for an electrically-powered vehicle having a front, opposing longitudinal sides, a rear, and at least one battery for storing and providing electrical energy. The battery charging system comprises: a duct oriented generally longitudinally in the vehicle, the duct comprises a funnel-shaped air intake duct having a forward opening located in the front of the vehicle for receiving air, an air discharge duct having an air outlet, and a turbine chamber located therebetween; a turbine rotatably secured in the turbine chamber, the turbine having an axis of rotation about a vertical axis; a generator operatively engaged with the turbine; a flywheel operatively engaged with the generator for storing mechanical energy when excess energy is provided by the turbine to the generator and releasing energy when inadequate energy is provided by the turbine to the generator; and electrical circuitry operatively connecting the generator to the battery for recharging the battery.

In a preferred embodiment of the battery charging system, the turbine rotates about a turbine shaft having a turbine gear; the generator is operatively mounted on a generator shaft; the flywheel rotates about a flywheel shaft having a flywheel gear; a first generator gear is mounted on the generator shaft and operatively engaged with the turbine gear; and a second generator gear is mounted on the generator shaft and operatively engaged with the flywheel gear. Preferably, the turbine gear, the first generator gear, the second generator gear, and the flywheel gear are each sized to optimize the rotational speed of its respective component, wherein the turbine gear is larger than the first generator gear, and the gear ratio between the turbine gear and the first generator gear is between one and fifty. Likewise, it is preferred that the second generator gear is larger than the flywheel gear, wherein the gear ratio between the second generator gear and the flywheel gear is between one and fifty.

The battery charging system may include a housing for the flywheel for sealing the flywheel, wherein the flywheel is contained in a reduced atmosphere, and it may further include a catastrophe-containment device for safely containing the flywheel.

The air outlet may be located in the rear of the vehicle, and it may be flared outward. A heat transfer element may be located in the air intake duct. In an alternative embodiment, the air discharge duct is "Y" shaped with air outlets located on the opposing sides of the vehicle.

In one aspect the invention provides a method for charging a battery in an electrically-powered vehicle having a front, opposing longitudinal sides, a rear, and at least one battery for storing and providing electrical energy. The method comprises: capturing air at the front of the vehicle as the vehicle moves in a forward direction; passing the captured air rearward through a duct in the vehicle to a turbine

chamber; rotating a turbine in the turbine chamber with the captured air; exhausting the captured air through an air discharge duct to an air outlet; generating electricity in a generator operatively engaged with the turbine; recharging the battery with the electricity generated in the previous step; storing mechanical energy in a flywheel that is operatively engaged with the generator; and releasing stored energy in the flywheel to the generator for generating electricity.

In another aspect the invention provides an improvement to a wind-powered battery charging system for an electrically-powered vehicle having a forward facing air intake duct, an air exhaust duct, a turbine chamber therebetween, a generator operatively engaged with the turbine and means for the generator to recharge batteries that store energy and provide power to the vehicle. The improvement comprises: a flywheel rotatively engaged with the generator for receiving and storing mechanical energy from the generator and for releasing stored energy to the generator, wherein the gear ratio between the turbine and the generator is between one and fifty; the gear ratio between the generator and the flywheel is between one and fifty; and the air exhaust duct discharges air through an air outlet located in a region defined by the rear of the vehicle and a wave vortex that forms behind the vehicle when the vehicle moves forward, so that the air exhausts into a relatively low-pressure region. The battery charging system may further include a heating element in the air intake duct, and the air discharge duct may be "Y" shaped and discharge air on opposing sides of the vehicle so as to take advantage of a Bernoulli effect.

Examples of the more important features of the invention thus have been summarized rather broadly in order that detailed description thereof that follows may be better understood, and in order that the contributions to the art may be appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject of the claims appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

For detailed understanding of the present invention, references should be made to the following detailed description of the preferred embodiment, taken in conjunction with the accompanying drawings, in which like elements have been given like numerals and wherein:

FIG. 1 shows a top view of an electrically-powered vehicle having a duct for channeling air to turbines, according to one embodiment of the present invention.

FIG. 2 shows a side view of the duct placed in the vehicle shown in FIG. 1.

FIG. 3 is an isometric view of an air intake duct, turbine chamber, and air exhaust duct, according to one embodiment of the invention.

FIG. 4 is a top view of an electrically-powered vehicle, according to an alternative embodiment of the invention.

FIG. 5 shows a partial elevational view of an air intake duct, turbine, generator, and flywheel according to an embodiment of the present invention.

FIG. 6 shows a cross-section of a flywheel placed in a housing that is placed in a catastrophe-containment device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a top view of an electrically-powered vehicle 10 having a duct for channeling air to turbines,

according to one embodiment of the present invention. FIG. 2 shows a side view of the duct placed in the vehicle shown in FIG. 1. FIG. 3 is an isometric view of the air intake duct, turbine chamber, and air exhaust duct, according to one embodiment of the invention. Referring to FIGS. 1-3 the vehicle 10 has an air intake duct 15 disposed longitudinally within the vehicle 10. As the vehicle 10 moves in a forward direction, air or wind enters a forward opening 17 of the air intake duct 15. The air intake duct 15 is preferably funnel shaped from its forward opening 17 to a turbine chamber 20. The cross-sectional area of the air intake duct 15 is greatest at its forward opening 17 and decreases in the direction of the air flow from the forward opening 17 to the turbine chamber 20. As best seen in FIG. 3, one or more adjustable scoops 18 may be used to adjust the wind intake into the intake duct to a desired volume. For example, it may be desirable to increase the wind intake at low vehicular speeds and to decrease the wind intake at high vehicular speeds, so as to regulate the air flow into the turbine chamber 20.

As air flows through the air intake duct 15, it is compressed and accelerated by the converging walls 15a of the air intake duct 15 and passed to the turbine chamber 20. In an alternative embodiment, a heat transfer element 19 may be placed at a suitable place in the air intake duct for heating, and thereby expanding, the incoming air prior to discharging the air into the turbine chamber.

One or more than one turbines 23 are placed in the turbine chamber 20 and have blades 23a designed to operatively engage the air flowing through the turbine chamber 20. The turbines 23 preferably rotate about their respective vertical axis. Air flowing into the turbine chamber 20 impinges on the blades 23a of the turbines 23 and applies a force that causes the turbines 23 to rotate. Although the embodiment of FIG. 1 shows two side-by-side placed turbines, the number of turbines utilized and their relative placement in the turbine chamber 20 will depend upon the design criteria used.

An air discharge duct 26 extends rearward from the turbine chamber 20 to an air outlet 29. Air, having passed through the turbines 23, is discharged into the air discharge duct 26, from where it is discharged into the atmosphere via the air outlet 29. The cross-sectional area of the air discharge duct 26 is greater than the exhaust outlet of the turbine chamber 20 so as to minimize pressure in the air discharge duct 26.

In one embodiment, the air outlet 29 is located in the rear of the car so that the air is discharged in a region of lower air pressure as compared to the air pressure in the forward opening 17 of the air intake duct 15. A wave vortex of air currents forms at the rear of a car being driven in a forward direction. Air outlet 29 is preferably located in the region defined by the rear of the vehicle 10 and the wave vortex because that region has a lower pressure than other surfaces of the vehicle 10. By discharging the air into a region of lower pressure than the pressure at the forward opening 17 of the air intake duct 15, an aspiration effect is introduced which increases the flow of air through the turbines 23. The flow of air through the turbines 23 may also be increased by flaring out the air discharge duct 26 at the air outlet 29, which further reduces the air discharge pressure.

FIG. 4 shows an alternative embodiment for discharging exhaust air from the turbine chamber 20 into the atmosphere. In such an embodiment, the air discharge duct 26 is split to discharge the air from the turbine chamber to either side of the vehicle 10'. For example, the discharge duct may be split to form a "Y" shape to provide two air ducts 26a' and 26a''

to discharge the exhaust air to their respective air outlets 29a' and 29a'' located on opposite sides of the vehicle 10'. The air outlets 29 are shaped and positioned to provide an aspiration effect to take advantage of the Bernoulli effect. This provides a lower discharge pressure for the turbines 23, which optimizes the rotational energy imparted to the turbines 23 by the air flowing therethrough.

FIG. 5 shows a partial elevational view of an air intake duct, turbine, generator, and flywheel according to an embodiment of the present invention. FIG. 6 shows a cross-section of a flywheel placed in a housing that is placed in a catastrophe-containment device. Referring to FIGS. 5-6, the turbines 23 rotate about an upright turbine shaft 32, which is supported by bearing supports 35. The bearing supports 35 are fastened to the vehicle 10 for support. Where the upright turbine shaft 32 passes through upper and lower surfaces of the turbine chamber 20, a seal 38 is provided to prevent air leakage, but yet allow the upright turbine shaft 32 to rotate freely. A turbine gear 42 is fastened to the upright turbine shaft 32.

A generator 45 is positioned near the turbines 23. One generator 45 is preferred, but the invention is operative with more. The generator 45 has an armature within fastened to an upright generator shaft 48. Generator bearing supports 53 secure the generator 45 by securing the upright generator shaft 48 to the vehicle 10. A first generator gear 56 and a second generator gear 58 are secured to the upright generator shaft 48. A turbine chain 60 is rotatively engaged with the turbine gear 42 and the first generator gear 56 for transferring rotational energy from the turbines 23 to the generator 45. Thus, as the turbines 23 are rotated by air flowing through them, the rotational energy imparted to the turbines 23 is transferred to the generator 45 by the turbine chain 60.

The rotational energy imparted to the first generator gear 56 is transferred through the upright generator shaft 48 to the armature within the generator 45, causing the armature to rotate. The rotation of the armature within the generator 45 causes the generator 45 to generate electricity. The generator 45 is operatively connected by electrical circuitry 63 to storage batteries 66. The electricity generated by the generator 45 charges the storage batteries 66.

Still referring to FIG. 5, the various components cooperate to provide an energy-efficient system. The storage batteries 66 provide electrical energy for powering the electrical vehicle 10. As the vehicle 10 is driven in a forward direction, air or wind is channeled through the forward opening 17 of the air intake duct 15 to the turbines 23, causing them to rotate. That rotational energy is transferred, via the turbine chain 60, to the armature within the generator 45, where the rotation of the armature causes the generator 45 to generate electricity, which is used to recharge the storage batteries 66. Thus, a clean, energy-efficient, self-contained, closed-loop system is provided.

This system is improved by providing a flywheel 70 positioned near the generator 45. One flywheel 70 is preferred, but the invention is operative with more. As seen best in FIG. 6, the flywheel 70 is secured to and rotates about an upright flywheel shaft 73. Flywheel bearing supports 75 support and secure the upright flywheel shaft 73, yet allow it to rotate freely. The flywheel bearing supports 75 are themselves secured to the vehicle 10, thereby securing the flywheel 70. The flywheel 70 is maintained in a reduced atmosphere by sealing it in a housing 77 as shown in FIG. 6. The housing 77 minimizes wind resistance, allowing the flywheel 70 to operate more efficiently. Where the upright flywheel shaft 73 passes through upper and lower surfaces of

the housing 77, a housing seal 79 maintains the reduced atmosphere, but yet allows the upright flywheel shaft 73 to rotate freely. For safety, the flywheel 70 is further contained in a catastrophe-containment device 81 that applies emergency braking and/or captures the flywheel if the vehicle becomes involved in a collision.

A flywheel gear 84 is secured to the upright flywheel shaft 73. A flywheel chain 86 is rotatively engaged with the flywheel gear 84 and the second generator gear 58. As the vehicle 10 is engaged in forward motion, a portion of the rotational energy transferred to the upright generator shaft 48 is, in turn, transferred to the flywheel 70 via the flywheel chain 86. The flywheel 70 stores mechanical energy in its rotation, while the generator 45 produces electric current for charging the storage batteries 66. As the vehicle 10 slows or stops, the air flow to the turbines 23 decreases, decreasing the rotational energy provided by the turbines 23. Without the flywheel 70, the generator 45 would quickly stop charging the storage batteries 66. However, the flywheel 70 continues to rotate when the vehicle 10 slows down or stops after being driven in a forward direction because mechanical energy had been stored in the rotation of the flywheel. This stored energy is transferred, via the flywheel chain 86, from the flywheel 70 to the generator 45, enabling the generator 45 to continue to produce electric current for charging the storage batteries 66. Thus, the flywheel 70 smooths out the flow of electric current generated by the generator 45, which provides more efficient charging of the storage batteries 66.

The various gears are sized to optimize the rotational speeds of their respective components. The turbine gear 42, which drives the generator 45 via the turbine chain 60 connected to the first generator gear 56, has a greater diameter than the first generator gear 56. One complete rotation of the turbine gear 42 results in from one to fifty complete rotations of the first generator gear 56, preferably ten. Similarly, the second generator gear 58, which drives the flywheel 70 via the flywheel chain 86, has a greater diameter than that of the flywheel gear 84. One rotation of the second generator gear 58 results in from one to fifty rotations of the flywheel gear 84, preferably twenty.

In a preferred embodiment, the gear ratio between the turbine gear 42 and the first generator gear 56 is ten; and likewise, the gear ratio between the second generator gear 58 and the flywheel gear 84 is ten. This gear combination rotates the flywheel 70 faster than either the turbines 23 or the generator 45, which is an efficient way to store energy in the flywheel 70. Depending on whether the vehicle 10 is being driven in a forward direction or slowing or stopping, the flywheel gear 84 may be either a driven gear or a driver gear, respectively. In either case, the second generator gear 58 and the flywheel gear 84 turn at their relative speeds because they are directly coupled by the turbine chain 60.

The present invention is illustrated by way of the foregoing description, and various modifications will be apparent to those skilled in the art in view thereof. It is intended that all such variations within the scope and spirit of the appended claims be embraced thereby.

What is claimed is:

1. An electrically-powered vehicle having a front, rear, opposing longitudinal sides, and a battery for storing and providing electrical energy, comprising:

(a) a duct assembly comprising:

(i) an air intake duct;

(ii) a turbine chamber having a turbine chamber inlet and exhaust outlet;

(iii) a discharge duct; and

(iv) a discharge outlet,

wherein the intake duct is connected to the turbine chamber inlet, the discharge duct is interposed between the turbine chamber exhaust outlet and the discharge outlet, and, the discharge duct has a larger cross sectional area than the turbine chamber exhaust outlet;

(b) a turbine placed in the turbine chamber, said turbine adapted to operate by the air passing through the duct when the vehicle is in motion; and

(c) a generator operatively engaged with the turbine, said generator providing electrical energy and charging the battery with the generated electrical energy when the turbine is in operation.

2. An electrically-powered vehicle having a front, rear, opposing longitudinal sides, and a battery for storing and providing electrical energy, comprising:

(a) a duct assembly comprising:

(I) an air intake duct having a forward opening;

(ii) a turbine chamber having a turbine chamber inlet and exhaust outlet;

(iii) a discharge duct; and

(iv) a discharge outlet,

wherein the intake duct is connected to the turbine chamber inlet, the discharge duct is interposed between the turbine chamber exhaust outlet and the discharge outlet, and, the discharge duct has a larger cross sectional area than the turbine chamber exhaust outlet;

(b) a turbine placed in the turbine chamber, said turbine adapted to operate with the air passing through the duct when the vehicle is in motion;

(c) a generator operatively engaged with the turbine, said generator providing electrical energy and charging the battery with the generated electrical energy when the turbine is in operation; and

(d) a flywheel operatively engaged with the generator for storing mechanical energy when the turbine is in operation.

3. The apparatus of claim 2 further having a circuitry operatively connecting the generator to the battery for recharging the battery.

4. The apparatus of claim 2, wherein the turbine rotates in a horizontal plane.

5. The apparatus of claim 2, wherein the turbine is engaged with the generator by a gear arrangement.

6. The apparatus of claim 5, wherein the generator is engaged with the flywheel by a gear arrangement.

7. The apparatus of claim 6, wherein the flywheel is placed in an enclosure.

8. The apparatus of claim 7, wherein the enclosure is substantially sealed from the outside air.

9. The apparatus of claim 7, wherein the flywheel rotates in a horizontal plane.

10. The apparatus of claim 5, wherein the gear arrangement provides a gear ratio of at least ten between the turbine and the generator.

11. The apparatus of claim 6, wherein the gear arrangement provides a gear ratio of at least ten between the generator and the flywheel.

12. The apparatus of claim 6 further comprising a catastrophe-containment device for safely containing the flywheel.

13. The apparatus of claim 2, wherein the discharge outlet is located in the rear of the vehicle.

14. The apparatus of claim 2, wherein the discharge outlet is adapted to discharge air on the opposing longitudinal sides of the vehicle.

15. The apparatus of claim 14, wherein the discharge duct is "Y" shaped with discharge outlets located on the opposing sides of the vehicle.

16. The apparatus of claim 14 further having an heating element for heating the air in the intake duct before it reaches the turbine.

17. The apparatus of claim 2, wherein the forward opening has a substantially greater cross-section than the discharge outlet.

18. The apparatus of claim 17, wherein the forward opening has an adjustable flap for adjusting air flow into the duct when the vehicle is in motion.

19. A wind-powered battery charging system for an electrically-powered vehicle having a front, opposing longitudinal sides, a rear, and at least one battery for storing and providing electrical energy, the battery charging system comprising:

(a) a duct assembly, oriented generally longitudinally in the vehicle, comprising:

(I) an air intake duct having a funnel shaped air intake with a forward opening in the front of the vehicle;

(ii) a turbine chamber having a turbine chamber inlet and exhaust outlet;

(iii) a discharge duct; and

(iv) a discharge outlet,

wherein the intake duct is connected to the turbine chamber inlet, the discharge duct is interposed between the turbine chamber exhaust outlet and the discharge outlet, and, the discharge duct has a larger cross sectional area than the turbine chamber exhaust outlet;

(b) a turbine adapted to rotate about a vertical axis placed in the turbine chamber;

(c) a generator operatively engaged with the turbine, said generator providing electrical energy when the turbine is in operation;

(d) a flywheel operatively engaged with the generator for storing mechanical energy when excess energy is provided by the turbine to the generator and releasing energy when inadequate energy is provided by the turbine to the generator; and

(e) electrical circuitry operatively connecting the generator to the battery for recharging the battery.

20. The battery charging system of claim 19 wherein: the turbine rotates about a turbine shaft having a turbine gear;

the generator is operatively mounted on a generator shaft; the flywheel rotates about a flywheel shaft having a flywheel gear;

a first generator gear is mounted on the generator shaft and operatively engaged with the turbine gear; and

a second generator gear is mounted on the generator shaft and operatively engaged with the flywheel gear.

21. The battery charging system of claim 20, wherein the gear ratio between the turbine gear and the first generator gear is at least ten.

22. The battery charging system of claim 21, wherein the gear ratio between the second generator gear and the flywheel gear is at least ten.

23. The battery charging system of claim 19, further comprising a housing for the flywheel for sealing the flywheel, wherein the flywheel is contained in a reduced atmosphere.

24. The battery charging system of claim 19, wherein the air outlet is located in the rear of the vehicle.

25. The battery charging system of claim 19, wherein the air discharge duct is "Y" shaped with air outlets located on the opposing sides of the vehicle.

26. The battery charging system of claim 19, further comprising a heat transfer element for heating air passing through the turbines.

27. In an electrically-powered vehicle having a front, opposing longitudinal sides, a rear, and at least one battery for storing and providing electrical energy, a method for charging the battery, comprising:

- (a) capturing air at the front of the vehicle as the vehicle moves in a forward direction;
- (b) passing the captured air rearward through a duct in the vehicle to a turbine chamber;
- (c) rotating a turbine in the turbine chamber having a turbine chamber exhaust outlet with the captured air;
- (d) exhausting the captured air through an air discharge duct having a larger cross sectional area than the turbine chamber exhaust outlet to an air outlet;
- (e) generating electricity in a generator operatively engaged with the turbine;
- (f) recharging the battery with the electricity generated in the previous step;
- (g) storing mechanical energy in a flywheel that is operatively engaged with the generator; and
- (h) releasing stored energy in the flywheel to the generator for generating electricity.

28. A wind-powered battery charging system for an electrically-powered vehicle having a forward facing air

intake duct, an air discharge duct, a turbine chamber having a turbine chamber exhaust outlet therebetween, the air discharge duct having a larger cross sectional area than the turbine chamber exhaust outlet, a generator operatively engaged with the turbine and means for the generator to recharge batteries that store energy and provide power to the vehicle, comprising:

- (a) a flywheel rotatively engaged with the generator for receiving and storing mechanical energy from the generator and for releasing stored energy to the generator, wherein the gear ratio between the turbine and the generator is between one and fifty and the gear ratio between the generator and the flywheel is between one and fifty; and
- (b) the air exhaust duct discharges air through an air outlet located in a region defined by the rear of the vehicle and a wave vortex that forms behind the vehicle when the vehicle moves forward, so that the air exhausts into a relatively low-pressure region.

29. The battery charging system of claim 28, further comprising a heating element in the air intake duct.

30. The battery charging system of claim 28, wherein the air discharge duct is "Y" shaped and discharges air on opposing sides of the vehicle so as to take advantage of a Bernoulli effect.

* * * * *



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Bernard

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[45] **Date of Patent:** **Dec. 15, 1998**

[54] **FLUID FLOW POWER GENERATION
SYSTEM WITH FOIL**

5,296,746 3/1994 Burkhardt 290/55
5,512,788 4/1996 Berenda et al. 290/55

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FOREIGN PATENT DOCUMENTS

901327 4/1985 Belgium 290/54
2 435 613 9/1978 France 290/54
3518516 A1 11/1986 Germany 290/54

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[51] **Int. Cl.⁶** **F03B 13/00**; H02P 9/04

[52] **U.S. Cl.** **290/54**; 290/42; 290/43;
290/44; 290/53; 290/55

[58] **Field of Search** 290/42, 43, 44,
290/53, 54, 55

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,247,253	1/1981	Seki et al.	416/44
4,314,160	2/1982	Boodman et al.	290/54
4,383,801	5/1983	Pryor	416/17
4,437,698	3/1984	Tantalo	290/54
4,477,040	10/1984	Karanik	244/58
4,504,192	3/1985	Cyrus et al.	416/41
4,921,061	5/1990	Arreola, Jr.	290/55

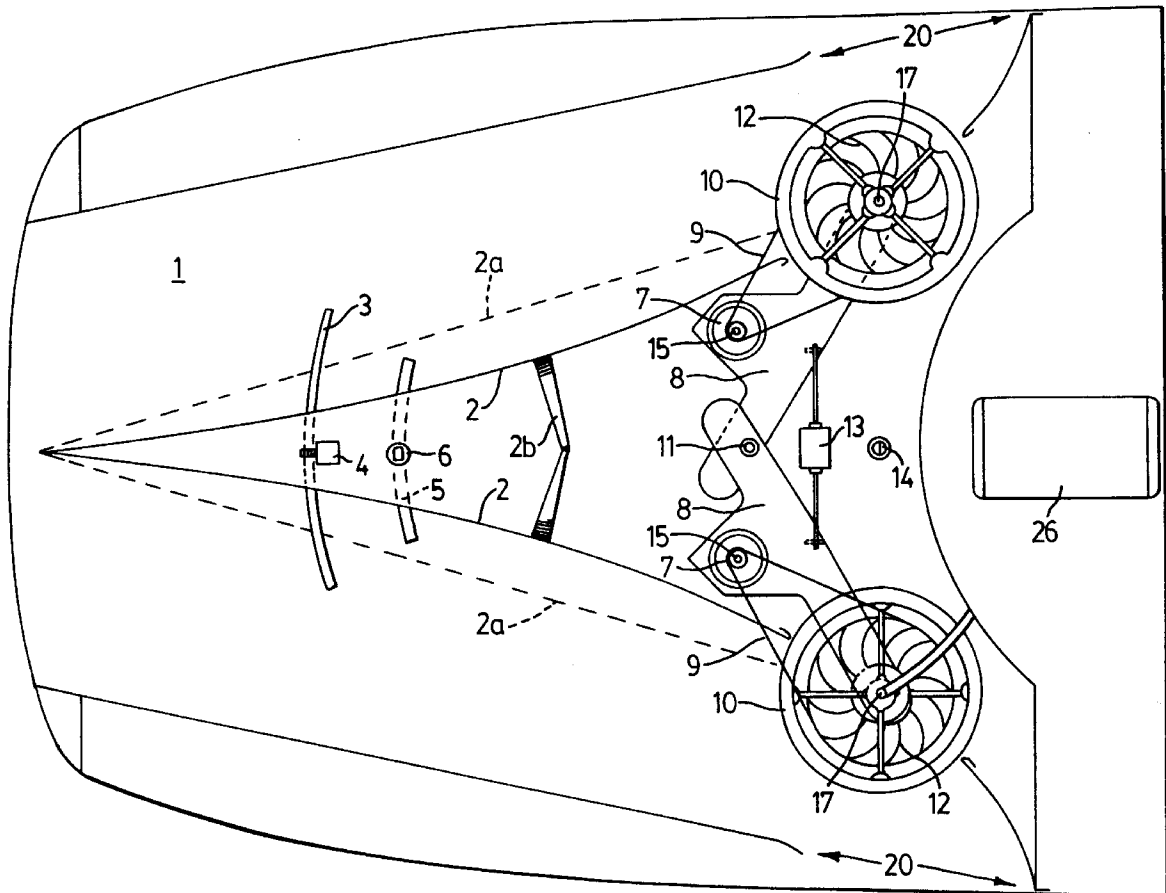
Primary Examiner—Nestor Ramirez

Assistant Examiner—Elvin G. Enad

[57] **ABSTRACT**

A fluid flow power generating system is disclosed. The system includes a foil for accelerating the velocity of a fluid flow past said foil, to increase the fluid's kinetic energy. A turbine is located downstream of the foil, and at least partially behind the foil, and the turbine is driven by the fluid. The foil shields the upwind side of the turbine. A generator is also connected to the turbine for generating electrical energy. The turbine is mounted relative to the foil, so the position of the turbine relative to said foil can be adjusted to expose more or less of the turbine to the fluid flow. In one embodiment there are provided a plurality of individual systems which form a tower.

15 Claims, 4 Drawing Sheets



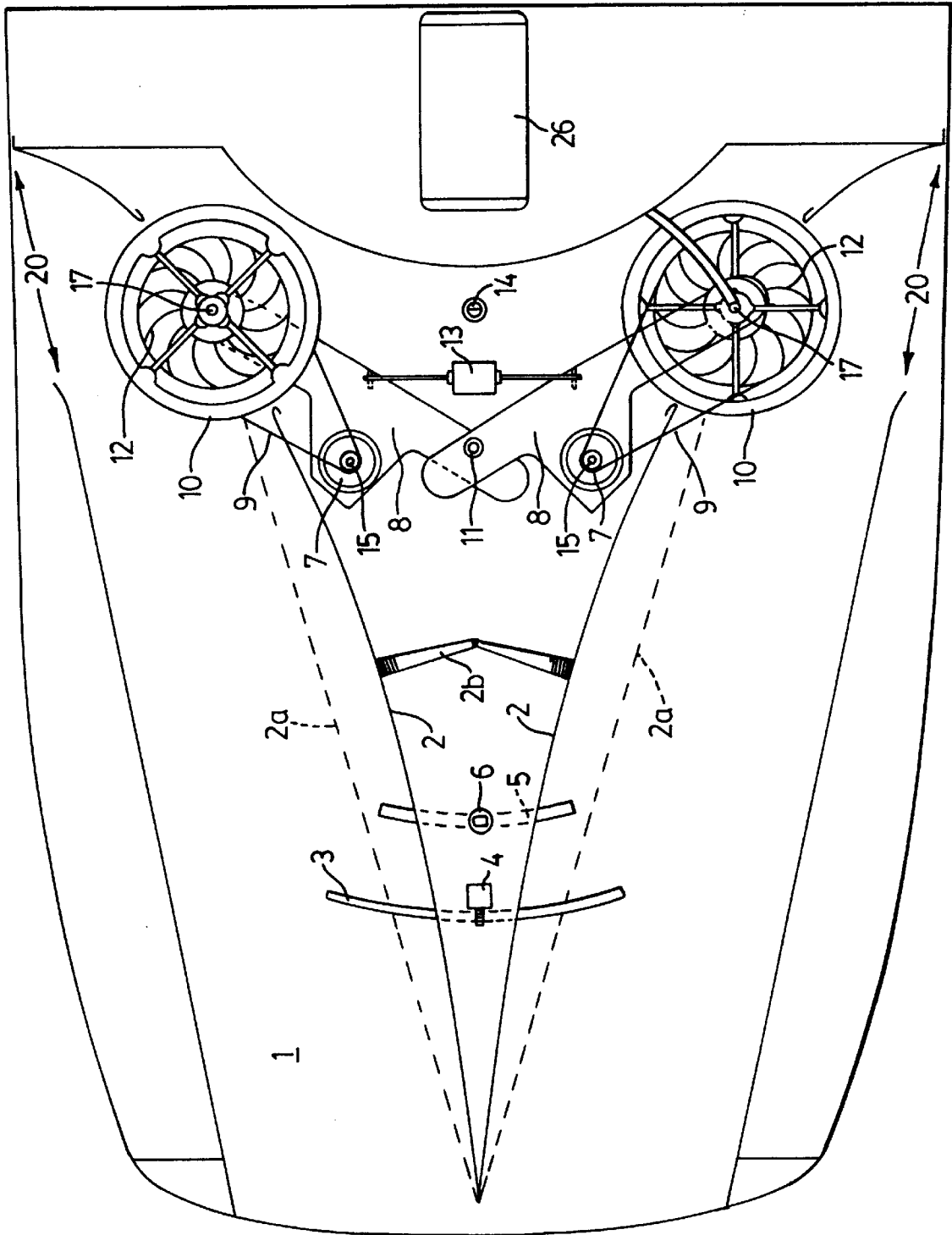


FIG. 1

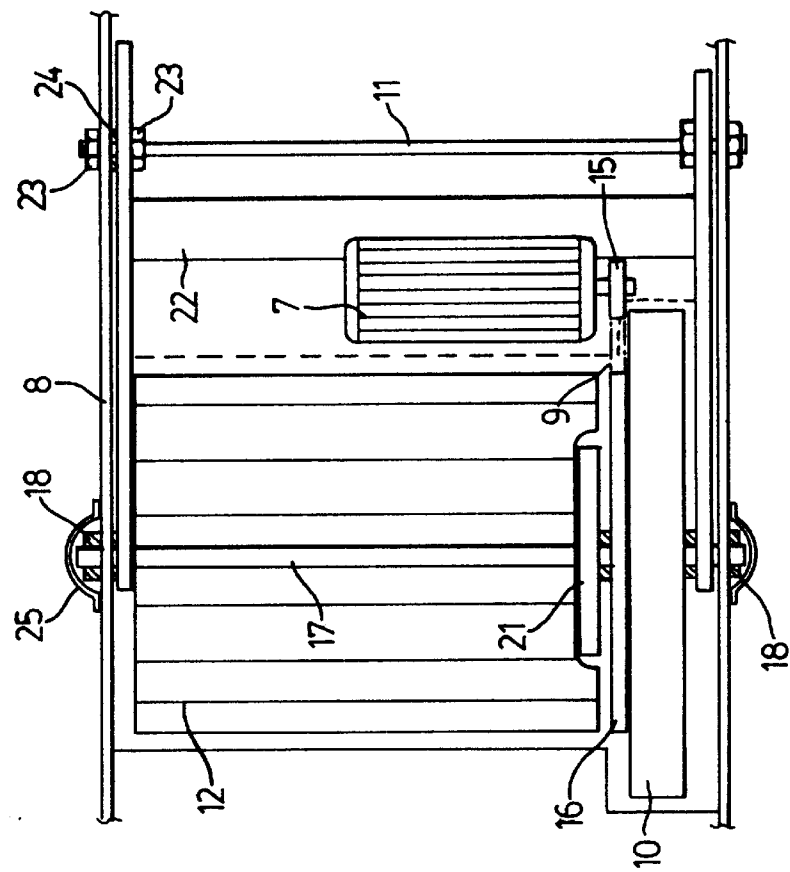


FIG. 3

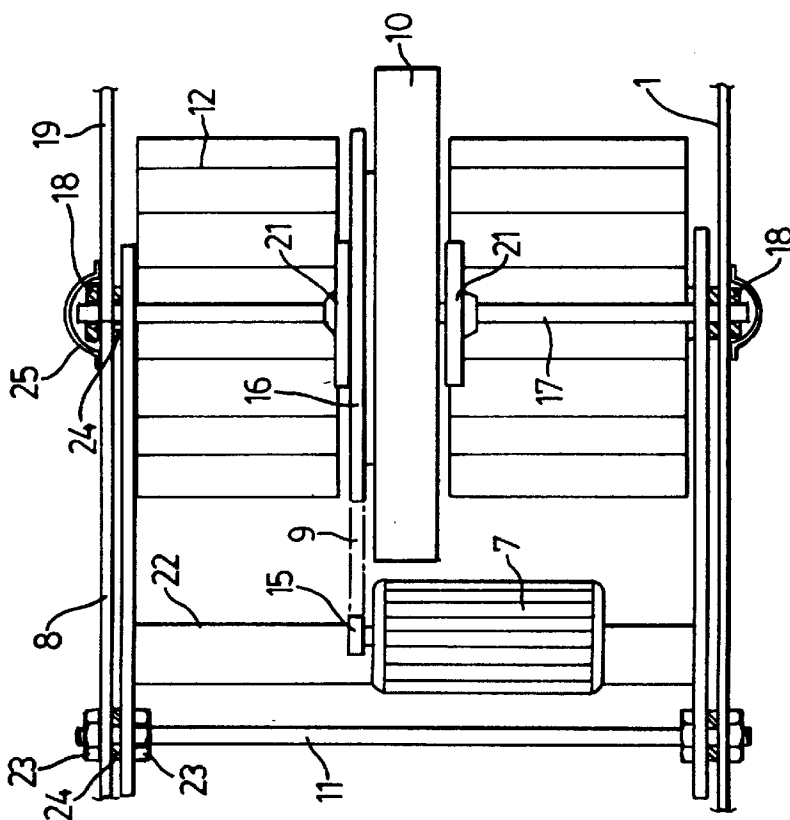


FIG. 2

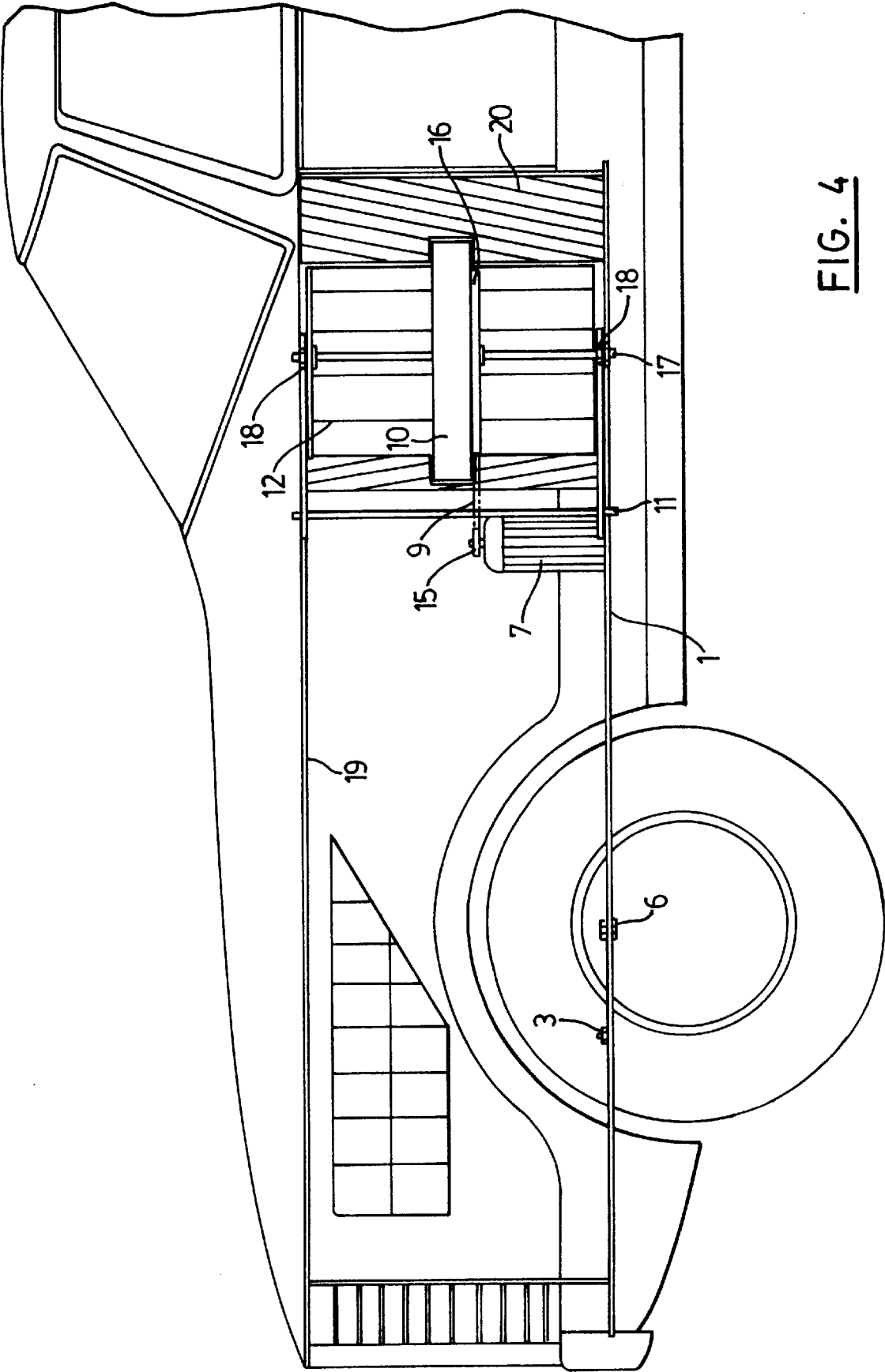


FIG. 4

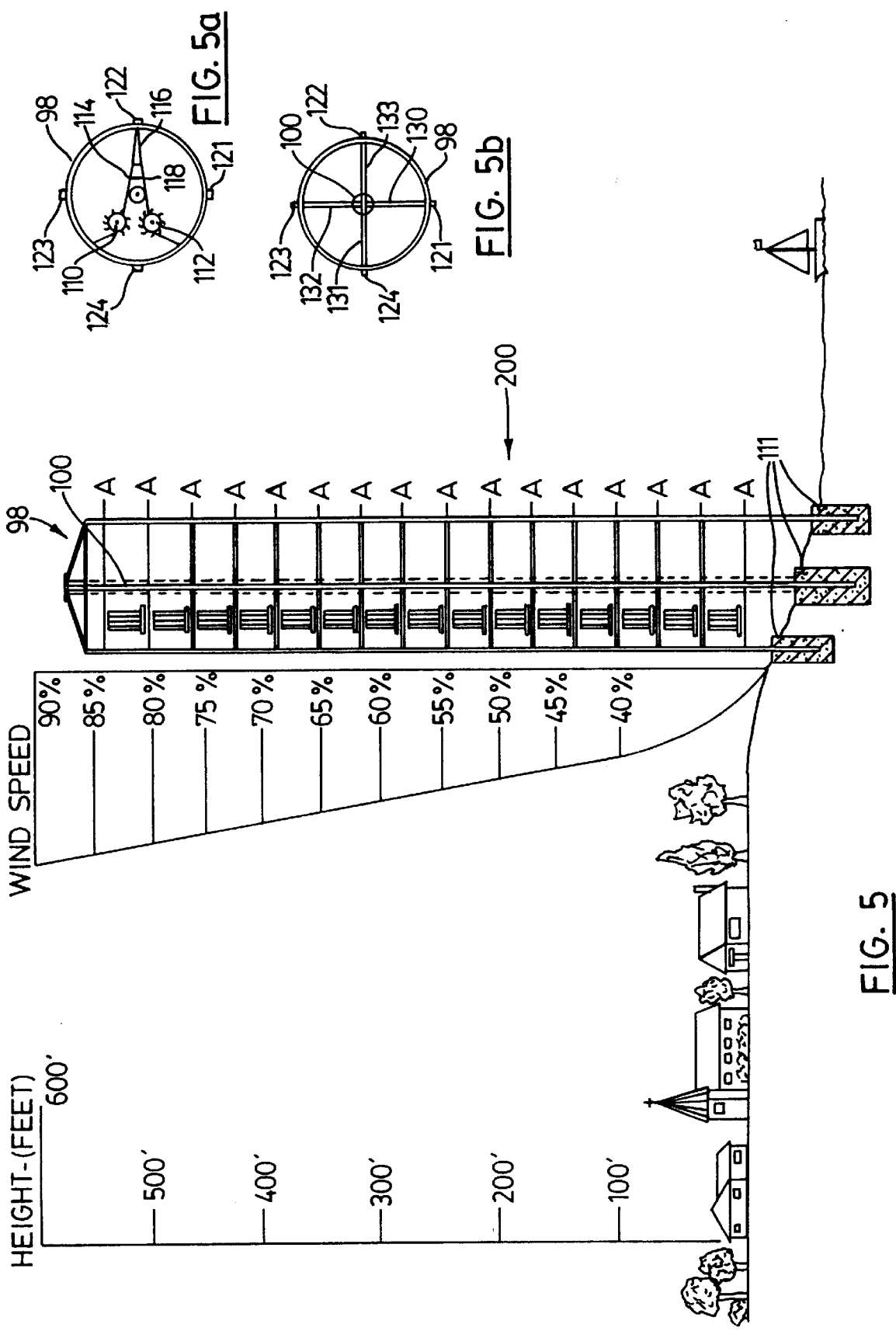


FIG. 5

FLUID FLOW POWER GENERATION SYSTEM WITH FOIL

FIELD OF THE INVENTION

This invention relates to power generation and more particularly relates to energy generation from a moving fluid, such as air (wind) or water.

BACKGROUND OF THE INVENTION

Wind power is being recognized as an important source of renewable energy. Numerous different types of windmill structures have been developed in the past for the purpose of utilizing wind power to generate energy such as electricity. However, in the past, maximum utilization of wind power has not been effected. One of the problems is maintenance. Each wind power station strives to utilize large scale wind power units, since larger units will require about the same maintenance per unit as smaller ones. However, these large units tend to take the form of single large horizontal axis propellers, which are organized in a grid fashion in a so called "wind farm". Such wind farms are unattractive and take up much space. Unfortunately, the places with good winds (shore lines and the like) also tend to be naturally scenic and there is a growing resistance to covering large acreages with propellers to form such a "wind farm".

Water power is also a source of energy. However, designs of energy absorbing devices for water have had various defects.

SUMMARY OF THE INVENTION

The present invention is directed to a fluid flow power generation system with a foil for the purpose of generating power to supply energy. The system consists of a foil to modify the fluid flow and which may be adjusted having regard to wind or water direction, and at least one turbine, to be driven by the fluid flowing around the foil, and which turbine is adjustable relative to the foil. In this sense turbine will be understood to comprehend any suitable structure for converting a fluid stream (air or water) velocity into useful energy, such as electricity.

By use of the air foil, having regard to the Bernoulli principle known as the "Law of Continuity", a flow of fluid can be accelerated by passing over the curved surface of the air foil. By means of such acceleration, the velocity of the air or water or other fluid past the turbines can be controlled and, the speed of the turbines can be increased, thereby enhancing the efficient utilization of the wind or water energy.

It is an object of the present invention to reduce the amount of acreage required by horizontal axis propeller wind farms, through the use of vertical axis turbines.

It is a further object of the present invention to improve the durability of the turbines by partly sheltering the turbine in an enclosure.

It is a further object of the present invention to improve the efficiency of the turbine by shielding the upwind or counter-rotating side of the turbine from the fluid passing and driving the turbine.

By moving the turbine relative to the end of the foil, more or less of the turbine can be exposed to the accelerated fluid flow developed by the foil, also enhancing the utilization of the energy contained in the moving fluid stream. By varying the camber (ie. degree or amount of bend) of the foil, the acceleration of the air stream, and thus the velocity past the turbine, can also be varied and controlled to maximize

velocity to a preferred one having an optional power output. In this sense, optimal power output will be understood to be the lowest velocity which still produces the necessary torque and turbine velocity for optimal power generation. Thus, at higher relative velocities (the speed of the fluid past the air foil system) a lower camber will be needed than at lower relative velocities. Further, at higher velocities, less of the turbine need be exposed to the fluid flow, to achieve the same power output. Exposing the turbine to excessive flow can create equipment damage and failure, and is undesirable. Alternatively, in lighter flow, more velocity may be desired to achieve a reasonable power output.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of a fluid flow power generation system according to the present invention mounted on an automobile;

FIG. 2 is a side view of a portion of the system, showing a turbine system having a double clutch;

FIG. 3 is a side view of a turbine with a lower flywheel and a single clutch;

FIG. 4 is a side view of a car having the air foil system mounted thereon;

FIG. 5 is a view of a tower arrangement for land-based use of the airfoil system;

FIG. 5A is a side view of one segment of the system; and

FIG. 5B is a top view of some structural elements for the segment of FIG. 5A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows the fluid flow power generating system mounted on a car according to the present invention. It is to be noted that the system may be mounted in any flow of moving fluid, either air or water, and that the mounting on a car is for illustration purposes only. The system includes a base plate 1 onto which is mounted a pair of opposed air foils 2. A track 3 is provided, together with an electric motor 4. A slot 5 is also provided, with a double headed bolt 6 extending between the air foil 2 and the base plate 1. Activation of the motor 4 permits the air foil to be directed laterally along the slot 5 so that the double headed bolt 6 slides within the slot 5.

A pair of generators 7, one associated with each turbine 12, are mounted on arms 8. A driving belt 9 extends between the generators 7 and the turbines 12. Mounted below the turbines 12 are flywheels 10.

Arms 8 interact at a pivot point or axle 11 to allow the turbines 12 to be adjusted relative to the air foil 2. Adjustment is accomplished by an electric motor 13 acting on a rod which extends between the electric motor 13 and the arms 8. By shortening the distance, (ie. the length of the rod) the turbines are moved together, while lengthening the distance extends the turbines further apart. The turbines are mounted on axle 17.

It can now be appreciated that the foregoing arrangement permits the turbines 12 to be extended or retracted more or less into the flow of air past air foil 2. Once past the turbine 12, the flow continues out opening 20. It can also be appreciated that the air foils 2 can be of variable camber, with the range being defined in part by dashed lines 2a. Varying the camber can be accomplished by any suitable means such as threaded actuator 2b, and may be either motor driver or even manually driven.

In FIG. 2 the base plate 1 is shown having the generator 7 mounted underneath the arm 8. The driving belt 9 is shown

in dashed outline. The flywheel **10** is shown mounted between upper and lower turbines **12** and **12(a)** on axle **17**. A pulley **15** is provided on the top of the generator for the driving belt **9**. A pulley and flywheel combination **16** are attached to the turbine **12** at the other end of the drive belt **9**.

There are also provided bearings **18** for the turbine axle **17** as well as a top clutch plate **19** and a clutch and pressure plate **21**. The top plate and clutch and pressure plate will be known to those skilled in the art and thus are not discussed in any more detail.

A metal brace **22** holds the assembly together, with the hold down nuts **23** on axle **17**. Also provided are spacers **24** and grease cups **25**.

FIG. **3** shows an alternate embodiment of the turbine, in which like numerals as in FIG. **2** refer to like elements.

FIG. **4** is a side view of the vehicle mounted version of the invention. FIG. **4** includes a track base plate **1** with track **3**. A double headed bolt **6** is also shown, as well as generators **7**, driving belt **9** and flywheel **10**. The pivoting point or axle **11** is shown as well as turbines **12** and pulleys **15** and **16**. The side opening **20** is shown in side view.

It can now be appreciated how the present invention achieves certain advantages over the prior art. In the event that the fluid speed, either wind or water is high, the turbines can be adjusted inwardly, to reduce the degree of exposure of the turbine to the flow past the air foil. Conversely, when the flow of fluid is low, the turbines can be fully extended into the flow again to maximize the usable energy contained within the flow. The preferred range is from 50% exposed, to completely retracted. It will be appreciated by those skilled in the art that the fully retracted position is extremely useful in northern climates. In such climates, although frequent strong winds are experienced, the build up of snow and ice on the equipment tends to damage or impair the turbines. By being able to retract the turbines in inclement weather, it is believed that the system according to the present invention will have an extended life (and one with fewer maintenance problems) because the system is less adversely affected by the elements.

It will also be appreciated by those skilled in the art that the shielding of the upwind turning side of the turbine reduces the drag on the upwind side and allows the turbine to be more efficient, at lower wind speeds. Thus, the maximum desirable extended position is to have 50% of the turbine exposed. Also, by being able to vary the camber of the foil, the optimum fluid flow can be maintained as the fluid passes the turbine. The optimum fluid flow is one which will provide adequate torque to the turbine, without having unnecessarily high speeds which could damage or otherwise excessively wear the turbine components.

Although the preferred embodiment includes a flywheel, for the purpose of storage of rotational energy, it will be appreciated by those skilled in the art that the turbine could be directly connected to the generator, without use of the flywheel. The flywheel is merely an efficient way of storing some of the energy gathered by the turbine. This may be especially effective when the turbines are mounted on a vehicle, in order that the flywheels can continue to generate power even as the speed of the turbines slow down because of the vehicle slowing.

FIG. **5** shows an alternate embodiment of the fluid flow power generation system. In this embodiment the air foil system is suitable for use as a fixed wind power generator **98**. In this embodiment, the system is shown mounted on a central axle **100**. A plurality of air foils (A) are mounted one

above the other, to form the wind driven power generating tower **98**. The purpose of extending such a tower vertically is two fold, namely, to extend the air foils higher into the air and to increase the density, per area of ground of power generators. In this manner, since the wind speed generally increases with height (see FIG. **5** which shows the height on the left hand side and the percentage of wind speed at that height), more energy can be taken out of the air stream and converted to useful power. Further, by being more densely configured (one on top of another), less area is required, than is required for conventional horizontal axis propeller systems. In this case the tower is supported on concrete footings **111**. The wind direction is shown as **200**.

FIG. **5(A)** shows a single power generating system which includes two turbines **110**, **112**, each partially behind an airfoil **114**, **116** respectively. Also shown is an actuator **118**, which can be moved to alter the camber of the foils **114**, **116**. Also shown is the central axle **100**, as well as column supports **121**, **122**, **123** and **124**.

FIG. **5(B)** shows a cross-section through a supporting section with the axle **100**, the supports, **121**, **122**, **123** and **124**, and cross-support elements **1230**, **131**, **132** and **133**.

It will be appreciated by those skilled in the art that many different structural solutions are possible, and that the same will be satisfactory providing they are strong enough to hold up to the wind loads the tower is exposed to. Also, while reference is made to an axle **100**, each segment A of the tower could be individually rotatable, or, the segments A could be locked together to rotate as one. Rotation is desirable to ensure the air foil of the system is pointing in the upwind direction as shown, regardless of the absolute compass direction of the wind.

By being mounted on the axle, the air foils will naturally, like a wind vane, seek the wind. In larger installations, the air foil may have to be moved along a track, by a motor or the like, to follow wind direction changes. Such direction can be manually adjusted, or it may be automatically adjusted by means of a wind vane sensor with an associated actuator or the like.

It will be appreciated that while reference herein is made to use of vertical axis turbines, other types of wind driven devices may also be employed. One of the key features of the present invention is to provide, in combination, an adjustable air foil system which responds to various conditions to optimize energy transfer and reduce equipment failure arising from extreme conditions. The adjustments may be made by a variable camber air foil, to modify the flow of the fluid to increase its speed, and kinetic energy. Some means to convert the kinetic energy of the fluid flow to some more useful form of energy such as electrical energy is also provided, and the means to convert the energy is adjustably mounted relative to the air foil. Thus the energy converting means, such as turbines, with associated generators can be variably deployed, relative to the air foil, with any desired optimal degree of exposure. For example, such turbines can be protected from freezing rain, hail, snow or other damaging precipitation in extreme conditions.

The power delivered by a ten tier air foil tower system would be determined by the size and height of both tower, rotor heights and angle of attack of the air foil. For example, a ten tier air foil tower comprised of 20' high by 6' diameter turbines with wind speeds of 8 to 30 miles per hour and a tower height of 300' with 4-30 kw generators per air foil (a total of 20 air foils per tower) could generate 2400 kw. On the other hand, a propeller driven wind turbine with a tower of 140' and an 86' diameter blade driving a 200 kw generator

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at the same wind speeds of 8 to 30 miles per hour would generate much less power.

Results would be that the air foil tower will generate up to 20 times the electrical energy, for the same surface area of wind farm.

Compare the above information with wind farms, one farm using propeller driven wind generators, and the other using air foil towers.

The wind farm using 2000 propeller wind generators of 200 kw each would need 250 acres of land (at 8 machines per acre). This field would produce 400,000 kw.

Using the air foil tower system and placing 160 towers at 8 towers per acre the total number of acres would be 20. The electrical power produced by this system on 20 acres would be 384,000 kw. On the other hand, if a farm of 250 acres were used then the total number of air foil towers could be 2000. The power produced would be 4,800,000 kw. This is a much greater density of power per surface area of wind farm. This calculation does not include extra power available through higher wind speeds at higher elevations.

To increase the net torque on the air foil turbines it is preferred to minimize the wind force on the upwind moving vane. Because of the air foil's aerodynamic shape and the ability of retracting the turbines into the air foil shielding of the upwind vane is achieved thereby reducing drag and result in an increase in tip speed. By introducing the curvature on the air foil (using Bernoulli equation and the Law of Continuity) the wind velocity is increased. The elements combined with a clutch and flywheel system allow more useable driving force which in turn leads to a higher energy from generators or the like.

While the foregoing description has primarily focused on a fluid power generating wind system, the concept is believed to be particularly applicable to water-based systems as well. More specifically, efficient low head hydro power generation may be achieved utilizing the same principle of an accelerating foil to drive a turbine. With respect to the wind powered system, the preferred embodiment is as shown in FIG. 5, namely, a tower of turbines and air foils mounted one upon the other to any desired height, although vehicle mounted systems are also comprehended.

I claim:

1. A fluid flow power generating system comprising:

- a foil for accelerating the velocity of a fluid flowing past said foil, to increase said fluid's kinetic energy, the foil being located on an upstream side of said system; and
- a turbine separate from said foil and being located downstream of said foil, and at least partially behind said foil, said turbine including vanes sized and shaped to be driven by said fluid;
- a generator, connected to said turbine for generating electrical energy; and

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an adjusting means, whereby a position of said turbine relative to said foil can be adjusted to position said turbine between a retracted position behind said foil to a more exposed position to expose more or less of said turbine to said fluid flow.

2. A fluid flow power generating system as claimed in claim 1, wherein said foil includes a camber, and said system includes a camber adjusting means, whereby said camber of said foil may be adjusted to optimize the energy produced.

3. A fluid flow power generating system as claimed in claim 1, wherein said turbine is a vertical axis turbine.

4. A fluid flow power generating system as claimed in claim 3, wherein said system comprises a plurality of turbines, and associated foils, mounted one above another in the form of a tower.

5. A fluid flow power generating system as claimed in claim 4, wherein said fluid is air, and said foils are pivotable, to accommodate changes in wind direction.

6. A fluid flow power generating system as claimed in claim 5, wherein said system includes an actuator to position said foils into said wind.

7. A fluid flow power generating system as claimed in claim 5, wherein said system further comprises a pair of foils, having opposite cambers, and a pair of turbines, each turbine located downstream and partially behind each foil.

8. A fluid flow power generating system as claimed in claim 7, wherein said system is mounted upon a vehicle.

9. A fluid flow power generating system as claimed in claim 5, wherein said system comprises a tower extending upwardly to a level having at least 60% of the prevailing wind speed.

10. A fluid flow power generating system as claimed in claim 5, wherein said system comprises a tower extending upwardly to a level having at least 80% of the prevailing wind speed.

11. A fluid flow power generating system as claimed in claim 1, wherein said adjusting means adjusts said turbines from a position fully behind said foil to an extended position wherein one half of said turbine is exposed to said fluid flow.

12. A fluid flow power generating system as claimed in claim 1, wherein said adjusting means adjusts said position of said turbines and in all positions a counter revolving portion of said turbine is shielded from said fluid flow.

13. A fluid flow power generating system as claimed in claim 1, further including a flywheel for storing rotational energy.

14. A fluid flow power generating system as claimed in claim 1, further including a means for converting DC electrical power into AC electrical power.

15. A fluid flow power generating system as claimed in claim 1 further including an enclosure, wherein said turbine may be retracted into said enclosure to substantially avoid inclement weather.

* * * * *



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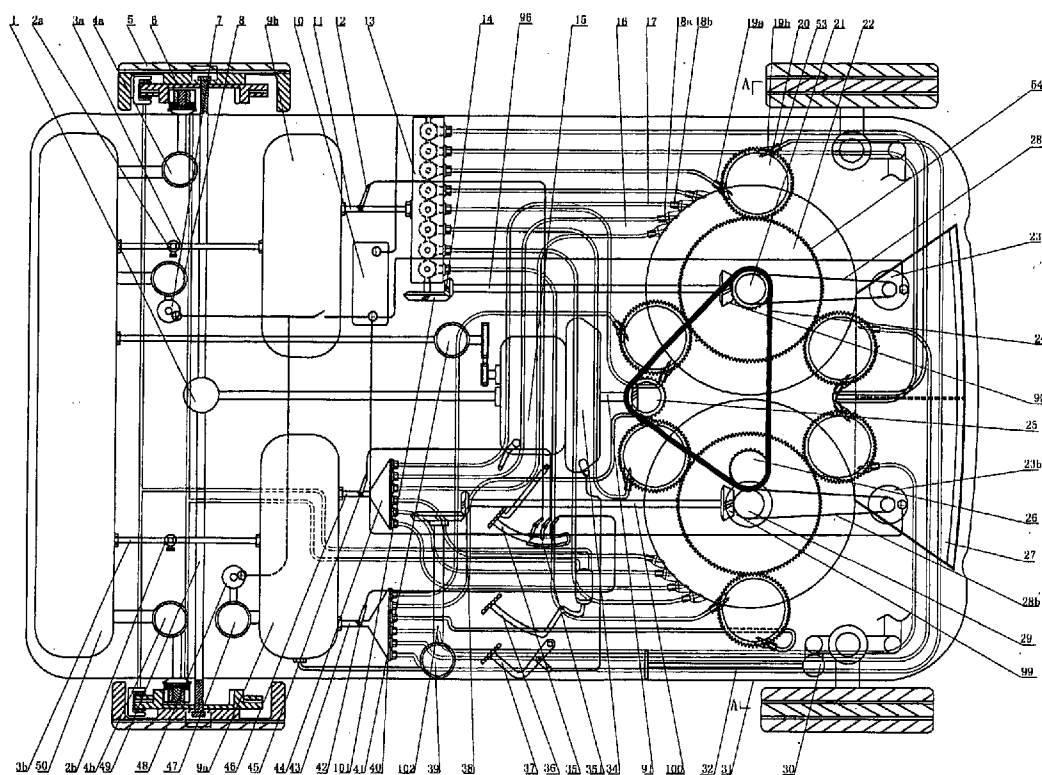
(19) **United States**(12) **Patent Application Publication**
Cong(10) **Pub. No.: US 2011/0280709 A1**(43) **Pub. Date: Nov. 17, 2011**(54) **WIND-GAS ENGINE ASSEMBLY AND
MOTOR VEHICLE WITH THE SAME****Publication Classification**(51) **Int. Cl.**
F04D 25/16

(2006.01)

(52) **U.S. Cl.** **415/60**(57) **ABSTRACT**(75) **Inventor:** **Yang Cong**, Guangdong (CN)(73) **Assignee:** **Yang Cong**, Guangdong (CN)(21) **Appl. No.:** **12/377,513**(22) **PCT Filed:** **Aug. 16, 2007**(86) **PCT No.:** **PCT/CN07/02468**§ 371 (c)(1),
(2), (4) Date:**Mar. 10, 2009**(30) **Foreign Application Priority Data**

Aug. 16, 2006 (CN) 200610062135.6

A wind-gas engine assembly and a motor vehicle with the same are provided. The wind-gas engine assembly comprises a high pressure gas engine (20) and a wind resistance engine (22) independent of each other. The high pressure gas engine generates primary power through injection of the high pressure gas. The wind resistance engine comprises an impeller chamber (221) and an impeller (222). The impeller chamber is provided with an air inlet (51) for receiving external wind resistance airflow, by which the impeller is driven to rotate to generate auxiliary power. The present invention not only utilizes wind resistance, but also saves energy and protects the environment.



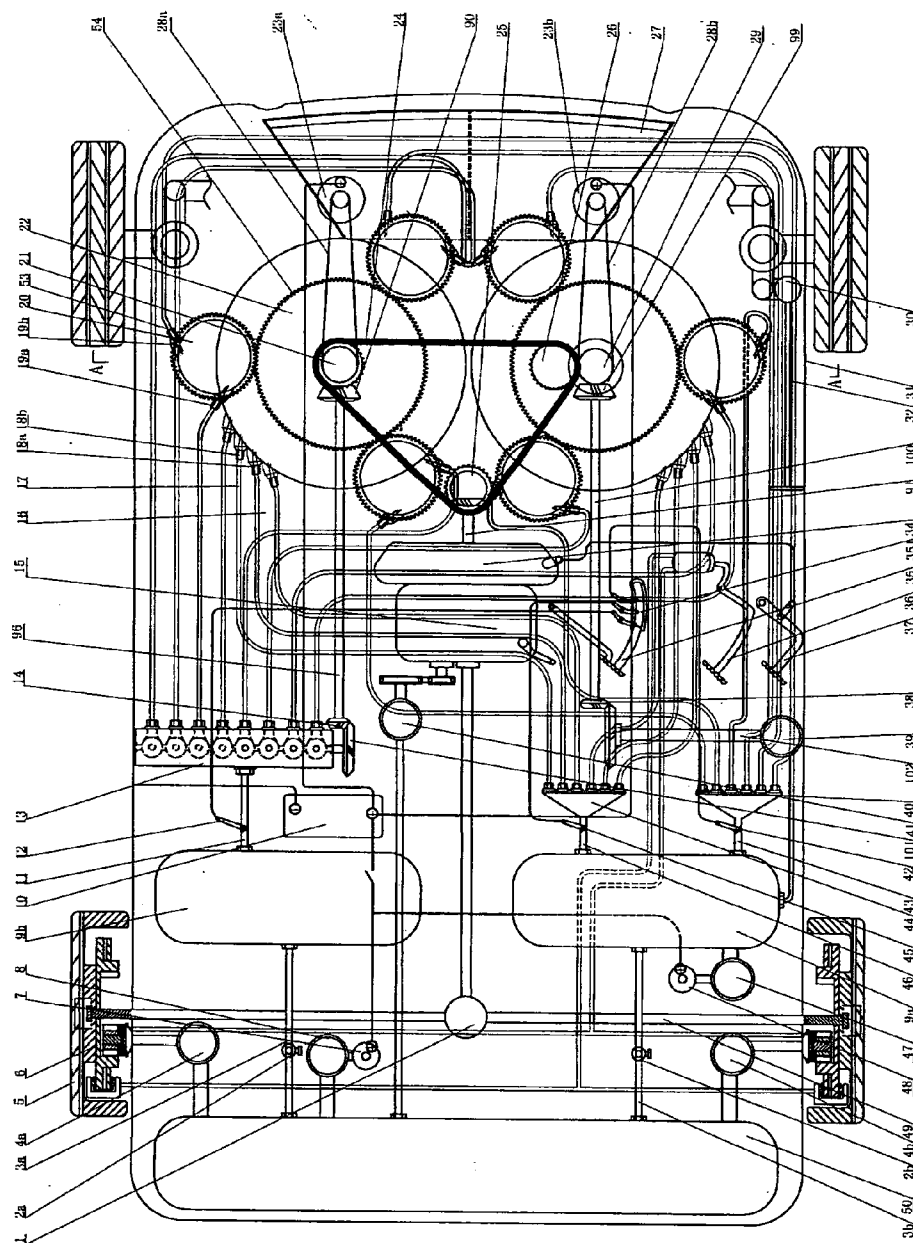


Fig. 1

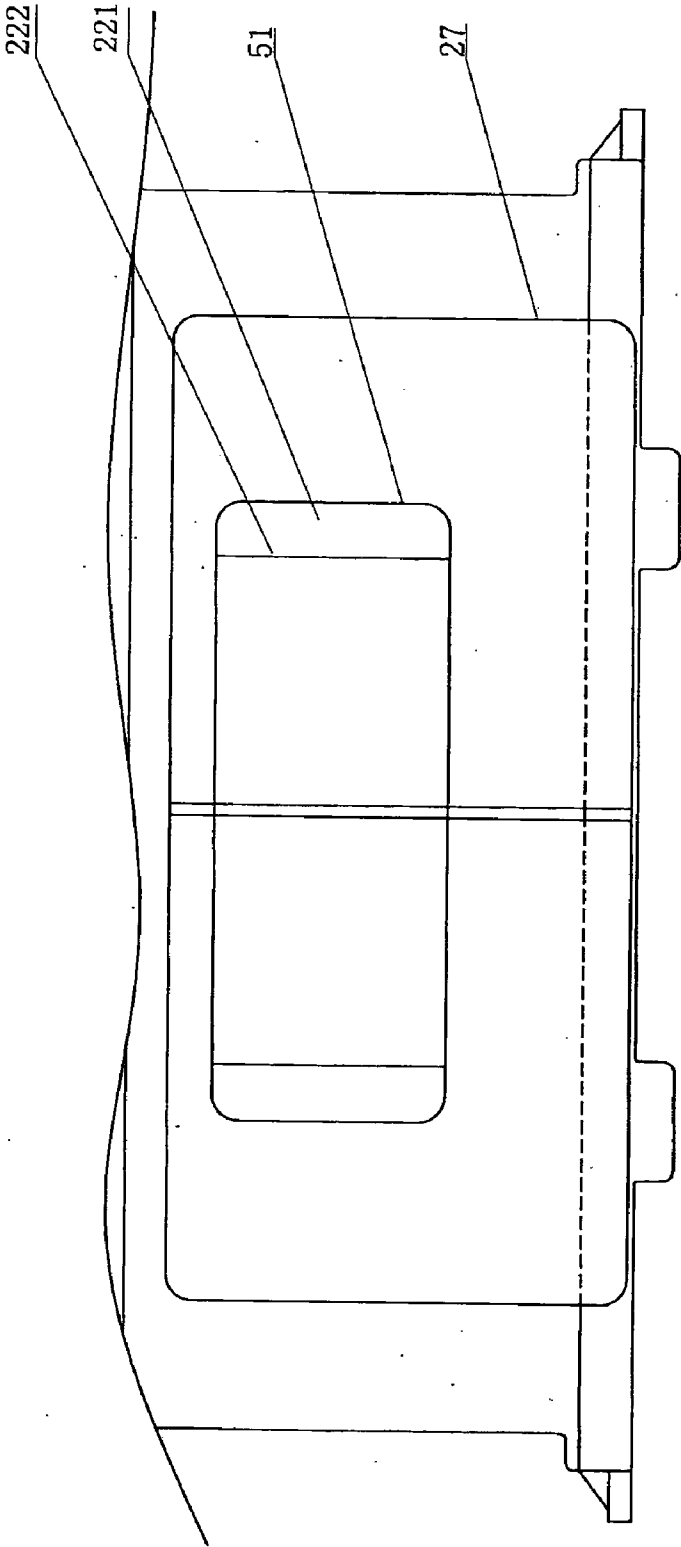


Fig. 2

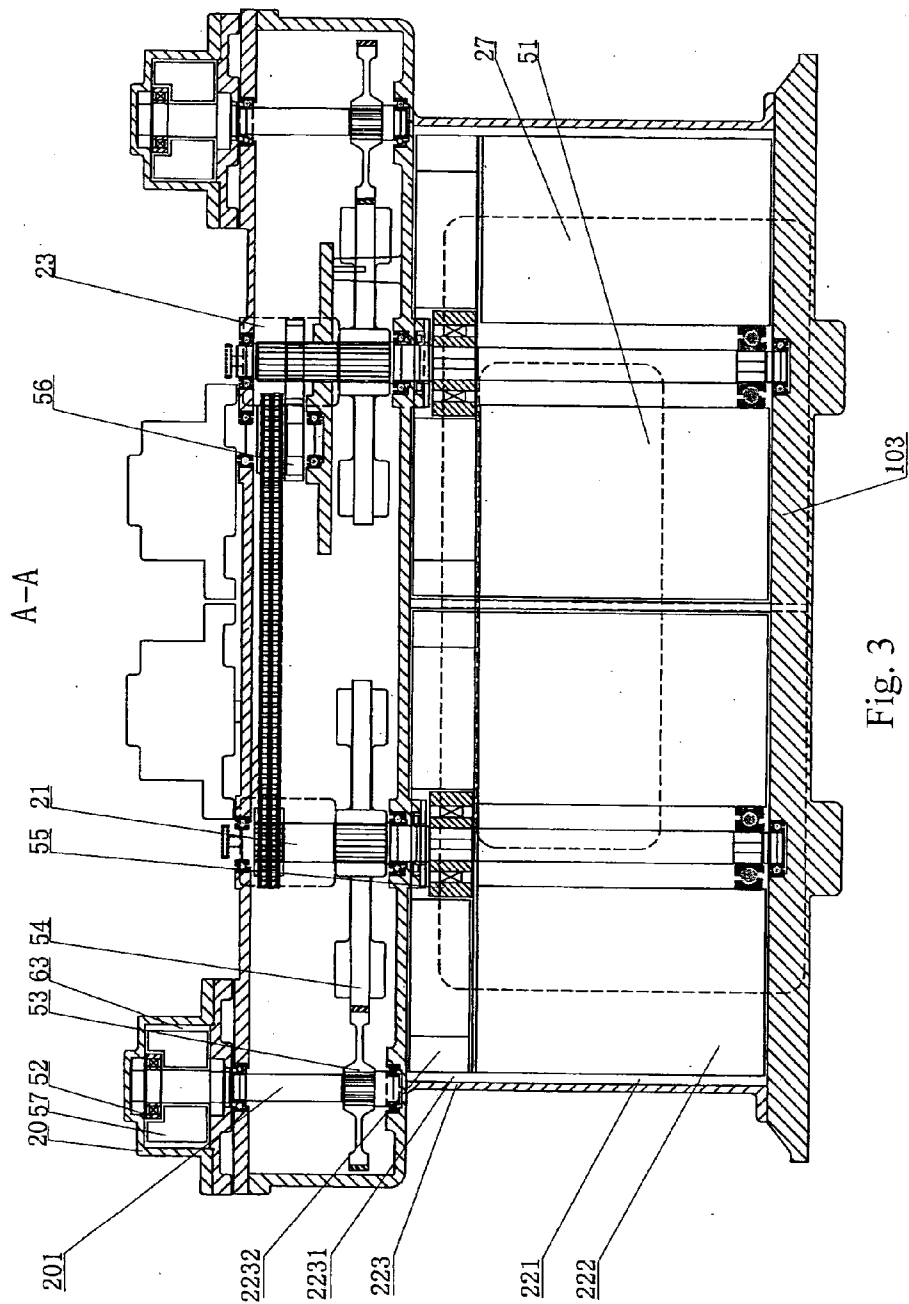


Fig. 3

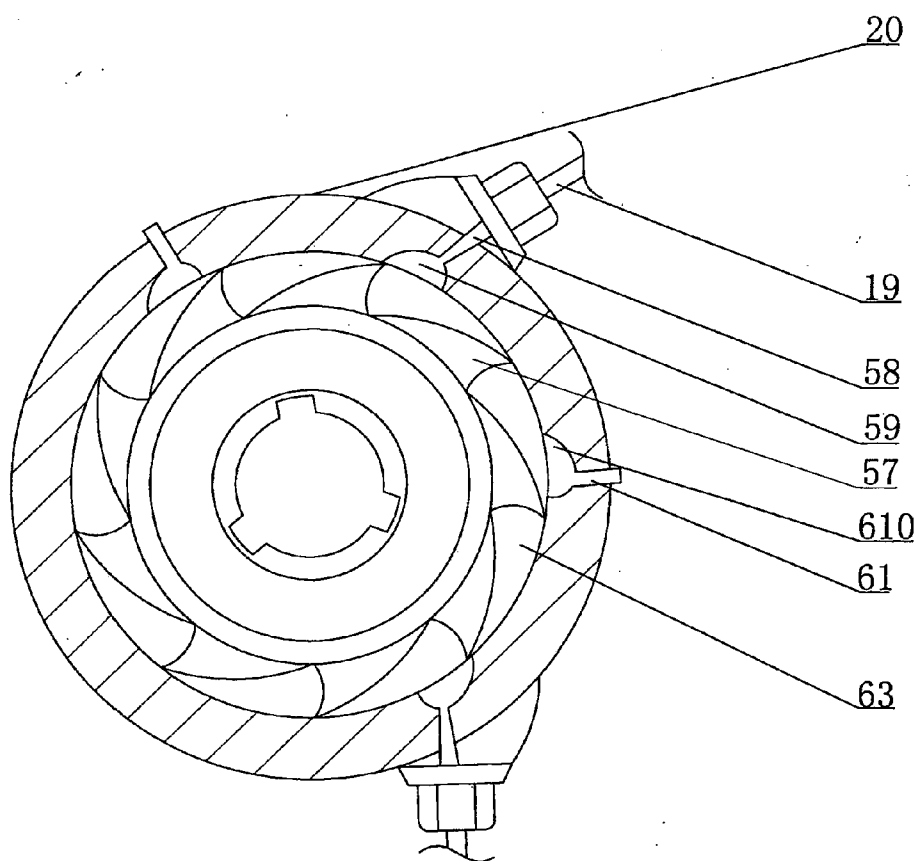


Fig. 4

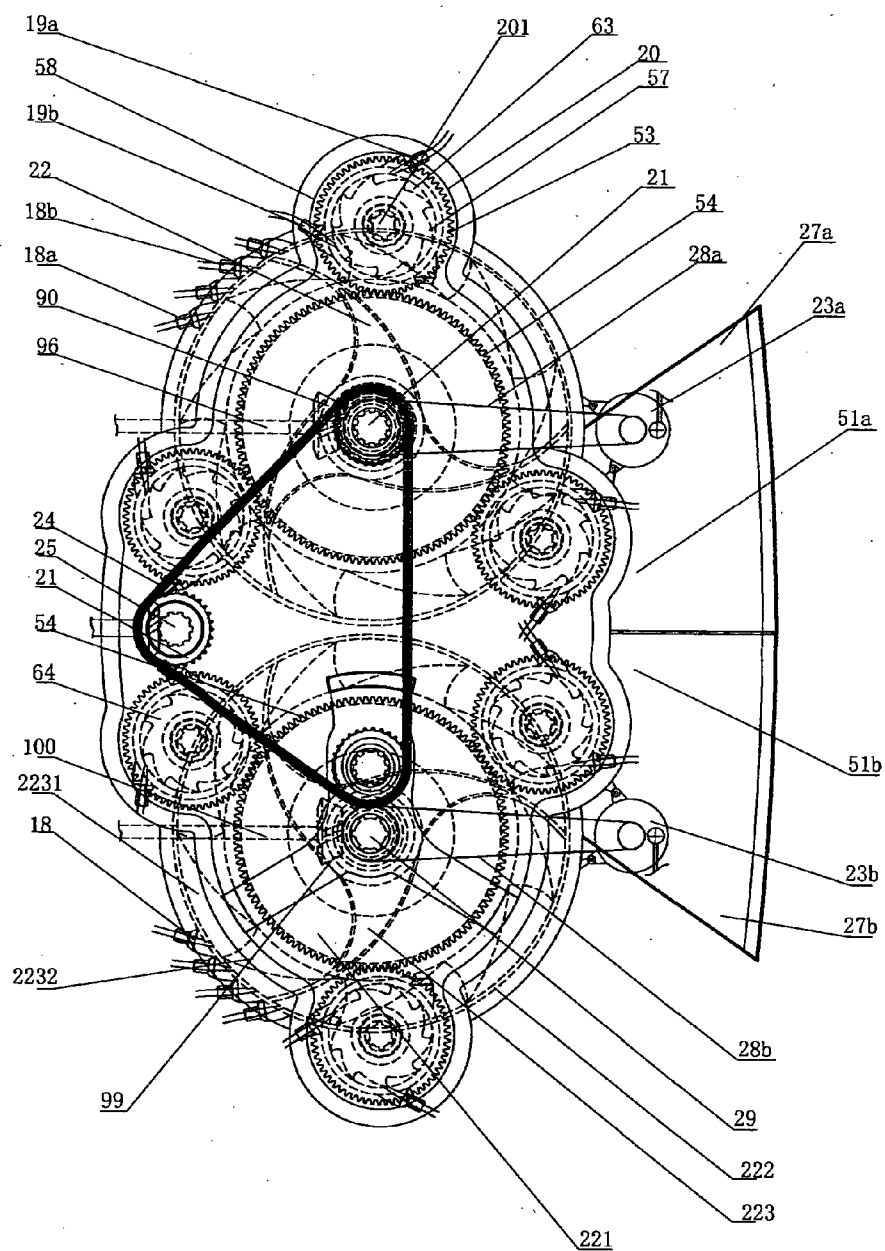


Fig. 5

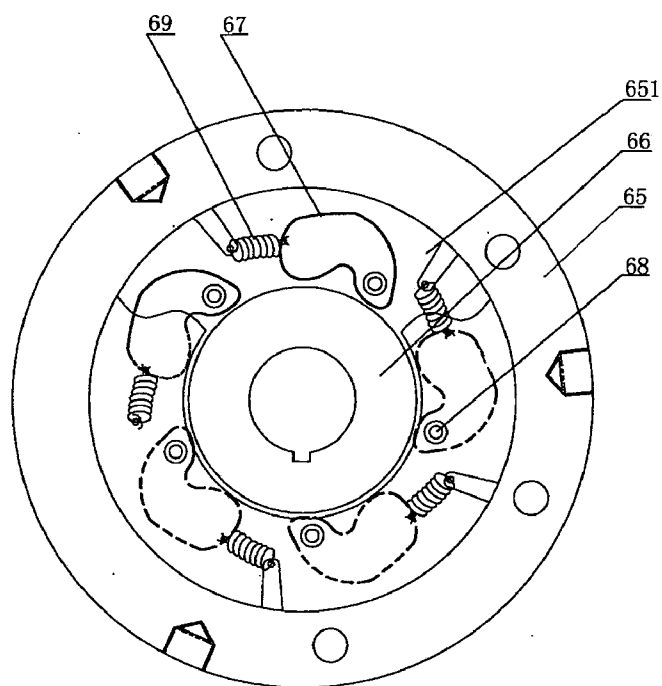


Fig. 6

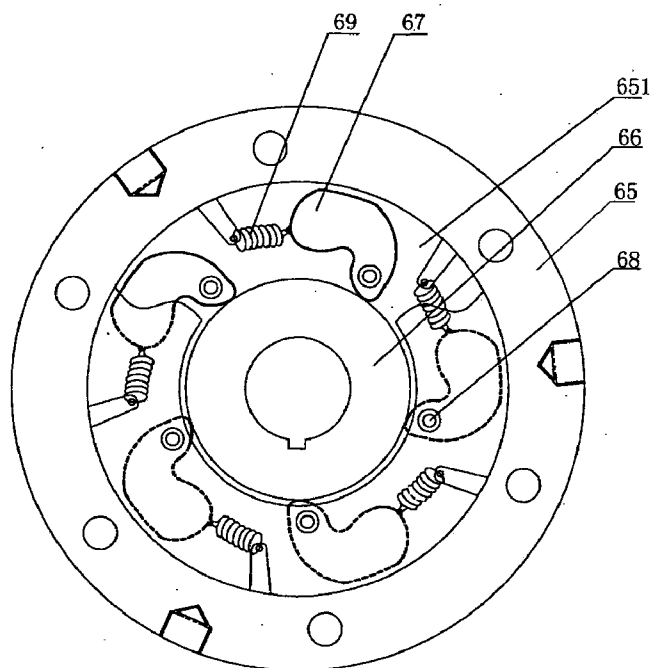


Fig. 7

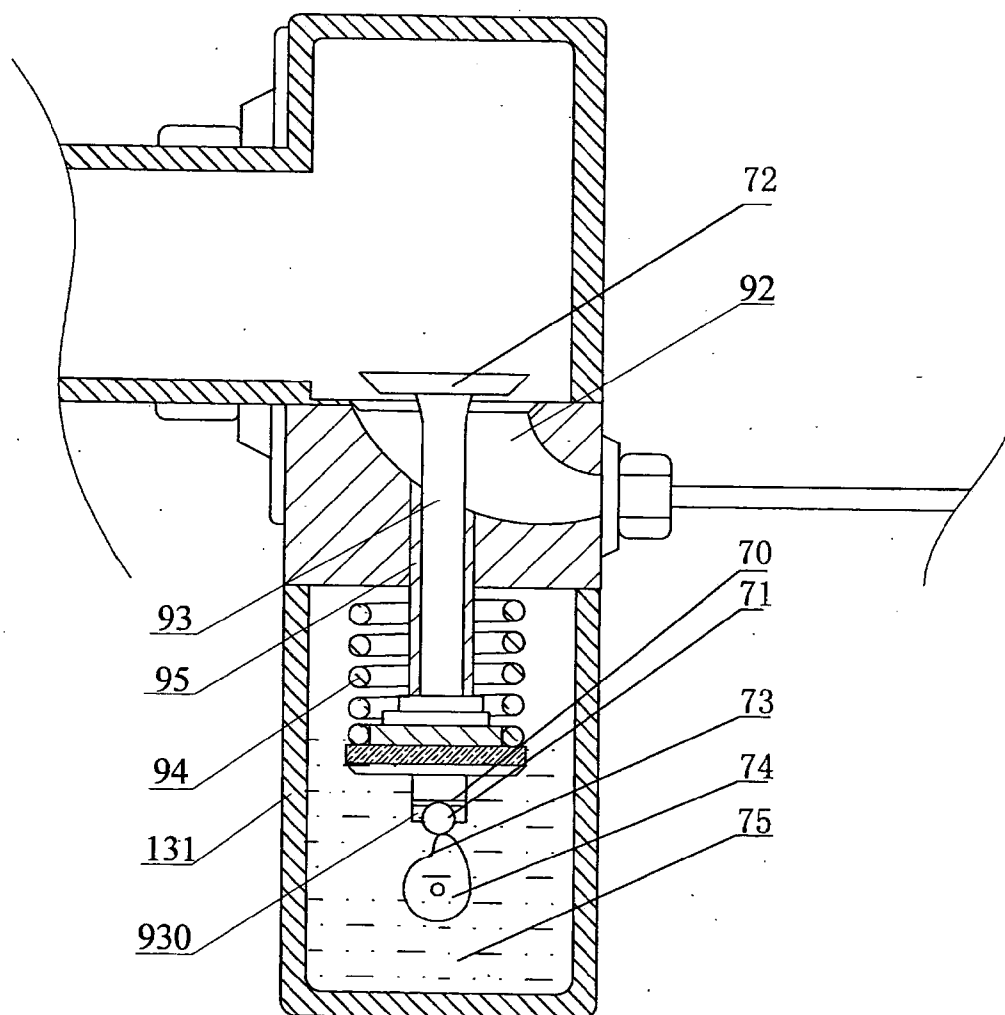


Fig. 8

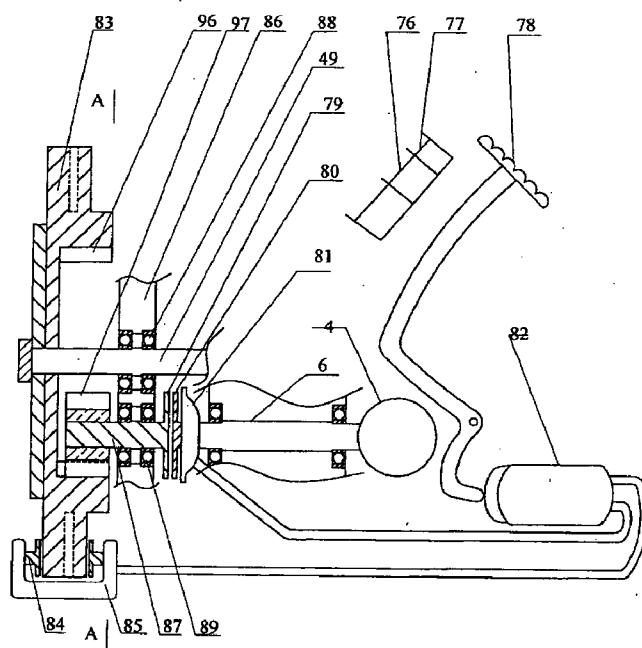


Fig. 9

A-A.

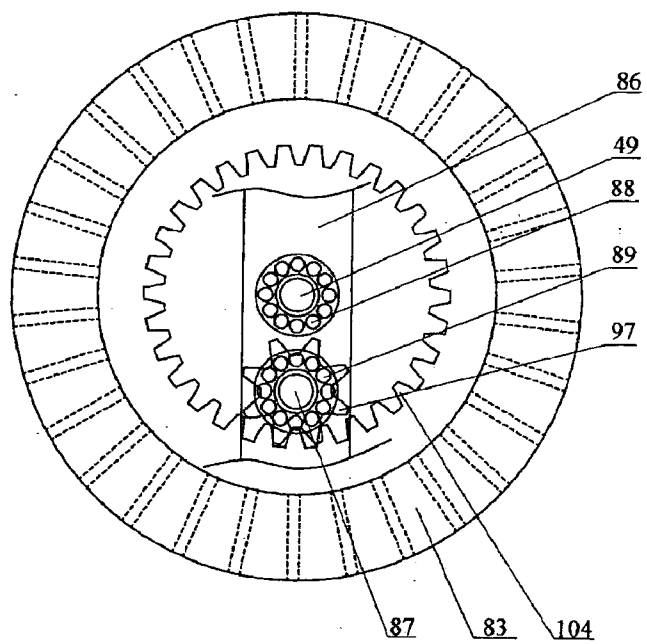


Fig. 10

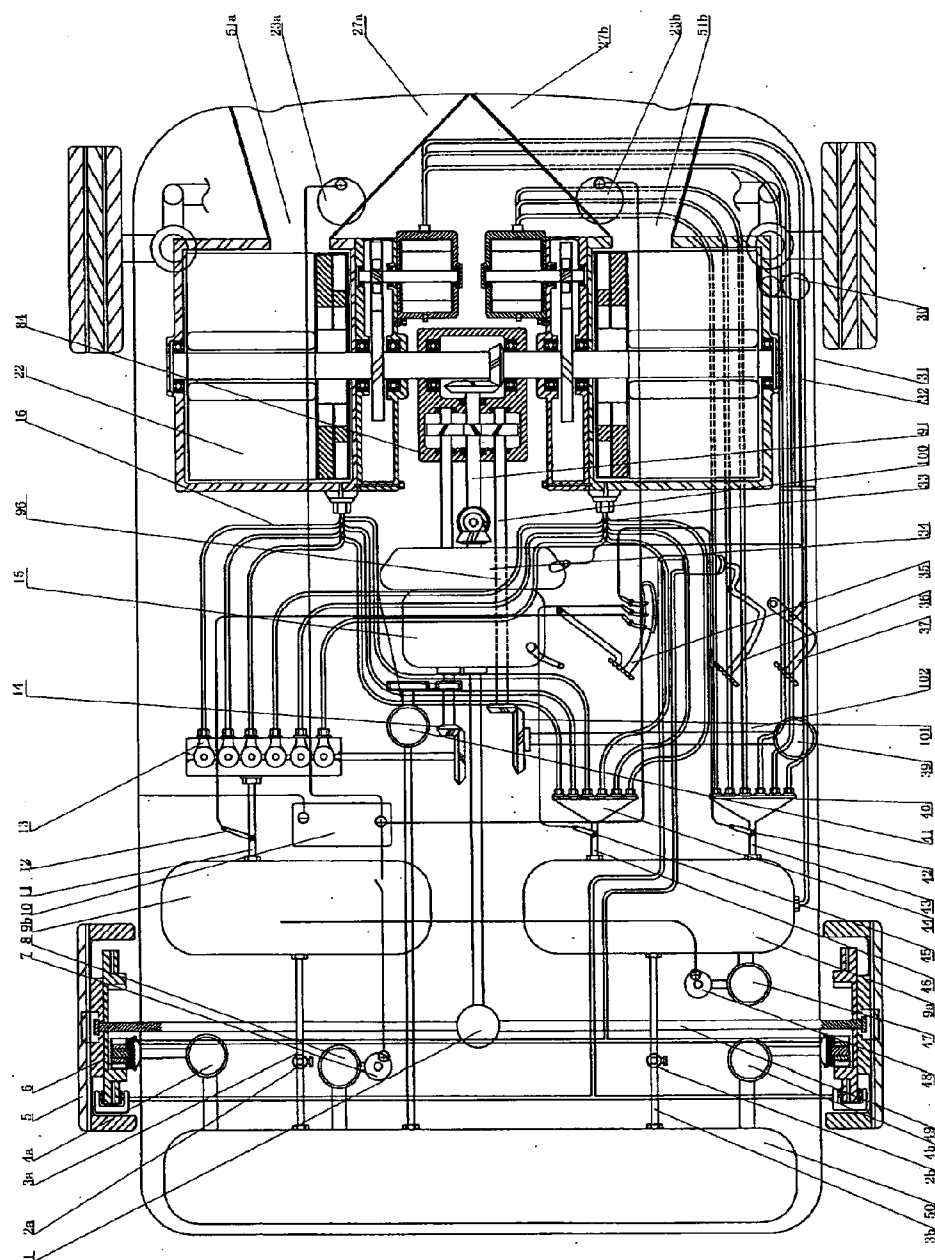


Fig. 11

WIND-GAS ENGINE ASSEMBLY AND MOTOR VEHICLE WITH THE SAME

FIELD

[0001] The present invention belongs to the mechanical field, and relates to an engine, which may be installed in various power machines that travel at a certain speed, such as large, medium or small sized cargo/passenger vehicles having steering wheels, railway trains, subway trains, marine vehicles and air crafts.

BACKGROUND

[0002] An engine using fuel as an energy source will consume a large amount of fuel, and discharge a large amount of waste gas and hot gas, which will pollute the environment. In order to save the fuel energy source and protect the global environment, there is a need for an engine that does not consume fuel, discharge waste gas or hot gas, or cause pollution.

[0003] Chinese patent CN2242352Y discloses a wind power electric generator for automobile, which comprises a windmill, a driving mechanism connected to the windmill, an electric generator connected to the driving mechanism, and a storage battery circuit connected to the output of the electric generator. The wind power electric generator for automobile is installed in the front of an automobile. The windmill rotates when the automobile travels, making the generator generate electricity, which is stored in the storage battery to operate the engine.

[0004] Chinese patent CN2073484U discloses a transport vehicle driven by electricity generated from wind power, which comprises a body and a wind power electricity generator, wherein the body comprises wheels, a chassis, a carriage and a storage battery and the wind power electric generator comprises an impeller, a shaft and an electric generator. The electric generator is fixed to the carriage and the impeller is fixed to the shaft. The impeller drives the generator through the shaft and the output of the electric generator is connected to the storage battery. During operation, wind energy is converted through the impeller into mechanical kinetic energy, which drives the electric generator via the shaft to generate electricity, and electrical energy generated by the electric generator is stored in the storage battery.

[0005] A common advantage of both CN2242352Y and CN2073484U is that wind energy can be converted into electrical energy, which is stored in the storage battery for use. However, they also have the following common shortcomings: 1. Energy conversion has to be performed, i.e. wind energy has to be converted into electrical energy. 2. They are only applicable to a transport vehicle driven by electric power; however, in order to convert electrical energy in turn into mechanical energy, a complicated electromechanical energy conversion system and a circuit control system are necessary for a transport vehicle driven by electric power. 3. The energy conversion efficiency is low. When storing the energy, wind energy needs to be converted into electrical energy; when using the energy, the stored electrical energy needs to be converted in turn into mechanical energy. Two energy conversions in the whole process result in a low energy conversion efficiency. 4. The storage battery is limited in capacity and is bulky, which greatly limits the application field of the transport vehicle using the storage battery as the primary power.

[0006] In view of the above, the traditional thinking always followed by person skilled in the art when utilizing wind energy is to convert wind energy into electrical energy, store the generated electrical energy, and utilize the stored electrical energy as needed with the electromechanical energy conversion and control technology in the prior art.

[0007] In order to utilize wind energy more directly, especially to directly utilize a wind resistance airflow generated in the running of a power machine, the applicant of the present invention filed a Chinese patent application titled with "A Wind-Air Engine-An Engine Employing Wind Power Pressure for Replacing Fuel Energy Source" with the publication number CN1828046, which discloses a wind-air engine and a motor vehicle equipped with the same, which comprise at least one impeller chamber, an impeller installed in the impeller chamber, and an air-jet system for jetting high pressure gas into the impeller chamber. The invention is characterized mainly in that the impeller chamber is provided with an air inlet for receiving external wind resistance airflow and with the air-jet system. During operation, the wind-air engine of the invention, which is installed in a power machine that can travel (especially a motor vehicle), can directly utilize the wind resistance airflow the power machine encounters through the air inlet provided for receiving the external wind resistance airflow, thereby transforming the resistance into a power. With the air-jet system and employing high pressure gas as the primary power, there is no fuel consumption, no waste gas or hot gas discharge, and no pollution.

[0008] The above-mentioned invention initiatively proposed a wind-air engine that directly utilizes the wind resistance airflow as auxiliary power and employs the high pressure gas as the primary power, as well as a motor vehicle equipped with the wind-air engine. The invention does not need to convert the wind resistance airflow into electrical energy. Therefore, no complicated electromechanical energy conversion system or circuit control system is needed, which greatly simplifies the structure of the power machine, especially of the motor vehicle. Besides, the invention provided a new approach to energy saving and an environmental protective substitute for fuel. However, in order to better utilize the wind resistance airflow and high pressure gas, to produce optimal cooperation between the primary power and the auxiliary power, and to increase usage efficiency of the primary power, it is still necessary to further improve the structure of the wind-air engine of the invention and the motor vehicle equipped with the wind-air engine.

SUMMARY

[0009] An object of the present invention is to provide a wind-gas engine assembly and a motor vehicle equipped with the same, wherein the wind-gas engine assembly employs high pressure gas as primary power and directly utilizes the wind resistance airflow that a power machine encounters during travel as auxiliary power, and can better utilize the high pressure gas and the wind resistance airflow cooperatively.

[0010] Another object of the present invention is to provide a wind-gas engine assembly and a motor vehicle equipped with the same, wherein the wind-gas engine assembly can not only directly employ the wind resistance airflow as a power, but also transform this power into regenerated high pressure gas to be stored for future use.

[0011] A further object of the present invention is to provide a wind-gas engine assembly and a motor vehicle

equipped with the same, wherein the wind-gas engine assembly is capable of recycling in time an inertia braking force produced when the motor vehicle is braked to decelerate, by transforming the inertia braking force into regenerated high pressure gas to be stored for future use.

[0012] The technical solution for achieving the above objects is described as below.

[0013] A wind-gas engine assembly is provided, which comprises at least one first high pressure gas engine and at least one wind resistance engine, wherein:

[0014] The first high pressure gas engine comprises at least one first impeller chamber, at least one first impeller and at least one first air-jet nozzle; the impeller chamber is provided with a fumarole and an exhaust vent; the first impeller is installed inside the first impeller chamber through a first shaft; the first air-jet nozzle, jetting a high pressure gas through the fumarole into the first impeller chamber, is installed at the casing of the first impeller chamber; and the first impeller outputs primary power through the first shaft; the primary power is used for driving a power machine equipped with the wind-gas engine assembly of the present invention.

[0015] The wind resistance engine comprises at least one second impeller chamber and at least one second impeller installed inside the second impeller chamber through a second shaft; an air inlet for receiving the external wind resistance airflow and an air outlet for exhausting gas are provided at a casing of the second impeller chamber.

[0016] When the power machine equipped with the wind-gas engine assembly of the present invention is traveling at a certain speed, the external wind resistance airflow that the power machine encounters is received through the air inlet at the second impeller chamber, and the wind resistance airflow entering the second impeller chamber drives the second impeller to rotate to generate auxiliary power, which is outputted through the second shaft.

[0017] A motor vehicle comprising a body, a gear box, a drive axle and wheels is provided, which is characterized in that it further comprises a wind-gas engine assembly, which comprises at least one first high pressure gas engine and at least one wind resistance engine, wherein:

[0018] The first high pressure gas engine comprises at least one first impeller chamber, at least one first impeller and at least one first air-jet nozzle; the impeller chamber is provided with a fumarole and an exhaust vent; the first impeller is installed inside the first impeller chamber through a first shaft; the first air-jet nozzle, jetting a high pressure gas through the fumarole into the first impeller chamber, is installed at a casing of the first impeller chamber; and the first impeller outputs primary power through the first shaft.

[0019] The wind resistance engine comprises at least one second impeller chamber and at least one second impeller installed inside the second impeller chamber through a second shaft; an air inlet for receiving the external wind resistance airflow and an air outlet for exhausting gas are provided at a casing of the second impeller chamber; and a wind resistance airflow entering the second impeller chamber drives the second impeller to rotate to generate auxiliary power, which is outputted through the second shaft.

[0020] The power outputted by the first shaft and the second shaft drives the gear box via a drive mechanism, and the output of the gear box drives the drive axle, which in turn drives the wheel supporting the body.

[0021] Moreover, inside the wind resistance engine is further provided a second high pressure gas engine, which comprises at least one third impeller chamber, at least one third impeller and at least one second air-jet nozzle, wherein: the third impeller chamber and the second impeller chamber are independent of each other; the third impeller is installed inside the third impeller chamber through the second shaft extended thereinto; the second air-jet nozzle is fixed to a casing of the third impeller chamber; the second air-jet nozzle is used for jetting a high pressure gas into the third impeller chamber to drive the third impeller to rotate; and the power generated by both the second impeller and the third impeller is outputted through the second shaft.

[0022] The wind resistance engine further comprises a first one-way clutch and a power output shaft, wherein the power output of the wind resistance engine drives the power output shaft via the first one-way clutch.

[0023] The wind resistance engine further comprises a first gas supply system, a second gas supply system, a third gas supply system and a fourth gas supply system, wherein:

[0024] The first gas supply system comprises a first high pressure air tank, a first valve and a first distributor, one output of the first high pressure air tank is connected to the first distributor via the first valve, and each of multiple outputs of the first distributor is correspondingly connected via a gas pipeline to the first air-jet nozzle installed at the first impeller chamber.

[0025] The second gas supply system comprises a second valve and a second distributor, another output of the first high pressure air tank is connected to the second distributor via the second valve, each of multiple outputs of the second distributor is correspondingly connected via a gas pipeline to the second air-jet nozzle installed at the third impeller chamber.

[0026] The third gas supply system comprises a second high pressure air tank, a third valve, an intermittently bursting air-jet mechanism, a third air-jet nozzle and a fourth air-jet nozzle, the output of the second high pressure air tank is connected to the air-jet mechanism via the third valve, the power output of the wind resistance engine drives the air-jet mechanism via a second drive mechanism, the third air-jet nozzle is installed at the first impeller chamber, the fourth air-jet nozzle is installed at the third impeller chamber, and the intermittently burst high pressure gas outputted by the air-jet mechanism in multiple routes is correspondingly inputted via a gas pipeline into the third air-jet nozzle and the fourth air-jet nozzle, respectively.

[0027] The fourth gas supply system comprises a third high pressure air tank, a first pressure reducing valve and a second pressure reducing valve, and the output of the third high pressure air tank is inputted into the first high pressure air tank via the first pressure reducing valve and into the second high pressure air tank via the second pressure reducing valve, respectively.

[0028] The wind resistance engine further comprises a first high pressure gas regeneration system, a second high pressure gas regeneration system, and a third high pressure gas regeneration system, wherein:

[0029] The first high pressure gas regeneration system comprises a first air compressor and a first drive mechanism, wherein the power outputted from the gear box drives the first air compressor via the first drive mechanism, and a compressed gas generated by the first air compressor is stored in the third high pressure air tank.

[0030] The second high pressure gas regeneration system comprises symmetrically positioned left and right deceleration brakes and a high-load air compressor, wherein the deceleration brake comprises a brake disc with inner ring teeth, a transmission mechanism with outer ring teeth, a driving disc, a driven disc, a first bearing, a second bearing, a supporting base and a clutch device; the brake disc with inner ring teeth and the wheels are fixed coaxially; at a half-axle of the drive axle is installed the first bearing, to which is fixed the supporting base, to which is fixed the second bearing; the transmission mechanism is fixedly connected to the driving disc through a drive shaft supported on the second bearing; the transmission mechanism, positioned at an inner side of the second bearing such that the outer ring teeth of the transmission mechanism are engaged with the inner ring teeth of the brake disc; the driving disc positioned at an outer side of the second bearing such that the brake disc drives the transmission mechanism fixedly provided with the driving disc to rotate through the engagement when the brake disc fixed to the wheel rotates; the driven disc, fixed to one end of a shaft, moves back and forth driven by the clutch device, and drives the high-load air compressor via the other end of the shaft; and the high pressure gas generated by the high-load air compressor is inputted into the third high pressure air tank.

[0031] The third high pressure gas regeneration system comprises an electric generator, a storage battery, a motor and a third air compressor, wherein the power output of the wind resistance engine drives the electric generator via a third drive mechanism, electrical energy outputted by the electric generator is stored by the storage battery, whose output is connected to the motor, while the output of the motor drives the third air compressor, and a compressed gas generated by the third air compressor is stored in the third high pressure air tank.

[0032] Moreover, the fumarole provided at the inner side of the first impeller chamber is an air-jet slot expanding abruptly.

[0033] With the above technical solution, the present invention has the following beneficial technical effects:

[0034] 1. The wind-gas engine assembly of the present invention, although simple in structure, is essentially different from a traditional engine in the following aspects: 1) the technical problems to be solved are different: the technical problem to be solved in the present invention is how to use the external wind resistance airflow as a power, while a prior art engine is powered by an internal energy source, which is mainly fuel; 2) the technology solutions are different: the air inlet provided at the wind-gas engine assembly of the present invention is always open to the outside, so as to receive the external wind resistance airflow constantly to directly drive the impeller to operate to produce the power; although the prior art engine is also provided with an opening, the opening is generally used as a fuel injection hole or a ventilation hole for providing oxygen necessary for burning; one of ordinary skill in the art would appreciate that the air inlet of the present invention for receiving the wind resistance airflow is much larger than the fuel injection hole or the ventilation hole, and the function and effect of the air inlet provided at the wind-gas engine assembly of the present invention is obviously different from that of the prior art; 3) the effects are totally different: a power machine equipped with the wind-gas engine assembly of the present invention uses the wind resistance airflow as the power; the higher the traveling speed of the power machine is, the greater the utilization of the strong wind resistance airflow is; therefore, the engine of the present

invention, when employed as auxiliary power, can significantly increase the traveling speed of the power machine without remarkably increasing the amount of energy consumed when the power machine travels at a high speed; in addition, the wind-gas engine assembly of the present invention employs high pressure gas as the power, while the gas can be added simply and quickly, and the disassembly and replacement are very easy.

[0035] 2. The wind-gas engine assembly of the present invention comprises a high pressure gas engine and a wind resistance engine, which are independent of each other. It is advantageous in the following aspects:

[0036] 1) Based on the fact that the high pressure gas has a high flow velocity and is relatively focused while the wind resistance airflow has a low flow velocity and is relatively dispersed, the corresponding impellers can be designed pertinently to increase the energy conversion efficiency (for example, the blade of the impeller of the high pressure gas engine should be designed to be small, while the blade of the impeller of the wind resistance engine big should be designed to be large).

[0037] 2) The operation state of the engine can be flexibly changed as needed to reduce unnecessary load and further save energy. For example, when the motor vehicle equipped with the wind-gas engine assembly of the present invention is in the start stage, since the traveling speed of the motor vehicle is basically zero or very low and the wind resistance is very low, the wind resistance engine substantially does not function; under this circumstance, one may only use the high pressure gas engine, and the wind resistance engine can be disengaged through the one-way clutch to make it released from the operation state and stopped rotating with the high pressure gas engine, thus reducing the load of the high pressure gas engine. When the motor vehicle is in a downhill state, since the high pressure gas engine is not needed to provide the power, the high pressure gas engine can be disengaged through the one-way clutch to make it released from the operation state and stopped rotating with the wind resistance engine, thus reducing the unnecessary energy consumption and transforming to the greatest extent the wind energy received by the wind resistance engine into the compressed gas to be stored.

[0038] 3. The acceleration performance and output power of the motor vehicle can be greatly increased by further providing the second high pressure gas engine inside the wind resistance engine, and, as needed, using the first high pressure gas engine and the second high pressure gas engine at the same time, which is especially suitable for large cargo vehicles and race cars, etc.

[0039] 4. The wind-gas engine assembly is provided with the first high pressure air compressor, the second high pressure air compressor, and the intermittently bursting air-jet mechanism, and can be provided with two working gases with different pressures according to different power requirements. For example, the working pressure of the second high pressure air compressor can be configured to be lower than that of the first high pressure air compressor; when a long travel is to be made for a long time at a low speed, a small amount of high pressure gas can be supplied intermittently to the high pressure gas engine through the intermittently bursting air-jet mechanism, so as to keep the power machine traveling continuously with relatively low energy consumption. On the contrary, when necessary, the working pressure of the second high pressure air compressor can be configured to be

higher than that of the first high pressure air compressor, so as to provide powerful intermittent bursting performance.

[0040] 5. The wind-gas engine assembly is provided with the electric generator, the storage battery and the motor in order to: 1) provide necessary electricity to be used in the vehicle (such as illumination, audio play, etc.); and 2) convert the electrical energy stored in the storage battery into high pressure gas at any time, so as to provide power for the motor vehicle for emergency uses.

[0041] 6. With the third high pressure air tank and the pressure reducing valve, when the working pressures of the first high pressure air tank and the second high pressure air tank are lower than a set value, the working gas is supplied automatically via the pressure reducing valve to ensure the stable working performance of the wind-gas engine assembly.

[0042] 7. With the deceleration brake, the brake energy can be recycled in time and converted into compressed gas to be stored through the high-load air compressor, which will greatly reduce the consumption of the compressed gas.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] FIG. 1 is a top view of the assembly structure of the motor vehicle equipped with the wind-gas engine assembly;

[0044] FIG. 2 is a right side view of the wind resistance engine in FIG. 1;

[0045] FIG. 3 is a sectional view along the line A-A in FIG. 1;

[0046] FIG. 4 is an enlarged schematic view of the structure of the first high pressure gas engine in FIG. 1;

[0047] FIG. 5 is an enlarged schematic view of the structure of driving relation between the first high pressure gas engine and the wind resistance engine in FIG. 1;

[0048] FIG. 6 is a schematic view of the structure of the one-way clutch in FIG. 3;

[0049] FIG. 7 is a schematic view of the structure of the one-way clutch in FIG. 6 when the inner wheel of the one-way clutch is in a locked state;

[0050] FIG. 8 is a schematic view of the internal structure of the air-jet mechanism in FIG. 1;

[0051] FIG. 9 is a schematic view of the structure of the deceleration brake;

[0052] FIG. 10 is a structural schematic view of engagement between the brake disc and the transmission mechanism in FIG. 9; and

[0053] FIG. 11 is a schematic structural view of another motor vehicle equipped with the wind-gas engine assembly.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0054] The present invention will be further described below in detail with reference to drawings and embodiments.

Example 1

[0055] As shown in FIG. 1, a motor vehicle equipped with a wind-gas engine assembly comprises a body 31, a wind-gas engine assembly, a gear box 15, a drive axle 1, a half-axle 49 of the drive axle, and wheels 5.

[0056] As shown in FIGS. 1-8, the wind-gas engine assembly comprises a first high pressure gas engine 20, a wind resistance engine 22, a pinion 53, a left power output shaft 21, a right power output shaft 29, a reversing wheel 26, a primary power output shaft 91, a sprocket 24, a gas supply system, and

a high pressure gas regeneration system. Two wind resistance engines 22 are positioned symmetrically left and right.

[0057] As shown in FIGS. 1, 3, 4, 6 and 7, three first high pressure gas engines 20 having the same structure are fixed symmetrically to the casing of the left and the right wind resistance engines 22, respectively. As an example, the first high pressure gas engine 20 fixed to the left wind resistance engine 22 comprises a first impeller chamber 63, a first impeller 57, a one-way clutch 55, a first air-jet nozzle 19a, and a third air-jet nozzle 19b. The structure of the one-way clutch 52, as shown in FIGS. 6 and 7, comprises an outer wheel 65, an inner wheel 66, a wedge 67, a cage 651 and a spring 69, wherein the cage 651, which is fixed to the outer wheel 65, configure the wedge 67 to be between the circular inner wheel and outer wheel 65, with the help of the spring 69 and a supporting shaft 68. When the outer wheel 65 is motionless, the inner wheel 66 may rotate freely and there is no driving relation therebetween (FIG. 6); when the outer wheel 65 rotates clockwise, the wedge 67 is locked to the inner wheel 66 (FIG. 7) under the action of the centrifugal force, rendering the inner wheel 66 rotating with the outer wheel 65. When the outer wheel 65 comes to a stop, the wedge 67 is released from the locked state with the inner wheel 66 under the action of the elastic restoring force of the spring 69. Along the casing of the first impeller chamber 63 are provided alternately fumaroles 58 and exhaust vent 61 wherein an air-jet slot 59 expanding abruptly is formed inside the fumaroles 58 and near the inner side of the first impeller chamber 63, so as to quickly increase the jetting area of the high pressure gas at the first impeller 57. The first air-jet nozzle 19a and the third air-jet nozzle 19b are correspondingly installed at the fumarole 58, and jet the high pressure gas into the first impeller chamber 63 through the respective fumarole 58, wherein the first air-jet nozzle 19a is used for jetting continuous high pressure gas into the first impeller chamber 63, and the third air-jet nozzle 19b is used for jetting intermittently burst high pressure gas into the first impeller chamber 63. The first impeller 57 in the first impeller chamber 63 is fixed to the outer wheel 65 of the one-way clutch 52. The first shaft 201 is fixedly connected to the inner wheel 66 of the one-way clutch 52. To the first shaft 201 is fixed the pinion 53, through which a first primary power generated by the rotation of the first impeller 57 is transmitted to a gear wheel 54 fixed to the left power output shaft 21.

[0058] As shown in FIGS. 1-3 and 5, the wind resistance engine 22 comprises a second impeller chamber 221, a second impeller 222 and a second high pressure gas engine 223, wherein the second high pressure gas engine 223 comprises a third impeller chamber 2231, a third impeller 2232, a second air-jet nozzle 18a and a fourth air-jet nozzle 18b. The third impeller chamber 2231 and the second impeller chamber 221 are independent of each other, and positioned in the casing of the same wind resistance engine 22. The second impeller chamber 221 is provided with an air inlet 51 for receiving the external wind resistance airflow and an air outlet 103 for exhausting gas. The third impeller chamber 2231 is provided with a fumarole and an exhaust vent similar to the fumarole 58 and the exhaust vent 61 at the first impeller chamber 63 of the first high pressure gas engine 20. The second air-jet nozzle 18a and the fourth air-jet nozzle 18b are installed at the casing of the second high pressure gas engine 223 for jetting high pressure gas into the third impeller chamber 2231 through their respective fumarole, wherein the second air-jet nozzle 18a is used for jetting the continuous high pressure gas into the third impeller chamber 2231, and the fourth air jet nozzle

18b is used for jetting the intermittently burst high pressure gas into the third impeller chamber **2231**. The second impeller **222** and the third impeller **2232** are integrated, one end of which is supported on the inner wall of the second impeller chamber **221** through a shaft, and the other end of which is installed at the outer wheel **65** of the one-way clutch **55**. The inner wheel **66** of is fixed to the left power output shaft **21** and the one-way clutch **55** has the same structure with the one-way clutch **52**. The internal opening of a trumpet-type air duct **27**, with a bigger external opening and a smaller internal opening, is fixedly connected to the air inlets **51a**, **51b** of the wind resistance engine **22**, and the external opening of the trumpet-type air duct **27** is installed at the front end of the body **31** where the wind resistance is the greatest. The received external wind resistance airflow is guided into the second impeller chamber **221** through the trumpet-type air ducts **27a**, **27b** to drive the second impeller **222** to rotate to generate the auxiliary power. The auxiliary power generated by the second impeller **222** and the second primary power generated by the third impeller **2232** are outputted to the left power output shaft **21** through the one-way clutch **55**. At the start stage, when the wind resistance engine **22** has no power output, although the first high pressure gas engine **20** drives the left power output shaft **21** to rotate, the wind resistance engine **22** will not rotate with the left power output shaft **21** because of the one-way driving function of the one-way clutch **55**, thus reducing the starting load of the first high pressure gas engine **20**.

[0059] In order to output the power via the left and the right power output shafts (**21**, **29**) with the help of the chain **24**, a reversing wheel **26** is provided beside the gear wheel **54** of the right power output shaft **29**. The gear wheel **54** transmits the power output to the reversing wheel **26**. A gear **25** is fixed to the primary power shaft **91** of the transmission gear box **15**. The gear wheel **54**, the reversing wheel **26** and the gear **25** are driven with the help of the chain **24** to transmit the power outputted from the left and the right power output shafts (**21**, **29**) to the primary power shaft **91**. The power is then transmitted to the drive axle **1** through the gear box **15**. The drive axle **1** is connected to the half-axle **49** of the drive axle; and the half-axle **49** drives the wheel **5** supporting the body **31** to rotate.

[0060] As shown in FIGS. 1 and 3, the gas supply system comprises a first gas supply system, a second gas supply system, a third gas supply system and a fourth gas supply system, wherein:

[0061] the first gas supply system comprises a first high pressure air tank **9a**, a first valve **42** and a first distributor **40**, wherein one output of the first high pressure air tank **9a** is connected to the first distributor **40** via the first valve **42**, and each of the multiple outputs of the first distributor **40** is correspondingly connected to the first air-jet nozzle **19a** installed at the casing of the first high pressure gas engine **20**, so as to provide continuous high pressure gas for the first impeller chamber **63**.

[0062] The second gas supply system comprises the first high pressure air tank **9a**, a second valve **45** and a second distributor **44**, wherein another output of the first high pressure air tank **9a** is connected to the second distributor **44** via the second valve **45**, each of the multiple outputs of the second distributor **44** is correspondingly connected to the second air-jet nozzle **18a** installed at the casing of the second

high pressure gas engine **223**, and the second air-jet nozzle **18a** provides continuous high pressure gas for the third impeller chamber **2231**.

[0063] The third gas supply system comprises a second high pressure air tank **9b**, a third valve **12**, an intermittently bursting air-jet mechanism **13**, a third air-jet nozzle **19b** and a fourth air-jet nozzle **18b**. The function of the air-jet mechanism **13** is to transform the continuously inputted gas into multiple routes of the intermittently outputted gas. The internal structure of the air-jet mechanism **13**, as shown in FIG. 8, comprises multiple distribution controllers **131** and camshafts **74**, wherein each of the distribution controllers **131** comprises a valve **72**, a mandril **93**, a valve port **92** and an elastic restoring device **94**. The front end of the mandril **93** is fixed to the valve **72**, and the rear part of the mandril **93** is inserted into a lubrication oil chamber **75** through a gland **95**, and nested in and fixedly connected to the elastic restoring device **94**. The rear end of the mandril **93** is provided with a chamber **930** and an oil passage **70**. At the camshaft **74** is provided a set of cams **73** separated by a certain distance for driving each of the mandrils **93**. The lubrication oil is introduced into the chamber **930** through the oil passage **70**. In the chamber **930** is provided a rolling ball **71**. Under the action of the lubrication oil, the frictional resistances between the rolling ball **71** and the cam **73** at the camshaft **74** as well as between the rolling ball **71** and the chamber **930** can be greatly reduced. When the rolling ball **71** at the rear end of the mandril **93** is pushed by the cam **73**, the mandril **93** and the valve **72** move upwards to open the valve port **92**; when the rolling ball **71** is not pushed by the cam **73**, the mandril **93** and the valve **72** return to the natural state under the action of the elastic restoring force, and the valve **72** closes the valve port **92**. During operation, the power outputted from the left power output shaft **21** drives the camshaft **74** to rotate via a conical gear **90**, a second drive shaft **96** and a conical gear **14**. Each of the cams **74** at the camshaft **73** intermittently pushes the ball **71** at the rear end of the mandril **93**, so as to periodically open and close the valve port **92**. When the third valve **12** is opened, the intermittently burst high pressure gas is generated through the air-jet mechanism **13**. The output of the second high pressure air tank **9b** is connected to the air-jet mechanism **13** via the third valve **12**. The third air-jet nozzle **19b** is installed at the casing of the first impeller chamber **63**. The fourth air-jet nozzle **18b** is installed at the casing of the third impeller chamber **2231**. The intermittently burst high pressure gas outputted from the air-jet mechanism **13** in multiple routes is jetted into the first high pressure gas engine **20** via the third air-jet nozzle **19b**, and into the second high pressure gas engine **223** via the fourth air-jet nozzle **18b**, generating the power output. When a long travel is to be made for a long time at a low speed, it is only needed to intermittently supply a small amount of high pressure gas to the first high pressure gas engine **20** and the second high pressure gas engine **223** through the intermittently bursting air-jet mechanism **13**, so as to keep the power machine traveling continuously with low energy consumption.

[0064] In order to conveniently control the three valves, a valve pedal **35** is provided, as shown in FIG. 1. The valves (**42**, **44** and **12**) are controlled respectively by triggering a corresponding travel switch **351** through the pedal **35**, so as to control the first to the third gas supply systems.

[0065] It is necessary to explain that, two different working pressures can be provided as needed by separately providing different first high pressure air tank **9a** and second high pres-

sure air tank 9b, so as to improve the start and acceleration performance of the motor vehicle. For example, the instantaneous bursting performance of the engine can be improved by increasing the working pressure of the second high pressure air tank 9b.

[0066] Considering that the first high pressure air tank 9a and the second high pressure air tank 9b may consume high pressure gas constantly in the working process, the working pressure will decline gradually, which will directly affect the working performance of the wind-gas engine assembly. Therefore, the present invention provides the fourth gas supply system, which will provide constant working pressure for the first high pressure air tank 9a and the second high pressure air tank 9b, thus ensuring the stable working performance of the wind-gas engine assembly.

[0067] The fourth gas supply system comprises a third high pressure air tank 50, a first pressure reducing valve 2b, and a second pressure reducing valve 2a. The pressure of the high pressure gas stored in the third high pressure air tank 50 is much higher than that of the working gas in the first high pressure air tank 9a and the second high pressure air tank 9b. The output of the third high pressure air tank 50 is inputted into the first high pressure air tank 9a via the first pressure reducing valve 2b, and is inputted into the second high pressure air tank 9b via the second pressure reducing valve 2a. With the third high pressure air tank 50 and the pressure reducing valves (2a, 2b), when the working pressures of the first high pressure air tank 9a and the second high pressure air tank 9b are lower than a set value, the working gas will be automatically supplemented via the pressure reducing valves (2a, 2b) to ensure the stable working performance of the wind-gas engine assembly.

[0068] As shown in FIG. 1, the high pressure gas regeneration system comprises a first high pressure gas regeneration system, a second high pressure gas regeneration system, a third high pressure gas regeneration system, and a fourth high pressure gas regeneration system.

[0069] The first high pressure gas regeneration system comprises a first air compressor 41 and a first drive mechanism 96, wherein the power outputted from the gear box 15 drives the first air compressor 41 via the first drive mechanism 96, and the compressed gas generated by the first air compressor 41 is stored in the third high pressure air tank 50.

[0070] As shown in FIGS. 1, 9 and 10, the second high pressure gas regeneration system comprises deceleration brakes and high-load air compressors (4a, 4b) positioned symmetrically left and right. The deceleration brakes are used for converting inertia kinetic energy of the traveling motor vehicle into rotation kinetic energy, so as to utilize rotation kinetic energy to drive the high-load air compressor to work, converting braking energy into the form of compressed gas for storing the energy. As an example, the second high pressure gas regeneration system at the left side of the wheel 5 will be described below. The deceleration brake 6 comprises a brake disc 83 fixedly provided with inner ring teeth 104, a transmission mechanism 87 with outer ring teeth 97, a driving disc 79, a driven disc 80, a first bearing 88, a second bearing 89, a supporting base 86 and a clutch device. The brake disc 83 fixedly provided with inner ring teeth 104 and the wheel 5 are fixed coaxially. The first bearing 88 is installed at the half-axle 49 of the drive axle, the supporting base 86 is fixed to the first bearing 88, and the second bearing 89 is fixed to the supporting base 86. The transmission mechanism 87 with outer ring teeth 97 is fixedly connected to the driving disc 79

through the drive shaft 79a, which is supported on the second bearing 89. The transmission mechanism 87 with outer ring teeth 97 is positioned at the inner side of the second bearing 89, and outer ring teeth 97 of the transmission mechanism 87 are engaged with the inner ring teeth 104 of the brake disc 83. The driving disc 79 is positioned at the outer side of the second bearing 89. When the brake disc 83 fixed to the wheel 5 rotates, it drives the transmission mechanism 87 to rotate through engagement, and drives the driving disc 79 and the transmission mechanism 87 to rotate coaxially. The driven disc 80 provided corresponding to the driving disc 79 is pushed to move back and forth by the clutch device. The clutch device comprises a pedal 78, a hydraulic chief-pump 82 and a hydraulic actuating pump 81. The hydraulic chief-pump 82 is controlled through the pedal 78. And the output of the hydraulic chief-pump 82 controls the hydraulic actuating pump 81, which pushes the driven disc 80 to move back and forth. The driven disc 80 is fixed to one end of a shaft 6 to drive the high-load air compressor 4a through the other end of the shaft 6. The high pressure gas generated by the high-load air compressor 4a is inputted into the third high pressure air tank 50 to be stored.

[0071] The travel of the pedal 78 is classified into a deceleration braking pressurizing travel 77 and a deceleration braking travel 76. When it is required to decelerate, the pedal 78 is stepped down to the position of deceleration braking pressurizing travel 77, and the pedal 78 drives the hydraulic chief-pump 82, which drives the hydraulic actuating pump 81, which pushes the driven disc 80 to engage with the driving disc 79. As a result, when the driving disc 79 rotates, the driven disc 80 is driven to rotate, which drives the high-load air compressor 4a to work, and thus the braking inertial energy is regenerated and converted into the high pressure gas that is supplied to the air tank 50 to be stored. When it is required to brake, the pedal 78 is stepped down to the position of deceleration braking travel 76, and the pedal 78 drives the hydraulic chief-pump 82, which acts on the hydraulic actuating pump 81 and the hydraulic actuating pump 85 simultaneously. On one hand, the deceleration braking pressurizing process continues through the second high pressure gas regeneration system; on the other hand, the brake pad 84 is pushed by the hydraulic actuating pump 85 to brake quickly at same time.

[0072] The third high pressure gas regeneration system comprises left and right electricity generators (23a, 23b), a storage battery 10, a motor 7 and a third air compressor 8. The power output of the left and the right wind resistance engines drives the electric generators (23a, 23b) via transmission belts (28a, 28b). The electrical energy outputted by the electric generators (23a, 23b) is stored by the storage battery 10, whose output is connected to the motor 7. The output of the motor 7 drives the third air compressor 8, and the compressed gas generated by the third air compressor 8 is stored in the third high pressure air tank 50.

[0073] The fourth high pressure gas regeneration system comprises a fourth air compressor 39 and a fourth drive mechanism, wherein the fourth drive mechanism comprises a conical gear 99, a drive shaft 100, a conical gear 101, and a drive shaft 101. The power output of the right power output shaft 29 drives the fourth air compressor 39 through the conical gear 99, the drive shaft 100, the conical gear 101 and the drive shaft 101, and the compressed gas generated by the fourth air compressor 39 is stored in the first high pressure air tank 9a.

[0074] It is necessary to explain that, as appreciated by one of ordinary skill in the art, the high pressure gas regenerated by any high pressure gas regeneration system can be stored in any air tank. However, it is preferred to introduce the regenerated high pressure gas into the third high pressure air tank 50 to be stored, so as to keep the working pressures of high pressure gas in the first high pressure air tank 9a and the second high pressure air tank 9b relatively constant, and not changed by the input of the regenerated high pressure gas, and to keep the working performance of the engine not affected.

[0075] In order to make the present invention better understood, the starting, traveling and braking process of the motor vehicle will be briefly described below, respectively:

[0076] In the starting stage, the valve pedal 35 is stepped down to the travel of the first valve 42 to open the first valve 42. Continuous high pressure gas is jetted into each of the first high pressure gas engines 20 through the first gas supply system. The power is provided by the first high pressure gas engine 20 to the drive axle 1 sequentially via the one-way clutch 52, the pinion 53, the gear wheel 54, the left and the right power output shafts (21, 29), the chain 24, the gear 25, the primary power shaft 91 and the gear box 15 to drive the wheels 5 to rotate via the half-axle 49 of the drive axle. During this process, the wind resistance engine 22 has no power output since the wind resistance is very low, and the wind resistance engine 22 will not rotate with the left power output shaft 21 because of the one-way driving function of the one-way clutch 55. If the power is not enough for starting, the second valve 45 can be further opened to start the second high pressure gas engine 223 in the wind resistance engine 22 through the second gas supply system. The power provided by the first high pressure gas engine 20 and the second high pressure gas engine 223 together may improve the starting performance of the motor vehicle.

[0077] When the motor vehicle travels at a certain speed, the external wind resistance airflow that the motor vehicle encounters is received through the wind resistance airflow air inlet 51 to drive the second impeller 222 to rotate, so as to generate the auxiliary power. At this time, the high pressure gas engine 20 and the wind resistance engine 22 together provide power for the motor vehicle.

[0078] When it is not necessary to provide power for the motor vehicle, for example, when the motor vehicle is going downhill or in a sliding state, the first high pressure gas regeneration system, the second high pressure gas regeneration system, and the third high pressure gas regeneration system can be started to recover the surplus wind resistance airflow in time and transform it into the regenerated high pressure gas to be inputted into the air tank to be stored for use.

[0079] When the motor vehicle is required to be decelerated and braked, the second high pressure gas regeneration system is started. The deceleration brake can convert inertia kinetic energy of the traveling motor vehicle into rotation kinetic energy, which is utilized to drive the high-load air compressors (4a, 4b) to work, thus skillfully converting the braking energy into the form of compressed gas for storing the energy. This solution can greatly reduce consumption of the compressed gas, especially when in a city where there is a traffic jam and decelerating and braking are often needed.

Example 2

[0080] Another motor vehicle equipped with the wind-gas engine assembly is provided, as shown in FIG. 11. This

example is different from Example 1 in that: the high pressure gas engine 20 and the wind resistance engine 22 in this example are installed horizontally, while the high pressure gas engine 20 and the wind resistance engine 22 in Example 1 are installed vertically; that is, the shafts of the high pressure gas engine 20 and the wind resistance engine 22 in this example are horizontal, while the shafts of the high pressure gas engine 20 and the wind resistance engine 22 in Example 1 is vertical. Therefore, in this example, the left power output shaft 21 and the right power output shaft 29 are integrated and rotate coaxially, and are not necessary to be driven by the reversing wheel or the chain. In addition, two separate trumpet-type air ducts (27a, 27b) are needed since the space between the wind resistance airflow air inlets (51a, 51b) provided at the left and the right wind resistance engines 22 is large and the trumpet-type air duct is somewhat different in shape; while in Example 1, the trumpet-type air ducts (27a, 27b) are integrated because the air inlets (51a, 51b) are close to each other. Except for those above, the structure is the same with that in Example 1.

What is claimed is:

1. A wind-gas engine assembly, comprising:
at least one first high pressure gas engine; and
at least one wind resistance engine,

wherein the first high pressure gas engine comprises at least one first impeller chamber, at least one first impeller and at least one first air-jet nozzle; the impeller chamber is provided with a fumarole and an exhaust vent; the first impeller is installed inside the first impeller chamber through a first shaft; the first air-jet nozzle, jetting a high pressure gas through the fumarole into the first impeller chamber, is installed at the casing of the first impeller chamber; and the first impeller outputs primary power through the first shaft,

wherein the wind resistance engine comprises at least one second impeller chamber and at least one second impeller installed inside the second impeller chamber through a second shaft; an air inlet for receiving external wind resistance airflow and an air outlet for exhausting gas are provided at a casing of the second impeller chamber; and a wind resistance airflow entering the second impeller chamber drives the second impeller to rotate to generate auxiliary power which is outputted through the second shaft.

2. The wind-gas engine assembly according to claim 1, wherein inside the wind resistance engine is further provided a second high pressure gas engine, which comprises:

at least one third impeller chamber,

at least one third impeller, and

at least one second air-jet nozzle,

wherein the third impeller chamber and the second impeller chamber are independent of each other; the third impeller is installed inside the third impeller chamber through the second shaft extended thereto; the second air-jet nozzle is fixed to a casing of the third impeller chamber; the second air-jet nozzle is used for jetting a high pressure gas into the third impeller chamber to drive the third impeller to rotate; and power generated by both the second impeller and the third impeller is outputted through the second shaft.

3. The wind-gas engine assembly according to claim 2, comprising a first one-way clutch and a power output shaft, wherein the power output of the wind resistance engine drives the power output shaft via the first one-way clutch, such that

the impeller of the wind resistance engine will not rotate with the power output shaft when the wind resistance engine has no power output.

4. The wind-gas engine assembly according to claim 3, comprising a second one-way clutch, wherein the power output of the first high pressure gas engine drives the second one-way clutch, and the output of the second one-way clutch drives the power output shaft via a driving mechanism, such that the impeller of the first high pressure gas engine will not rotate with the power output shaft when the first high pressure gas engine has no power output.

5. The wind-gas engine assembly according to claim 1, further comprising a first gas supply system which comprises a first high pressure air tank, a first valve and a first distributor, wherein the output of the first high pressure air tank is connected to the first distributor via the first valve, and each of multiple outputs of the first distributor is correspondingly connected via a gas pipeline to the first air-jet nozzle installed at the first impeller chamber.

6. The wind-gas engine assembly according to claim 5, comprising a fourth gas supply system which comprises a third high pressure air tank and a first pressure reducing valve, and the output of the third high pressure air tank being inputted into the first high pressure air tank via the first pressure reducing valve.

7. The wind-gas engine assembly according to claim 6, comprising a first high pressure gas regeneration system which comprises a first air compressor and a first drive mechanism, the power output of the wind resistance engine driving the first air compressor via the first drive mechanism, and a compressed gas generated by the first air compressor being stored in the third high pressure air tank.

8. The wind-gas engine assembly according to claim 1, wherein the fumarole provided at an inner side of the first impeller chamber is an air-jet slot expanding abruptly.

9. The wind-gas engine assembly according to claim 2, comprising a first gas supply system and a second gas supply system, wherein the first gas supply system comprises a first high pressure air tank, a first valve and a first distributor, and one output of the first high pressure air tank is connected to the first distributor via the first valve, and each of multiple outputs of the first distributor is correspondingly connected via a gas pipeline to the first air jet nozzle installed at the first impeller chamber; the second gas supply system comprises a second valve and a second distributor; another output of the first high pressure air tank is connected to the second distributor via the second valve; and each of multiple outputs of the second distributor is correspondingly connected via a gas pipeline to the second air-jet nozzle installed at the third impeller chamber.

10. The wind-gas engine assembly according to claim 8, comprising a third gas supply system which comprises a second high pressure air tank, a third valve, an intermittently bursting air-jet mechanism, a third air-jet nozzle and a fourth air-jet nozzle, wherein the output of the second high pressure air tank is connected to the air jet mechanism via the third valve; the power output of the wind resistance engine drives the air-jet mechanism via a second drive mechanism; the third air-jet nozzle is installed at the casing of the first impeller chamber; the fourth air-jet nozzle is installed at the casing of the third impeller chamber; and the intermittently burst high pressure gas outputted by the air-jet mechanism in multiple routes is correspondingly inputted via a gas pipeline into the third air-jet nozzle and the fourth air-jet nozzle, respectively.

11. The wind-gas engine assembly according to claim 9, comprising a fourth gas supply system which comprises a third high pressure air tank, a first pressure reducing valve and a second pressure reducing valve, and the output of the third high pressure air tank being inputted into the first high pressure air tank via the first pressure reducing valve and into the second high pressure air tank via the second pressure reducing valve, respectively.

12. The wind-gas engine assembly according to claim 10, comprising a first high pressure gas regeneration system which comprises a first air compressor and a first drive mechanism, the power output of the wind resistance engine driving the first air compressor via the first drive mechanism, and a compressed gas generated by the first air compressor being stored in the third high pressure air tank.

13. The wind-gas engine assembly according to claim 10, comprising a third high pressure gas regeneration system which comprises an electric generator, a storage battery, a motor and a third air compressor, wherein the power output of the wind resistance engine drives the electric generator via a third drive mechanism, electrical energy outputted by the electric generator is stored in the storage battery, whose output is connected to the motor, and the output of the motor drives the third air compressor, and a compressed gas generated by the third air compressor is stored in the third high pressure air tank.

14. A motor vehicle, comprising a body, a gear box, a drive axle and wheels, wherein the motor vehicle further comprises a wind-gas engine assembly comprising:

- at least one first high pressure gas engine; and
- at least one wind resistance engine,

wherein the first high pressure gas engine comprises at least one first impeller chamber, at least one first impeller and at least one first air-jet nozzle; the impeller chamber is provided with a fumarole and an exhaust vent; the first impeller is installed inside the first impeller chamber through a first shaft; the first air-jet nozzle, jetting a high pressure gas through the fumarole into the first impeller chamber, is installed at a casing of the first impeller chamber; and the first impeller outputs primary power through the first shaft,

wherein the wind resistance engine comprises at least one second impeller chamber and at least one second impeller installed inside the second impeller chamber through a second shaft; an air inlet for receiving external wind resistance airflow and an air outlet for exhausting gas are provided at a casing of the second impeller chamber; and a wind resistance airflow entering the second impeller chamber drives the second impeller to rotate to generate auxiliary power which is output through the second shaft,

wherein power outputted by the first shaft and the second shaft drives the gear box via a drive mechanism, and the output of the gear box drives the drive axle, which drives the wheels supporting the body.

15. The motor vehicle according to claim 14, wherein inside the wind resistance engine is further provided a second high pressure gas engine, which comprises:

- at least one third impeller chamber,
- at least one third impeller, and
- at least one second air-jet nozzle,

wherein the third impeller chamber and the second impeller chamber are independent of each other; the third impeller is installed inside the third impeller chamber

through the second shaft extended thereinto; the second air-jet nozzle is fixed to a casing of the third impeller chamber; the second air-jet nozzle is used for jetting a high pressure gas into the third impeller chamber to drive the third impeller to rotate; and power generated by both the second impeller and the third impeller is outputted through the second shaft.

16. The motor vehicle according to claim **15**, comprising a first one-way clutch and a power output shaft, wherein the power output of the wind resistance engine drives the power output shaft via the first one-way clutch.

17. The motor vehicle according to claim **14**, further comprising a first gas supply system which comprises a first high pressure air tank, a first valve and a first distributor, wherein the output of the first high pressure air tank is connected to the first distributor via the first valve, and each of multiple outputs of the first distributor is correspondingly connected via a gas pipeline to the first air-jet nozzle installed at the first impeller chamber.

18. The motor vehicle according to claim **17**, comprising a fourth gas supply system which comprises a third high pressure air tank and a first pressure reducing valve, and the output of the third high pressure air tank being inputted into the first high pressure air tank via the first pressure reducing valve.

19. The motor vehicle according to claim **18**, comprising a first high pressure gas regeneration system which comprises a first air compressor and a first drive mechanism, the power outputted from the gear box driving the first air compressor via the first drive mechanism, and a compressed gas generated by the first air compressor being stored in the third high pressure air tank.

20. The motor vehicle according to claim **18**, comprising a second high pressure gas regeneration system which comprises symmetrically positioned left and right deceleration brakes and a high-load air compressor, wherein the deceleration brake comprises a brake disc with inner ring teeth, a transmission mechanism with outer ring teeth, a driving disc, a driven disc, a first bearing, a second bearing, a supporting base and a clutch device; the brake disc with inner ring teeth and the wheels are fixed coaxially; at a half-axle of the drive axle is installed the first bearing, to which is fixed the supporting base, to which is fixed the second bearing; the transmission mechanism is fixedly connected to the driving disc through a drive shaft supported on the second bearing; the transmission mechanism, positioned at an inner side of the second bearing such that the outer ring teeth of the transmission mechanism are engaged with the inner ring teeth of the brake disc; the driving disc positioned at an outer side of the second bearing such that the brake disc drives the transmission mechanism fixedly provided with the driving disc to rotate through the engagement when the brake disc fixed to the wheel rotates; the driven disc, fixed to one end of a shaft, moves back and forth driven by the clutch device, and drives the high-load air compressor via the other end of the shaft; and the high pressure gas generated by the high-load air compressor is inputted into the third high pressure air tank.

21. The motor vehicle according to claim **15**, comprising a first gas supply system, a second gas supply system and a third gas supply system, wherein the first gas supply system comprises a first high pressure air tank, a first valve and a first distributor, one output of the first high pressure air tank is connected to the first distributor via the first valve, and each of multiple outputs of the first distributor is correspondingly connected via a gas pipeline to the first air-jet nozzle installed

at the first impeller chamber; the second gas supply system comprises a second valve and a second distributor, another output of the first high pressure air tank is connected to the second distributor via the second valve, each of multiple outputs of the second distributor is correspondingly connected via a gas pipeline to the second air-jet nozzle installed at the third impeller chamber; and the third gas supply system comprises a second high pressure air tank, a third valve, an intermittently bursting air-jet mechanism, a third air-jet nozzle and a fourth air-jet nozzle, the output of the second high pressure air tank is connected to the air-jet mechanism via the third valve, the power output of the wind resistance engine drives the air-jet mechanism via a second drive mechanism, the third air-jet nozzle is installed at the first impeller chamber, the fourth air-jet nozzle is installed at the third impeller chamber, and the intermittently burst high pressure gas outputted by the air-jet mechanism in multiple routes is correspondingly inputted via a gas pipeline into the third air-jet nozzle and the fourth air-jet nozzle, respectively.

22. The motor vehicle according to claim **21**, comprising a fourth gas supply system which comprises a third high pressure air tank, a first pressure reducing valve and a second pressure reducing valve; the output of the third high pressure air tank being inputted into the first high pressure air tank via the first pressure reducing valve and into the second high pressure air tank via the second pressure reducing valve, respectively.

23. The motor vehicle according to claim **22**, comprising a first high pressure gas regeneration system which comprises a first air compressor and a first drive mechanism, the power outputted from the gear box driving the first air compressor via the first drive mechanism, and a compressed gas generated by the first air compressor being stored in the third high pressure air tank.

24. The motor vehicle according to claim **22**, comprising a second high pressure gas regeneration system which comprises symmetrically positioned left and right deceleration brakes and a high-load air compressor, wherein the deceleration brake comprises a brake disc with inner ring teeth, a transmission mechanism with outer ring teeth, a driving disc, a driven disc, a first bearing, a second bearing, a supporting base and a clutch device; the brake disc with inner ring teeth and the wheels are fixed coaxially; at a half-axle of the drive axle is installed the first bearing, to which is fixed the supporting base, to which is fixed the second bearing; the transmission mechanism is fixedly connected to the driving disc through a drive shaft supported on the second bearing; the transmission mechanism, positioned at an inner side of the second bearing such that the outer ring teeth of the transmission mechanism are engaged with the inner ring teeth of the brake disc; the driving disc positioned at an outer side of the second bearing such that the brake disc drives the transmission mechanism fixedly provided with the driving disc to rotate through the engagement when the brake disc fixed to the wheel rotates; the driven disc, fixed to one end of a shaft, moves back and forth driven by the clutch device, and drives the high-load air compressor via the other end of the shaft; and the high pressure gas generated by the high-load air compressor is inputted into the third high pressure air tank.

25. The motor vehicle according to claim **23**, comprising a third high pressure gas regeneration system which comprises an electric generator, a storage battery, a motor and a third air compressor, wherein the power output of the wind resistance engine drives the electric generator via a third drive mechanism.

nism, electrical energy outputted by the electric generator is stored in the storage battery, whose output is connected to the motor, and the output of the motor drives the third air compressor, and a compressed gas generated by the third air compressor is stored in the third high pressure air tank.

26. The wind-gas engine assembly according to claim **14**, wherein the fumarole provided at an inner side of the first impeller chamber is an air-jet slot expanding abruptly.

27. The wind-gas engine assembly according to claim **14**, further comprising a trumpet-type air duct with a bigger

external opening and a smaller internal opening, wherein the internal opening of the trumpet-type air duct is fixedly connected to an air inlet of the wind resistance engine, a wind resistance airflow received externally is guided into the second impeller chamber through the trumpet-type air duct, there are two wind resistance engines positioned symmetrically left and right; and to a casing of each of the wind resistance engines is fixed at least one of the first high pressure gas engines.

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(54) **MOTOR VEHICLES**

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(58) **Field of Classification Search** **180/2.1, 180/2.2, 165, 301, 302**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,198,501 A * 9/1916 Wintermute 180/7.4
3,444,946 A * 5/1969 Waterbury 180/2.2

3,876,925 A * 4/1975 Stoeckert 322/1
3,948,047 A * 4/1976 Gilbert 60/325
3,967,132 A * 6/1976 Takamine
4,043,126 A * 8/1977 Santos 60/407
4,168,759 A * 9/1979 Hull et al. 180/2.2
4,179,007 A * 12/1979 Howe 180/2.2
4,254,843 A * 3/1981 Han et al. 180/165
4,355,508 A * 10/1982 Blenke et al. 60/416
4,753,078 A * 6/1988 Gardner, Jr. 60/668
5,280,827 A * 1/1994 Taylor et al. 180/165
5,549,174 A * 8/1996 Reis 180/165

(Continued)

FOREIGN PATENT DOCUMENTS

CN 2073484 3/1991

(Continued)

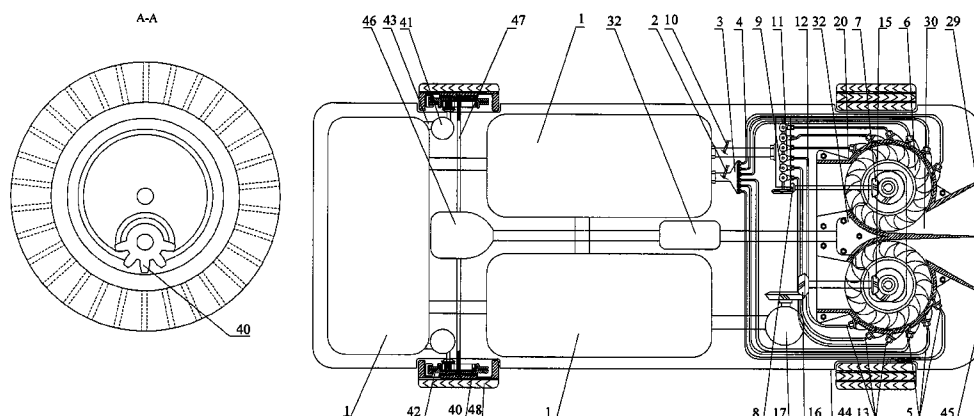
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(57) **ABSTRACT**

A wind-powered pneumatic engine including one or more impeller chambers and one or more impellers disposed in the impeller chambers is provided. One or more air inlets for receiving external wind resistance airflow are disposed on the impeller chambers, and the external wind resistance airflow entering the air inlets drives the impellers to operate to generate power output. The wind-powered pneumatic engine further includes an air-jet system for jetting HPCA into the impeller chambers, and the internal high-pressure compressed air jetted by the air-jet system in conjunction with the external wind resistance airflow entering the air inlets drives the impellers to operate to generate power output. In the present invention, the external resistance airflow around a motor vehicle moving at a speed is converted into power for use, which greatly reduces energy consumption and improves the moving speed of a motor vehicle. A motor vehicle equipped with wind-powered pneumatic engine is also provided.

12 Claims, 5 Drawing Sheets



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U.S. PATENT DOCUMENTS

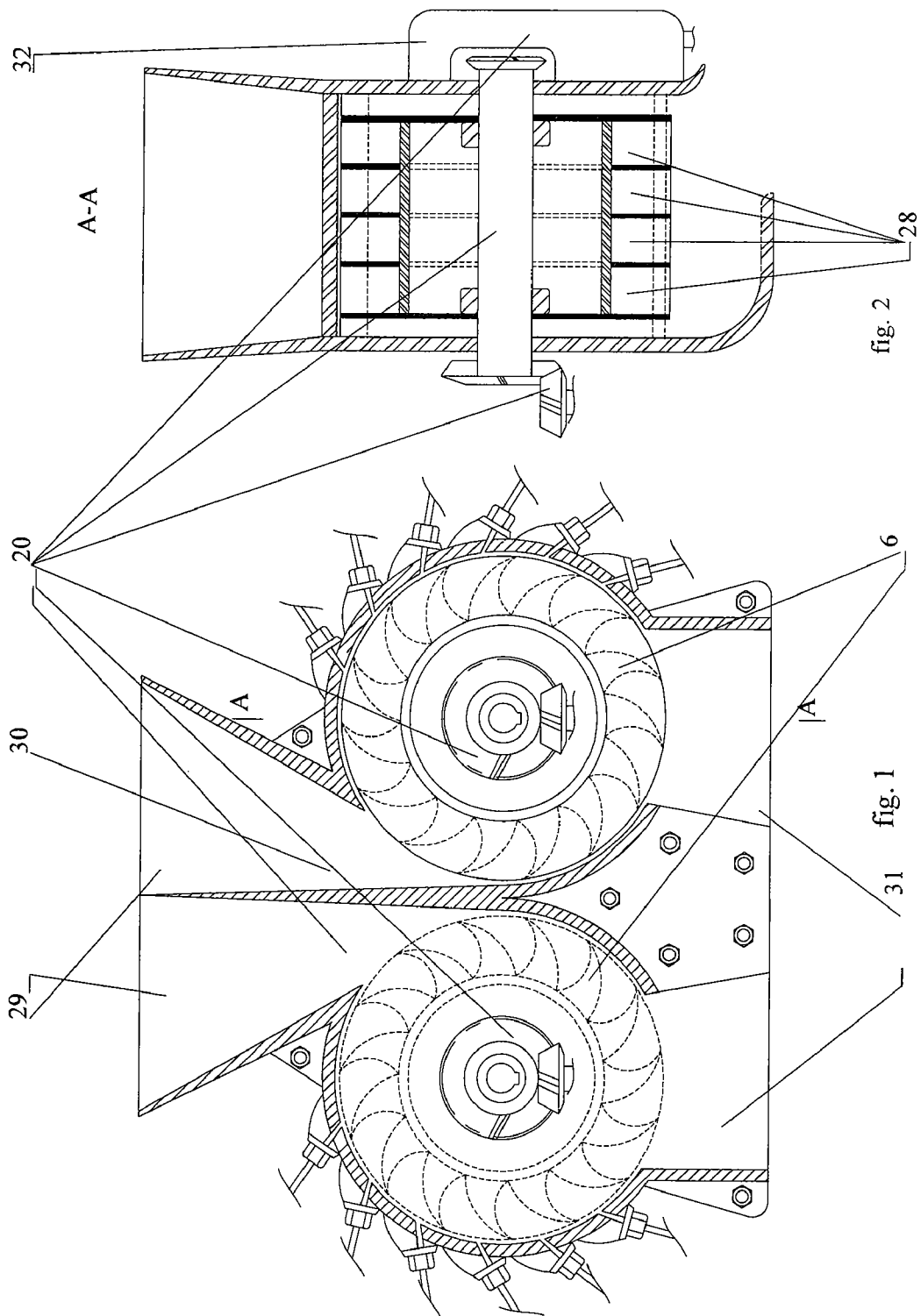
6,044,924	A *	4/2000	Adli	180/302
6,138,781	A *	10/2000	Hakala	180/2.2
6,270,308	B1	8/2001	Groppel	
6,311,487	B1 *	11/2001	Ferch	60/413
7,147,239	B2 *	12/2006	Teslak et al.	180/306
7,641,005	B2	1/2010	Cong	
2002/0153178	A1 *	10/2002	Limoniuss	180/2.2
2003/0209370	A1 *	11/2003	Maberry	180/2.2
2010/0101874	A1	4/2010	Cong	

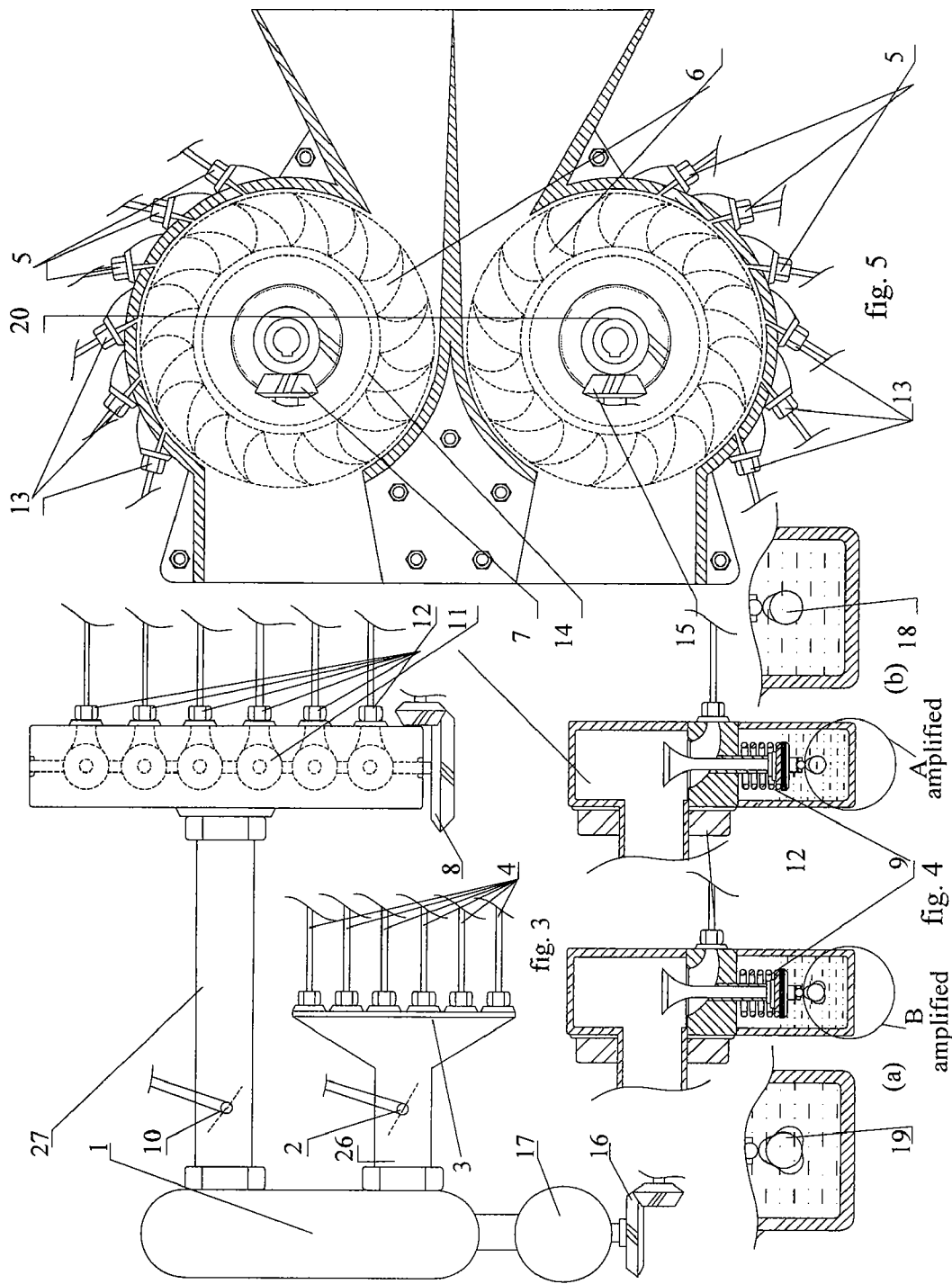
2010/0122855	A1	5/2010	Cong
2010/0122856	A1	5/2010	Cong
2010/0122857	A1	5/2010	Cong
2010/0122858	A1	5/2010	Cong

FOREIGN PATENT DOCUMENTS

CN	2242352	12/1996
CN	1351228	5/2002
FR	2292129	6/1976

* cited by examiner





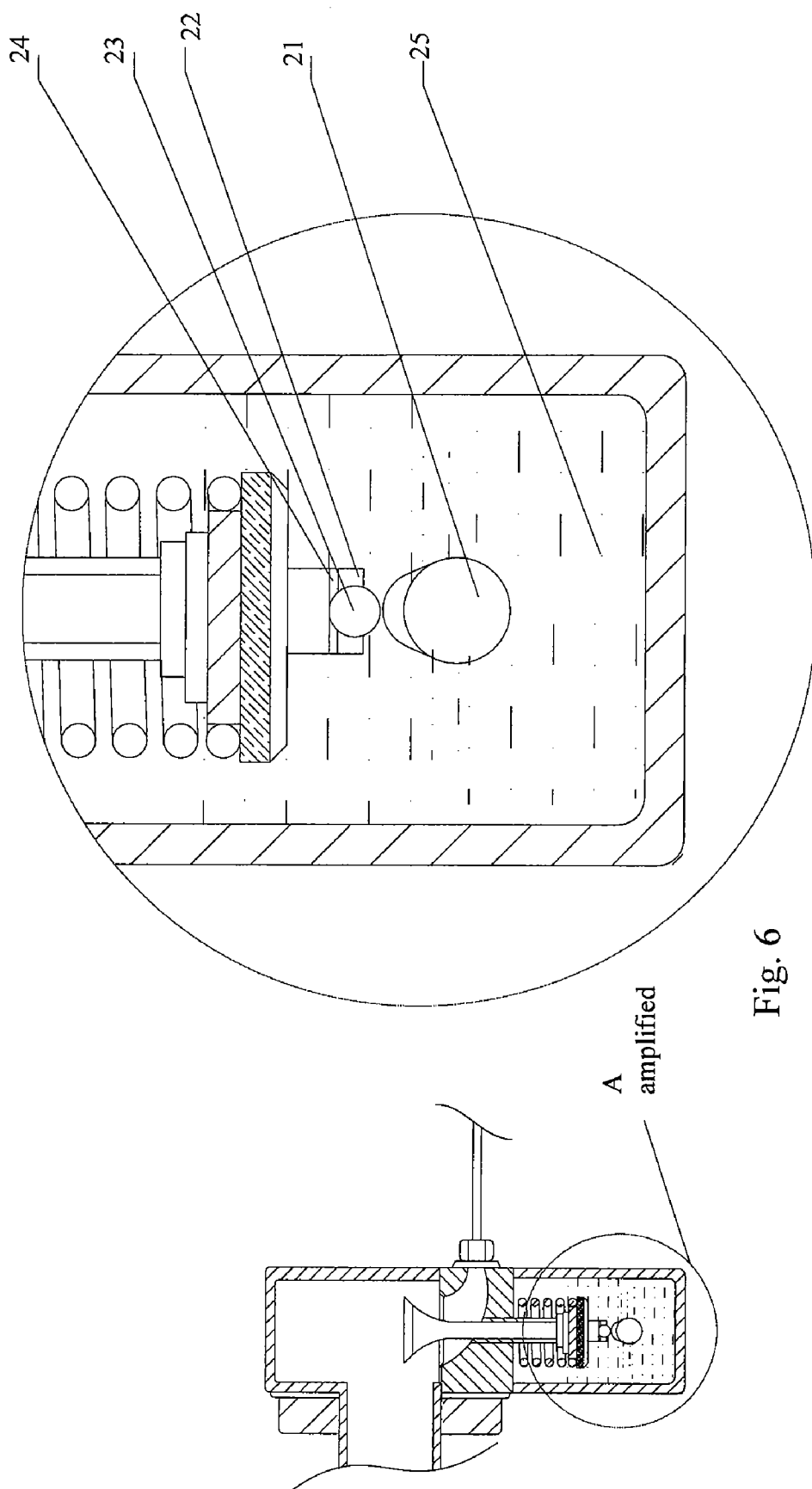
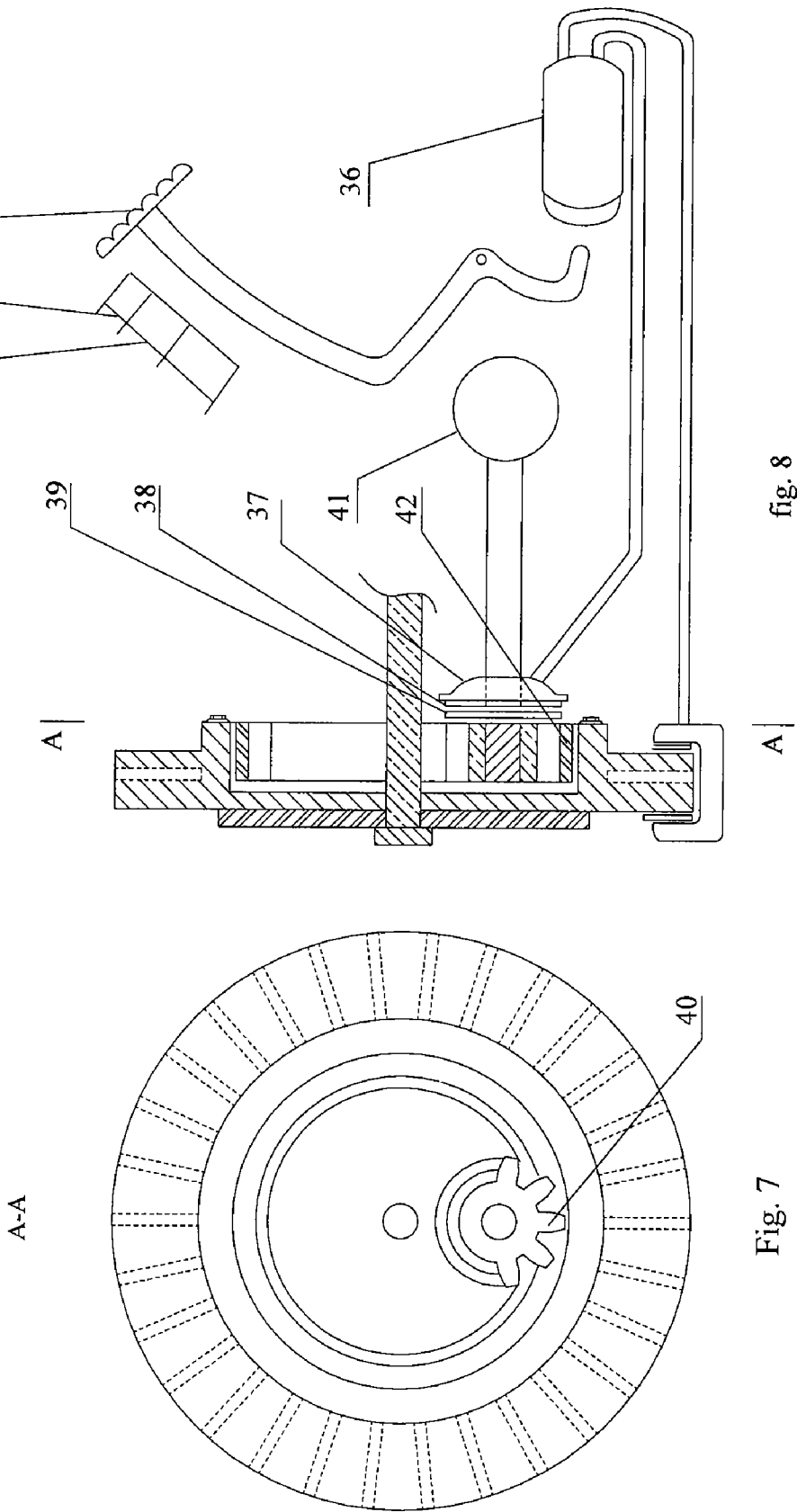


Fig. 6



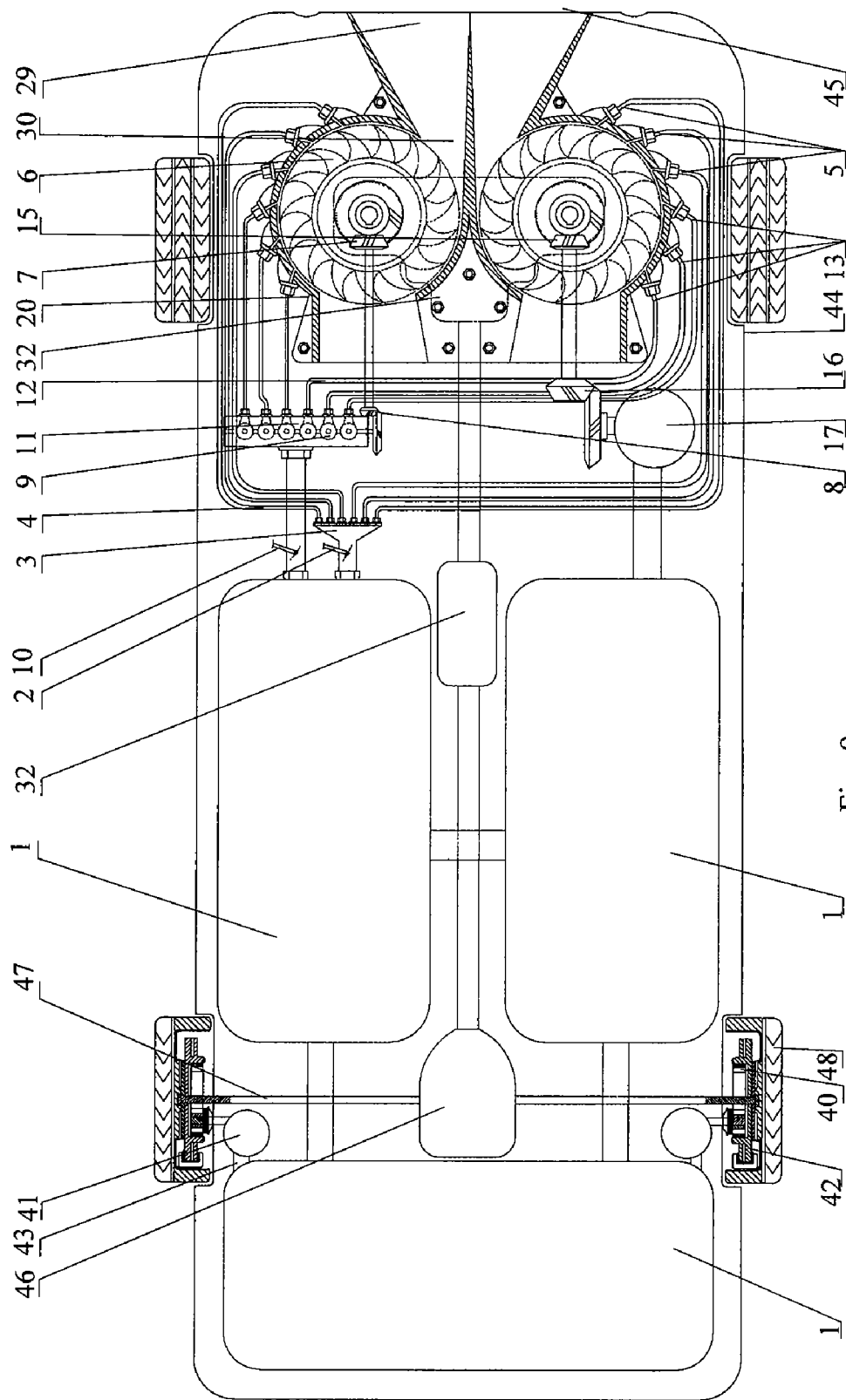


Fig. 9

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MOTOR VEHICLES**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a Continuation-in-part of U.S. application Ser. No. 11/802,341, filed May 22, 2007, which is a Continuation of International Application No. PCT/CN05/01911, filed Nov. 14, 2005, the entire disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

The present invention relates to an engine installed in large, medium or small size cargo or passenger vehicles having steering wheels, railway trains, subway trains, marine travel vehicles, aerospace travel vehicles and all other motor vehicles that move at a certain speed, and relates to the field of machines.

2. Description of Related Art

Engines using fuels as an energy source consume a large quantity of fuels, and discharge large amounts of waste gases and hot gases, which pollute the environment. In order to save fuel energy source and protect the global environment, there is a need for engines that do not consume fuel, discharge waste gases and hot gases or cause pollution. Conventional engines that convert wind force into mechanical kinetic energy are installed in fixed places. Since the mechanical devices installed with the engines do not move at a speed, the engines can only passively receive limited wind force under natural weather, ambient and wind conditions for driving impellers to operate and generate the mechanical kinetic energy. Therefore, there is a need for an engine capable of actively converting wind resistance airflow around a motor vehicle moving at a speed into mechanical power for use.

SUMMARY OF THE INVENTION

The present invention is directed to providing a wind-powered pneumatic engine capable of converting wind resistance airflow around a moving power machine into mechanical power for use without consuming fuels and discharging waste gases or hot gases, and a motor vehicle equipped with the same.

The present invention is further directed to providing a wind-powered pneumatic engine using high-pressure compressed air (HPCA) as a direct power source, and a motor vehicle equipped with the same.

The present invention is further directed to providing a wind-powered pneumatic engine capable of converting the wind resistance airflow into mechanical power, converting the mechanical power into regeneration HPCA and storing the regeneration HPCA for use, and a motor vehicle equipped with the same.

The present invention is still further directed to providing a wind-powered pneumatic engine capable of recycling inertia power when a motor vehicle is decelerated and braked, transforming the inertia power into regeneration HPCA and storing the regeneration HPCA for use, and a motor vehicle equipped with the same.

The technical solution for achieving the above objects is described as follows.

A wind-powered pneumatic engine includes impeller chambers and impellers disposed in the impeller chambers. Air inlets for receiving external wind resistance airflow are disposed on the impeller chambers, and the external wind

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resistance airflow entering the air inlets drives the impellers to operate to generate power output.

The wind-powered pneumatic engine further includes an air-jet system for jetting the HPCA into the impeller chambers, and the HPCA jetted by the air-jet system in conjunction with the external wind resistance airflow entering the air inlets drives the impellers to operate to generate power output.

The air inlets for receiving the external wind resistance airflow are trunk shape inlets, each having a large outer edge and a small inner edge.

The wind-powered pneumatic engine further includes an HPCA regeneration, storage and supply system composed of an air tank and a first HPCA compressor. An output of the air tank is connected with the air jet system. The power output generated after the operation of the impellers drives the first HPCA compressor. The HPCA regenerated by the first HPCA compressor is input into and stored in the air tank.

The wind-powered pneumatic engine further includes a second HPCA compressor driven by an external braking force. The second HPCA compressor regenerates and converts the external braking force into HPCA, which is then input into and stored in the air tank.

The air-jet system includes a first controller, a distributor, a first air-jet pipe set and a first air-jet nozzle set connected in sequence. The HPCA stored in the air tank is input into the distributor through the first controller, and is then diverged by the distributor and input into each air-jet pipe of the first air-jet pipe set. Then, the HPCA is jetted into the impeller chambers by each air-jet nozzle of the first air-jet nozzle set connected with each air-jet pipe of the first air-jet pipe set.

The air-jet system further includes a second controller, a distribution controller for converting the input HPCA into intermittent burst HPCA, a second air-jet pipe set, and a second air-jet nozzle set connected in sequence. The HPCA stored in the air tank is input into the distribution controller through the second controller. The intermittent burst HPCA is generated by the distribution controller and distributed to each air jet pipe of the second air-jet pipe set, and is then jetted into the impeller chambers by each air-jet nozzle of the second air-jet nozzle set connected with each air jet pipe of the second air jet pipe set.

The impeller chambers are dual impeller chambers, each having an impeller disposed therein. Air inlets for receiving the external wind resistance airflow are disposed on at least one of the impeller chambers.

A motor vehicle, including a vehicle body, a gear box, a drive bridge, and tires, is characterized by further including a wind-powered pneumatic engine having impeller chambers and impellers disposed in the impeller chambers. Air inlets for receiving external wind resistance airflow are disposed on the impeller chambers, and the air inlets are trunk shape inlets, each having a large outer edge and a small inner edge. The outer edge of the trunk shape inlet is disposed at the front end of the vehicle body. The external wind resistance airflow entering the air inlets drives the impellers to operate to generate power output. The power output of the impellers is transmitted by the gear box to drive the drive bridge, and the drive bridge drives the tires supporting the vehicle body.

The wind-powered pneumatic engine further includes an air-jet system for jetting HPCA into the impeller chambers. The internal HPCA jetted by the air-jet system in conjunction with the external wind resistance airflow entering the air inlets drives the impellers to operate to generate power output.

The wind-powered pneumatic engine further includes an HPCA regeneration, storage and supply system composed of

an air tank and a first HPCA compressor. An output of the air tank is connected with the air jet system. The power output generated after the impellers' operation drives the first HPCA compressor. The HPCA regenerated by the first HPCA compressor is input into and stored in the air tank.

The wind-powered pneumatic engine further includes a deceleration and brake pressurizing system and a second HPCA compressor. The second HPCA compressor is driven by a braking force generated by the deceleration and brake pressurizing system when the engine is decelerated to regenerate HPCA. The regenerated HPCA is input into and stored in the air tank.

The air jet system includes a first controller, a distributor, a first air jet pipe set, and a first air-jet nozzle set connected in sequence, and includes a second controller, a distribution controller for converting the input HPCA into intermittent burst HPCA, a second air-jet pipe set, and a second air-jet nozzle set connected in sequence. The HPCA stored in the air tank is input into the distributor through the first controller, and is then diverged by the distributor and input into each air-jet pipe of the first air-jet pipe set. The HPCA is jetted into the impeller chambers by each air-jet nozzle of the first air-jet nozzle set connected with each air-jet pipe of the first air-jet pipe set. The HPCA stored in the air tank is input into the distribution controller through the second controller. The intermittent burst HPCA is generated by the distribution controller and distributed to each air-jet pipe of the second air-jet pipe set, and is then jetted to the impeller chambers by each air-jet nozzle of the second air-jet nozzle set connected with each air-jet pipe of the second air-jet pipe set.

The impeller chambers are dual impeller chambers, each having an impeller disposed therein. Air inlets for receiving the external wind resistance airflow are disposed on at least one of the impeller chambers.

The impeller chambers are dual impeller chambers, each having an impeller disposed therein. The distribution controller includes a valve set and cams for opening or closing the valve set, in which the power output of one impeller drives the first HPCA compressor, and the power output of the other impeller drives the cams.

With the above technical solution, the present invention has the following beneficial technical effects.

1. With the air inlets for receiving the external wind resistance airflow disposed on the impeller chambers, the external wind resistance airflow entering the air inlets is used as power to drive the impellers to operate to generate power output, thereby converting the resistance into power. Moreover, the higher the moving speed of the power machine is, the greater the utilization of the strong wind resistance airflow is. Therefore, the present invention, when adopted as an auxiliary power, can significantly increase the moving speed of the power machine without increasing the amount of energy consumed when moving at a high speed. The wind-powered pneumatic engine of the present invention can be installed in large, medium or small size cargo or passenger vehicles having steering wheels, railway trains, subway trains moving on land, marine power machines, aerospace power machines and all other power machines that move at a speed. In addition, in the present invention, the wind resistance airflow is used to drive the engine directly, without consuming fuels and discharging waste gases or hot gases, thereby greatly reducing exhaust gases of the power machines, especially vehicles that cause pollution to the atmosphere, and thus protecting the global environment.

2. Furthermore, the HPCA is used as the power, and the HPCA jetted by the air-jet system in conjunction with the external wind resistance airflow entering the air inlets drives

the impellers to operate to generate power output. Therefore, the present invention has the advantages of no fuel consumption, and no waste gases or hot gases discharges, and can achieve self-start and continuous operation to generate power output without being restricted by natural weather, ambient conditions, particularly wind conditions.

3. Through the HPCA regeneration, storage and supply system, the power output generated after the operation of the impellers is transmitted to the first HPCA compressor, and the first HPCA compressor inputs the regenerated HPCA into the air tank for storage. The wind resistance airflow around the power machine is regenerated and converted into HPCA which is stored to be recycled for use.

4. Through the deceleration and brake pressurizing device and the second HPCA compressor, the kinetic energy produced as the motor vehicle decelerates and brakes is transmitted to the second HPCA compressor, and the second HPCA compressor subsequently recycles the braking energy and uses the braking energy to regenerate HPCA to be input into and stored in the air tank, such that the utilization of the energy is further enhanced. This solution is particularly suitable for the motor vehicle that frequently decelerates, brakes, and stops.

5. Through the automatic intermittent burst and jetted HPCA, the air jet time is greatly shortened, thereby saving large usage amounts of the HPCA. This solution is suitable for the motor vehicles that travels over a long distance and a long time at a low speed or that frequently decelerates, idles, and accelerates, thereby ensuring the continuous moving of the motor vehicle.

6. By installing the air inlets of the wind-powered pneumatic engine at the front end of the motor vehicle, particularly at the position where the wind resistance is the greatest, the wind resistance airflow is used to the maximum extent, thereby generating optimal power output and increasing the moving speed of the motor vehicle.

In order to make the aforementioned and other objects, features and advantages of the present invention comprehensible, preferred embodiments accompanied with figures is described in detail below.

It is to be understood that both the foregoing general description and the following detailed description are exemplary, and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

FIG. 1 is a schematic structural view of a wind-powered pneumatic engine;

FIG. 2 is a schematic structural view of the wind-powered pneumatic engine and a central primary power output gear box;

FIG. 3 is a schematic structural view of a HPCA regeneration, storage and supply system and an air-jet system of the wind-powered pneumatic engine;

FIGS. 4(a), (b) are schematic structural views of two types of distribution controllers;

FIG. 5 is a schematic structural view of the wind-powered pneumatic engine;

FIG. 6 is a schematic structural view of an improved distribution controller;

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FIG. 7 is a schematic structural view of an internal gear transmission mechanism of a brake disc of a brake of a deceleration and brake pressurizing device;

FIG. 8 is a schematic structural view of a deceleration and brake pressurizing system of the wind-powered pneumatic engine; and

FIG. 9 is a schematic structural view of a motor vehicle equipped with the wind-powered pneumatic engine.

DESCRIPTION OF EMBODIMENTS

The present invention is further described in detail with accompanying drawings and embodiments.

As shown in FIGS. 1-8, a wind-powered pneumatic engine 20 includes trunk shape inlets, each having an outer edge 29 and an inner edge 30, impeller chambers 28, impellers 6, impeller flywheels 14, a left impeller main shaft auxiliary power conical gear 7, a right impeller main shaft auxiliary power conical gear 15, a primary power output gear box 32, and air outlets 31; a HPCA regeneration, storage and supply system, including an air tank 1, a first HPCA compressor 17, and a conical gear 16 for transmitting the first HPCA compressor 17; an air-jet system for start and acceleration, including a first controller 2 for opening the HPCA to perform start and acceleration, a distributor 3, a first air-jet pipe set 4 connected with the distributor 3, a first air-jet nozzle set 5, a second controller 10 for opening the HPCA to perform automatic intermittent burst air-jet acceleration, a distribution controller 11, a second air jet pipe set 12 connected with the distribution controller 11, a second air-jet nozzle set 13, a conical gear 8, an HPCA jet pipe 26, and an HPCA jet pipe 27; a deceleration and brake pressurizing system, including a deceleration and brake pressurizing device 42 and a high-load second air compressor 41.

Referring to FIGS. 1, 2 and 5, impellers 6 and impeller flywheels 14 are disposed in the symmetrical dual impeller chambers 28, and air-jet nozzle sets (5, 13) are disposed on the impeller chambers 28. The HPCA is jetted into the impeller chambers 28 through the air-jet nozzle sets (5, 13), and the HPCA drives the impellers 6 to operate and is exhausted via the air outlets 31. The impeller chambers 28 are further provided with the trunk shape inlets for receiving external wind resistance airflow. The trunk shape inlet has the outer edge 29 and the inner edge 30, and the diameter of the outer edge 29 of the trunk shape inlet is 1-30 times, preferably 3.6 times, of the diameter of the inner edge 30. The external wind resistance airflow enters the impeller chambers 28 through the trunk shape inlets to drive the impellers 6 to operate, the external wind resistance airflow after driving the impellers 6 to operate is exhausted via the air outlets 31. The power generated after the operation of the impellers 6 is gear-shifted and output through the central primary power output gear box 32. In order to make the impellers 6 operate directionally, and the airflow jetted from the air-jet nozzles drive the impellers to operate better, the air jetted by the air-jet nozzle set (5, 13) is directional.

With the above technical solution, the HPCA is used to drive the engine, so as to achieve self-start and operation without being restricted by natural weather, ambient, and wind conditions. More importantly, when a power machine moves at a speed, the trunk shape inlets disposed on the impeller chambers 28 actively receives any external resistance airflow around the power machine to drive the engine, so as to convert strong wind resistance into power for use, thereby greatly reducing the power consumption. The wind-powered pneumatic engine of the present invention is widely applied to large, medium or small size cargo or passenger

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vehicles having steering wheels, railway trains, subway trains moving on land, marine power machines, aerospace power machines and all other power machines that move at a speed.

Referring to FIGS. 3 and 5, an HPCA regeneration, storage and supply system is provided, which includes the air tank 1, the first HPCA compressor 17, and the conical gear 16 for transmission. The power output of the impellers 6 is transmitted to the conical gear 16 through the right impeller main shaft auxiliary power conical gear 15, the conical gear 16 transmits the power output to the first HPCA compressor 17, and the HPCA generated by the first HPCA compressor 17 is input into and stored in the air tank 1.

Referring to FIG. 3, FIGS. 4(a), (b) and FIG. 5, an air-jet system includes the first controller 2, the distributor 3, the first air-jet pipe set 4, the first air-jet nozzle set 5, the second controller 10, the distribution controller 11, the second air-jet pipe set 12, the second air-jet nozzle set 13, the conical gear 8, the HPCA jet pipe 26, and the HPCA jet pipe 27. As shown in FIGS. 4(a), (b), the distribution controller 11 is a conventional gas distribution mechanism for motor vehicles, and includes cams (18, 19) and a valve set 9. The cam 19 in FIG. 4(a) has a distribution structure, and the cam 18 in FIG. 4(b) has a synchronous structure. The distribution controller 11 functions to convert the input HPCA into intermittent burst HPCA. During operation, the impellers 6 transmit the power to the conical gear 8 through the left impeller main shaft auxiliary power conical gear 7. If the conical gear 8 transmits the cam 18, the valve set 9 is opened and closed by the cam 18 synchronously to generate synchronous intermittent burst and jetted HPCA. If the conical gear 8 drives the cam 19 to rotate, or the valve set 9 is opened or closed in distribution by the cam 19, distributional intermittent burst and jetted HPCA is generated. The air tank 1 is connected with the distributor 3 through the HPCA jet pipe 26, and the first controller 2 is disposed on the HPCA jet pipe 26. The HPCA stored in the air tank 1 is input into the distributor 3 through the first controller 2, and is then diverged by the distributor 3 and input into each air-jet pipe of the first air-jet pipe set 4. Then, the HPCA is jetted into the impeller chambers 28 by each air-jet nozzle of the first air-jet nozzle set 5 connected with each air-jet pipe of the first air-jet pipe set 4. The air tank 1 is connected with the distribution controller 11 through the HPCA jet pipe 27, and the second controller 10 is disposed on the HPCA jet pipe 27. The HPCA stored in the air tank 1 enters the distribution controller 11 through the second controller 10. The intermittent burst HPCA is generated by the distribution controller and distributed to each air-jet pipe of the second air-jet pipe set 12, and the intermittent burst HPCA is then jetted into the impeller chambers 28 by each air-jet nozzle of the second air-jet nozzle set 13 connected with each air-jet pipe of the second air-jet pipe set 12.

During operation, the first controller 2 for the control of HPCA start and acceleration is turned on, such that the HPCA stored in the air tank 1 is jetted. The HPCA is distributed to the air jet pipe set 4 through the distributor 3, and is transmitted to the air-jet nozzle set 5 by the air-jet pipe set 4, and the HPCA airflow jetted by the air-jet nozzle set 5 impels the impellers 6, such that the impellers 6 is started and accelerated to operate to generate power. The power is transmitted to the conical gear 8 by the left impeller main shaft auxiliary power conical gear 7, the conical gear 8 drives the cam (18 or 19) of the distribution controller 11 to be start and operate. Under the effect of the cam (18 or 19), the valve set 9 is opened and closed continuously, and the second controller 10 is turned on at the same time, such that the HPCA is jetted from the HPCA jet pipe 27 to be supplied to the distribution controller 11. At this time, as the valve set 9 is opened and closed continuously,

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the HPCA is converted into intermittent burst and jetted HPCA by the distribution controller 11 and is then output. The auto intermittent burst HPCA is then transmitted to the air-jet nozzle set 13 by the air-jet pipe set 12 for jetting. The automatic intermittent burst HPCA impels the wind-powered pneumatic engine impellers 6 including a plurality of sets of impellers to accelerate operation, such that the wind-powered pneumatic engine impeller flywheels 14 also accelerate operation to generate power accordingly, and the power is output by the gear box 32 and transmitted to the power machine. As the power machine moves at a speed, the external wind resistance airflow around the power machine during moving is guided into the impeller chambers 28 through the trunk shape inlets having large outer edges and small inner edges. The wind resistance airflow further impels the impellers 6 to operate to generate power output, thereby transforming the resistance into power. In addition, the power is output by the right impeller main shaft auxiliary power conical gear 15 and transmitted to the conical gear 16. The conical gear 16 transmits the first HPCA compressor 17 to operate, and the HPCA generated by the first HPCA compressor 17 is continuously supplemented to the air tank 1 for storage, such that the wind-powered pneumatic engine can continuously accelerate operation to generate power.

To meet the requirements of the amount of the HPCA during the controllable HPCA start and acceleration and the automatic intermittent burst air-jet acceleration of the wind-powered pneumatic engine, in the present invention, the diameter of the HPCA jet pipe 26 and the diameter of the HPCA jet pipe 27 are respectively several times greater than the total diameter of the diameter of air-jet nozzle set 5 plus the diameter of the air-jet nozzle set 13.

In order to make the double impellers 6 of the wind-powered pneumatic engine start and accelerate directionally to operate to generate power, in the present invention, the air-jet nozzle set 5 and the air-jet nozzle set 13 are designed to have a certain directional air-jet function.

As shown in FIG. 6, in order to overcome or reduce frictional resistance between valve stem heads 22 of the valve set 9 and cams 21 of the valve set 9 when the cams 21 of the distribution controller operate to open or close the valves, the present invention is further provided with a design of adding sliding balls 23 at the valve stem heads 22. In order to make the sliding balls 23 of the valve stem heads 22 slide smoothly, a lubrication oil passage 24 leading to the sliding balls 23 is added at the valve stem heads 22, such that the lubrication oil in a lubrication oil chamber 25 of the distribution controller 11 enters the surfaces of the sliding balls 23 through the lubrication oil passage 24, thereby achieving lubrication, reducing frictional resistance, improving operating speed of the wind-powered pneumatic engine, and generating greater output torque.

Referring to FIGS. 7 and 8 together, the motor vehicle, when frequently decelerates, brakes, stops or restarts, consumes large amounts of HPCA. In order to supplement the excessive amount of HPCA consumed by the motor vehicle when it frequently decelerates, brakes, stops or restarts, and to ensure the amount of HPCA required when the wind-powered pneumatic engine restarts, the present invention provides a deceleration and brake pressurizing system capable of recycling the inertia power when the motor vehicle moving at a speed frequently decelerates and brakes and converting the inertia power into HPCA to be stored for reuse. The deceleration and brake pressurizing system includes a deceleration and brake pressurizing device 42 and a high-load second air compressor 41. The deceleration and brake pressurizing device 42 further includes a pedal 33, a hydraulic master

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pump 36, a clutch driven disc hydraulic working pump 37, a clutch driven disc 38, a clutch driving disc 39, and an internal gear transmission mechanism 40 of a brake disc of a brake. The pedal 33 drives the hydraulic master pump 36, the hydraulic master pump 36 drives the clutch driven disc hydraulic working pump 37, the clutch driven disc hydraulic working pump 37 impels the clutch driven disc 38 to abut against the clutch driving disc 39, and the internal gear transmission mechanism 40 of the brake disc outputs the inertia power generated when the motor vehicle decelerates to drive the high-load second air compressor 41 to work.

The operation process is described as follows. When it is required to decelerate, the pedal 33 is stepped down to reach a position of decelerating and pressurizing travel 35 from a free travel 34 of the deceleration and brake pressurizing device of the wind-powered pneumatic engine, the hydraulic master pump 36 starts to work, and functions on the clutch driven disc hydraulic working pump 37 to start the clutch driven disc hydraulic working pump 37 to work. The clutch driven disc hydraulic working pump 37 drives the clutch driven disc 38 to abut against the clutch driving disc 39, such that the inertia power of the motor vehicle, when decelerates, is directly transmitted by the brake disc internal gear transmission mechanism 40 to the high-load second air compressor 41, and the HPCA regenerated by the high-load second air compressor 41 is supplemented to the air tank 1 for storage, so as to be recycled and used.

As shown in FIG. 9, a motor vehicle equipped with wind-powered pneumatic engine includes a vehicle body 44, a wind-powered pneumatic engine 20, a drive bridge 46, a half-axle 47 of the drive bridge, and tires 48. The structure of the wind-powered pneumatic engine 20 is shown in FIGS. 1 to 8. The wind-powered pneumatic engine 20 is disposed in the vehicle body 44, the outer edge 29 of the trunk shape inlets of the wind-powered pneumatic engine 20 is mounted at the front end of the vehicle body 44 at a position 45 where the wind resistance is the greatest. In order to increase the speed of the wind resistance airflow entering the impeller chambers 28, the diameter of the outer edge 29 of the trunk shape inlets is 1-30 times, preferably 3.6 times, of the diameter of the inner edge 30. An output of a main power output gear box 32 of the wind-powered pneumatic engine 20 is connected with the drive bridge 46 of the motor vehicle. The drive bridge 46 is connected with the half-axle 47 of the drive bridge, the half-axle 47 of the drive bridge is then connected with the tires 48, and the tires 48 are fixedly connected with the internal gear transmission mechanism 40 of the brake disc of the brake.

During operation, the first controller 2 for HPCA start and acceleration is turned on, such that the HPCA stored in the air tank 1 is jetted. The HPCA is distributed to the air-jet pipe set 4 through the distributor 3, and the HPCA airflow is jetted from the air jet nozzle set 5 to impel the impellers 6 to start and accelerate to operate to generate power. The power is output to the conical gear 8 by the left impeller main shaft auxiliary power conical gear 7, the conical gear 8 drives the cam (18 or 19) of the distribution controller 11 to be started to operate. The second controller 10 for HPCA auto intermittent burst air-jet acceleration is turned on at the same time, such that the HPCA is jetted from the HPCA jet pipe 27 to be supplied to the distribution controller 11. The auto intermittent burst and jetted HPCA is output by the distribution controller 11, and is jetted through the air-jet nozzle set 13 after entering the second air-jet pipe set 12, so as to impel the impellers 6 to accelerate operation to generate power output. The internal HPCA stored in the air tank 1 drives the impellers 6 to operate to generate power. The power is transmitted to the gear box 32, and after the gear-shift of the gear box 32, the power is

output to drive the tires **48** through the drive bridge **46** and the half-axle **47** of the drive bridge, so that the motor vehicle starts to move. Meanwhile, the power is transmitted to the conical gear **16** through the right impeller main shaft auxiliary power conical gear **15**, and starts the first HPCA compressor **17** to operate through the conical gear **16**. The HPCA generated by the first HPCA compressor **17** is supplied to the air tank **1** for storage, so as to be recycled and used by the wind-powered pneumatic engine, and thereby the wind-powered pneumatic engine **20** operates continuously to generate power output.

When the motor vehicle moves at a certain speed, the wind resistance airflow around the motor vehicle is guided by the outer edge **29** of the trunk shape inlets mounted in the front end of the vehicle body **44** at the position **45** where the wind resistance is the greatest, passes through trunk shape inlets and enters the impeller chambers **28**. The wind resistance airflow further drives the impellers **6** to operate to generate power. Both the power and the power generated by the HPCA stored in the air tank **1** are output to the gear box **32**, and after the gear-shift of the gear box **32**, the power is output to drive the tires **48** of the motor vehicle to operate through the drive bridge **46** and the half-axle **47** of the drive bridge, such that the motor vehicle equipped with the wind-powered pneumatic engine moves at a higher speed.

When it is required to decelerate, the pedal **33** is stepped down to the position of decelerating and pressurizing travel **35**, the hydraulic master pump **36** starts to work. The hydraulic master pump **36** impels the clutch driven disc **38** to abut against the clutch driving disc **39** through the clutch driven disc hydraulic working pump **37**, such that the inertia power of the motor vehicle is transmitted to the high-load second air compressor **41** to work through the brake disc internal gear transmission mechanism **40**, so as to recycle the breaking energy and convert it into regenerated HPCA to be stored in the air tank **1**, so as to recycle and use the regenerated HPCA.

It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the present invention without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.

What is claimed is:

1. A deceleration and brake pressurizing system applicable to a motor vehicle comprising:

a deceleration and brake pressurizing device;
an internal gear transmission mechanism; and
an air compressor,

wherein the internal gear transmission mechanism transmits inertia power of the vehicle to drive the deceleration and brake pressurizing device, which outputs to drive the air compressor to work.

2. The deceleration and brake pressurizing system according to claim 1, further comprising a clutch driving disc driven by the internal gear transmission mechanism, a clutch driven disc and a hydraulic master pump to drive the clutch driven disc.

3. The deceleration and brake pressurizing system according to claim 2, further comprising a pedal, and a clutch driven disc hydraulic working pump, wherein when the pedal is stepped down to reach a position, the hydraulic master pump initiates the clutch driven disc hydraulic working pump to drive the clutch driven disc to abut against the clutch driving disc, such that inertia power of the motor vehicle is transmitted by the brake disc internal gear transmission mechanism to the air compressor to render it to work.

4. A motor vehicle, comprising a vehicle body, a gear box, a drive bridge, a drive bridge half-axle, wheels and an engine, wherein the engine comprises:

at least one impeller chamber;
at least one impeller disposed within the impeller chamber;
an air-jet system for jetting a high-pressure compressed air (HPCA) into the impeller chamber; and
a deceleration and brake pressurizing system,

wherein the impeller chamber comprises at least one air inlet disposed thereon for receiving the HPCA and at least one air outlet, wherein the HPCA drives the impeller to rotate, the impeller then drives the drive bridge through the gear box, and the drive bridge drives the wheels through the drive bridge half-axle, and

wherein the deceleration and brake pressurizing system comprises

a deceleration and brake pressurizing device;
an internal gear transmission mechanism; and
an air compressor,

in which the internal gear transmission mechanism transmits inertia power of the motor vehicle to drive the deceleration and brake pressurizing device, which outputs to drive the high-load second air compressor to compress air, and the compressed air is transmitted into the air-jet system.

5. The motor vehicle according to claim 4, wherein the deceleration and brake pressurizing device further comprises a clutch driving disc driven by the internal gear transmission mechanism, a clutch driven disc and a hydraulic master pump to drive the clutch driven disc.

6. The motor vehicle according to claim 5, wherein the deceleration and brake pressurizing system further comprises a pedal, a hydraulic master pump, and a clutch driven disc hydraulic working pump, wherein when the pedal is stepped down to reach a position, the hydraulic master pump initiates the clutch driven disc hydraulic working pump to drive the clutch driven disc to abut against the clutch driving disc, such that the inertia power of the motor vehicle is transmitted by the brake disc internal gear transmission mechanism to the air compressor to render it to work.

7. The motor vehicle according to claim 6, wherein the air-jet system comprises a first controller, a distributor, a first air-jet pipe set, and a first air-jet nozzle set operably connected in sequence, and wherein an HPCA is input into the distributor through the first controller, and is then diverged by the distributor and input into each air-jet pipe of the first air-jet pipe set, from which the HPCA is jetted into the impeller chamber by each air-jet nozzle of the first air-jet nozzle set connected to the air-jet pipe of the first air-jet pipe set.

8. The motor vehicle according to claim 7, wherein the air-jet system further comprises a second controller, a distribution controller, a second air-jet pipe set, and a second air-jet nozzle set operably connected in sequence, and wherein an HPCA is input into the distribution controller through the second controller to generate an intermittent burst HPCA which is distributed to each air-jet pipe of the second air-jet pipe set, from which the HPCA is then jetted into the impeller chamber by each air-jet nozzle of the second air-jet nozzle set connected to each air-jet pipe of the second air-jet pipe set.

9. The motor vehicle according to claim 5, wherein the air-jet system comprises a first controller, a distributor, a first air-jet pipe set, and a first air-jet nozzle set operably connected in sequence, and wherein an HPCA is input into the distributor through the first controller, and is then diverged by the distributor and input into each air-jet pipe of the first air-jet pipe set, from which the HPCA is jetted into the impeller

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chamber by each air-jet nozzle of the first air-jet nozzle set connected to the air-jet pipe of the first air-jet pipe set.

10. The motor vehicle according to claim **9**, wherein the air-jet system further comprises a second controller, a distribution controller, a second air-jet pipe set, and a second air-jet nozzle set operably connected in sequence, and wherein an HPCA is input into the distribution controller through the second controller to generate an intermittent burst HPCA which is distributed to each air-jet pipe of the second air-jet pipe set, from which the HPCA is then jetted into the impeller chamber by each air-jet nozzle of the second air-jet nozzle set connected to each air-jet pipe of the second air-jet pipe set.

11. The motor vehicle according to claim **4**, wherein the air-jet system comprises a first controller, a distributor, a first air-jet pipe set, and a first air-jet nozzle set operably connected in sequence, and wherein an HPCA is input into the

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distributor through the first controller, and is then diverged by the distributor and input into each air-jet pipe of the first air-jet pipe set, from which the HPCA is jetted into the impeller chamber by each air-jet nozzle of the first air-jet nozzle set connected to the air-jet pipe of the first air-jet pipe set.

12. The motor vehicle according to claim **11**, wherein the air-jet system further comprises a second controller, a distribution controller, a second air-jet pipe set, and a second air-jet nozzle set operably connected in sequence, and wherein an HPCA is input into the distribution controller through the second controller to generate an intermittent burst HPCA which is distributed to each air-jet pipe of the second air-jet pipe set, from which the HPCA is then jetted into the impeller chamber by each air-jet nozzle of the second air-jet nozzle set connected to each air-jet pipe of the second air-jet pipe set.

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