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Patent Application

(Patent application in accordance with the regulation in the provision of Article 38 of the Patent Law)

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1. Title of the invention

Gear Train for a Hybrid Electric Automobile

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Specification

1. Title of the invention

Gear Train For A Hybrid Electric Automobile

2. Claims

I. In a gear train for a hybrid electric automobile comprising an input shaft, at least three friction engaging parts, a planetary gear device having at least four connectable elements, and an output shaft, the gear train is characterized in that the planetary gear device first element is connected to the input shaft through the first friction engagement part, the second element is connected to the output shaft, the third element is connected to the second and third friction engagement parts and to a first DC motor, also capable of serving as a generator, the fourth element is connected to a second DC motor, also capable of serving as a generator, and, further, the two DC motors are connected to a storage battery so as to allow the supply and receiving of electrical power, thus enabling independent power transmission from an internal combustion engine or a DC motor, or combined power transmission from both [those sources].

II. The gear train for a hybrid electric automobile of Claim 1, characterized in that the second DC motor is placed an idle state so as not to affect the planetary gear device and the motive force of the internal combustion engine is imparted to the planetary gear through selective engagement of the friction engagement parts, thus obtaining at least two stages of gear shift ratio from the engine motive force to the output shaft.

III. The gear train for a hybrid electric automobile of Claim 1, characterized in that as the operation of the internal combustion engine is stopped, the engagement of the third friction engagement part and the stopping of the first DC motor restricts the rotation of the planetary gear third element, imparting the motive force of the second DC motor to the fourth element, thus achieving at the output shaft a forward and reverse speed having a pre-determined gear shift ratio based on the electric motive force.

IV. The gear train for a hybrid electric automobile of Claim 1, characterized in that internal combustion engine motive force, under torque control, is imparted to the planetary gear device through the __*[ordinal number left blank –tr.]* friction engagement part, while the second DC motor motive force is imparted to the planetary gear device under deceleration or acceleration control, thus obtaining a continuously variable speed to the output shaft starting from zero; the storage battery is charged by one of the DC motors while the vehicle is traveling, and adjustment is made so that a portion of the engine drive load is lightened by the electrical motive force.

3. Detailed Description of the Invention

The present invention relates to a gear train in a hybrid electric automobile using a gasoline internal combustion engine and a battery-equipped electric motor as power sources.

In recent years, atmospheric pollution caused by gasoline engine vehicle exhaust gases has been accumulating in the atmosphere, unable to be fully detoxified, as cities become denser and motoring increases. In areas where dispersion is topographically or meteorologically prevented, it is now clear that [such gases] or particular pollutants can accumulate and cause direct harm to the human body, thus raising a growing problem in conflict with modern civilization. Given the relationship between vehicle travel patterns and carbon monoxide exhaust levels, car-induced pollution has led to the adoption of transport and road policies such as transportation restrictions and flyovers, while at the same time environmental standards have been established which strengthen restrictions on damaging components in exhaust gas, such as carbon monoxide, hydrocarbons, NOx, and solid particulates. This has led to proposals on the vehicle side such as the development of improved engines and exhaust gas cleaning devices to hold the amount of harmful components in the exhaust gas to below a certain level – so called "low emissions vehicles." Development has also been proposed of no-pollution vehicles using non-polluting drive devices, such as gas turbines or battery-equipped electric motors, etc. In all cases, except for some special-use vehicles, these may still be said to be under development around the world.

It would seem that superb human intellect and ceaseless technological progress will gradually lead to a revolutionary improvement in the motors for such vehicles, but there is a need [now] to reduce the exhaust gas pollution which is threatening human social life in cities as one step toward that ultimate goal.

The object of the present invention is to provide a gear train for a hybrid electric vehicle with a gasoline internal combustion engine and a storage battery-equipped electric motor, whereby driving [the vehicle] with one or a combination of these [drive sources] allows the amount of output exhaust gases to be varied during travel in keeping with atmospheric pollution conditions.

The present invention is explained below using the diagrammed embodiments. Fig. 1 shows an example of the hybrid electric vehicle gear train of the present invention; Fig. 2 shows a specific embodiment of the automatic transmission mechanism of Fig. 1. In each of these figures, case 1 contains a transmission mechanism, and an externally located electric motor mechanism. Inside this case 1, the input shaft 3 from the internal combustion engine 2 is connected to a first clutch 3 clutch drum 5 and a second clutch 6 clutch hub 7. A first clutch 4 clutch hub 8 is connected to a planetary gear device 20 first sun gear 21 through a first intermediate shaft 9; a second device 6 clutch drum 10 is connected to a second sun gear 22 thereof through a second intermediary shaft 11, and a brake 12 is disposed between a second clutch 6 clutch drum 10 and the case 1.

The planetary gear device 20 is integrally formed with the first and second sun gears 21 and the 22 and has meshing pinion gears 23 and 24; of these, a ring gear 25 meshes with the first pinion gear 23 and a carrier 26, which supports both pinion gears 23, 24, is connected to the output shaft 13. Oil pumps 14, 15 are respectively disposed on input shaft 3 and output shaft 13; the pressurized oil produced by these oil pumps 14, 15 is selectively supplied to clutches 4, 6 and brake 12 through a hydraulic control circuit (not shown). A low speed stage speed reduction ratio of $1+\frac{Z_{22}}{Z_{21}}$, determined by the number of first sun gear 21 teeth Z_{21} and the number of second sun gear 22 teeth Z_{22}, is obtained by the supply [of hydraulic pressure] to the input shaft 3 and the brake 12 to engage [these] by friction, and a high speed stage direct linkage is obtained by supplying [hydraulic pressure] to the first and second clutches 4, 6 and [consequent] friction engagement thereof.

An electric motor drive system path is disposed on such an internal combustion engine drive system path. Transfer gears 30, 31, respectively having the same pitch circle diameters. are disposed on the second intermediate shaft 11 which is integral with the planetary gear device 20 second sun gear 22, and on the ring gear 25. Drive gears 34, 35 are respectively meshed with transfer gears 30, 31 through intermediate gears 32, 33 in order to adjust the rotational direction [of transfer gears 30, 31]. On each of the drive gears 34, 35 are disposed DC motors 36, 37 capable of also becoming electric generators, and wiring 39, 40, capable of transferring electrical power, is connected between these DC motors 36, 37 and a storage battery 38, and is further connected to the exciter side of wiring 43, 44, which is equipped with controllers 41, 42 which change vary and change the polarity of an excitation current. An excitation current is thus supplied to the second DC motor 37 from the storage battery 38 to turn the drive gear 35, while at the same time hydraulic pressure is supplied to the brake 12 to engage it, thus restricting the rotation of the planetary gear device 20 second sun gear 22 so as to obtain a reduction ratio of $(1+\frac{Z_{22}}{Z_{25}}) \times \frac{Z_{31}}{Z_{35}}$, determined by the second sun gear 22 tooth count Z_{22}, the ring gear 25 tooth count Z_{25}, the transfer gear 31 tooth count Z_{31} and the drive gear 35 tooth count Z_{35}, so that an output torque of $(1+\frac{Z_{22}}{Z_{25}}) \times \frac{Z_{31}}{Z_{35}}$ x T is obtained with respect to the DC motor 37 torque T. Therefore output torque control is controlled by holding the reduction ratio in a fixed state, and the output shaft 13 is reversed and movement caused to go backward by [using] the controller to reverse polarity. Given the DC motor 37 characteristics, the DC motor 37 acts as a generator by virtue of being driven from the output side, yielding an engine brake effect and the capacity to charge the storage battery 38, but using the controller 42, it is [also] possible to cut the excitation current and travel without the engine brake.

In the gear train of the present invention, driven independently using an internal combustion engine and an electric motor constituted as described above, we shall further explain the hybrid drive in which the motive force from the internal combustion engine 2 is imparted to the first sun gear 21 by the action of the first clutch 4, while at the same time the motive force from DC motors 36 or 37 is respectively imparted to the second sun gear 22 or the ring gear 25. At this point, engine motive force output torque is controlled by the engine throttle valve, and both of the DC motors 36, 37 are made able to [function] as either motors or generators by means of the controllers 41, 42, while their rotational speed can be decreased or increased by the freely selected inclination [thereof]. By the combination of the three gears 21, 22, 23, whose output torque and rotational speed is thus controlled, the planetary gear device 20 attains a continuously variable transmission over a wide speed shift range on the output shaft 13 through the carrier 26. In this case, as shown in Fig. 3, deceleration is linear along the curve a from three times the first DC motor 36 input shaft 3 rpm to zero, and increases linearly along the curve b from the state at which it reverses at 0.5 times the second DC motor 37 input shaft 3 through zero up to approximately twice that [speed] in the positive rotation state. As a result, the speed ratio obtained on the output shaft 13, which is the rpm ratio with respect to the input shaft 3, passes continuously from zero through 0.3, at which the second DC motor 37 rotation is zero, through 1.0, at which the second DC motor 37 is the same as the input rotation, up to 1.5, at which the first DC motor 36 rotation is zero. In this continuously variable speed regime from zero to overdrive, the second DC motor 37 functions as a generator when the speed ratio is below 0.3, as does the first DC motor 36 when the [speed ratio] is above 0.3. The electrical energy obtained from this generation is used as is to activate the motor, not for charging the storage battery 38.

Efficiency is indicated in Fig. 4 as a horsepower ratio between the input shaft 3 and the output shaft 13 over the entire speed shift operational speed ratio range. In this figure, efficiency in the mechanical portion is taken to be 100%. The power transfer rate for the electrical portion is used as a parameter; curve c shows the case in which that efficiency is 80%, and curve d shows the case in which it is 50%. As is clear from the figure, efficiency climbs rapidly until the speed ratio reaches approximately 0.4; past that speed ratio, efficiency is maintained above 80% so long as the electrical portion power transfer efficiency does not drop below one half; in curve c, a high efficiency close to 100% is maintained. Fig. 5 shows the relationship of the stall torque ratio, which expresses the torque ratio obtained when the output shaft 13 is stopped, with respect to the electrical portion power transfer efficiency. As is clear from the figure, the rise in torque ratio is comparatively gradual up to an electrical portion power transfer efficiency of about 0.6, rising rapidly at subsequent efficiencies; a high torque ratio is obtained when the efficiency is zero, such as when the vehicle is starting to advance. In a hybrid drive of this type, the embodiment uses the generated electrical power as is for the motor, with none being used for charging, but a portion of the electrical power generated as part of the electrical drive during vehicle travel may be stored in the storage battery 38. It is also possible to use this system to supplement [power] from the storage battery 38 so that not all of the large torque [needed] during rapid acceleration is supplied from the internal combustion engine 2. Furthermore, a reverse speed may be obtained in this case as well using the controllers 41, 42.

To explain the use of the gear train of the present invention, drivable by means of the above three systems of standard internal combustion engine drive, electrical drive, and a hybrid drive of the two, the electrical drive system, which is of course completely free of exhaust gases, would be used in cities or at times or places where atmospheric pollution was excessive, at which times travel would take place by imparting a sufficient drive force at a pre-determined fixed reduction ratio. Next, when atmospheric pollution was middling, the load on the internal combustion engine 2 would be lightened by electrical power supplementation from the storage battery 38 using the hybrid drive system; exhaust gas generation would be ameliorated, and driving could be accomplished at the best efficiency at all times using continuously variable transmission. Furthermore, in locations where the exhaust gases are sufficiently dispersed in the atmosphere, such as fully exurban areas, a sufficient acceleration using a two stage gear shift ratio and a good response could be achieved using the internal combustion engine drive system.

Finally, to explain another embodiment of the planetary gear device 20 in Fig. 6, omitting those portions which are the same as described above, the two pinion gears 23', 24', which are separated in the figure, mesh respectively with sun gears 21, 22; the second pinion gear 23' is connected to the first intermediate shaft 9, and the carrier 26' which supports the first pinion gear 25' is connected to the second ring gear 28 which meshes with the second pinion gear 23'; two gear ratios – direct and overdrive – are obtained in the internal combustion engine drive system by selective operation of the two clutches 4, 6 and the brake 12.

As explained above, according to the hybrid electric vehicle gear train of the present invention, an electrical drive system with no exhaust gas whatsoever and a hybrid drive system which significantly reduces exhaust gas are provided in addition to a normal internal combustion engine system. Exhaust gas volumes are effectively reduced or made zero when driving at times or locations prone to atmospheric pollution, and vehicle function is sufficiently assured. Due to the planetary gear device 20 structure, overall gear train efficiency is comparatively high in the hybrid drive system even when the electrical portion efficiency is low, offering the advantages of continuously variable speed over a wide speed change range and a high torque ratio at start up. Furthermore, because the storage battery 38 can be charged during vehicle travel, the long charging times which are the biggest difficulty with electric vehicles can be eliminated, and control operations and changeover between each of the systems can be easily effected.

4. Brief Description of Figures

Figure 1 is a block diagram showing an example of the gear train of the present invention. Figure 2 is a vertical cross-sectional view that shows the structure of the automatic transmission mechanism within Figure 1. Figure 3 is a graph showing the correlation between the speed ratio of the DC electric motor and the speed ratio of the gear train. Figure 4 is a graph showing the correlation between gear train efficiency and the speed ratio thereof using the power transfer efficiency of the electrical portion as a parameter. Figure 5 is a graph showing the correlation of the stall torque ratio and the power transfer efficiency of the electrical portion. Figure 6 is a block diagram showing another example of the gear train of the present invention.

2. Internal combustion engine
3. Input shaft
4. First clutch
6. Second clutch
12. Brake
13. Output shaft
20. Planetary gear
21. First sun gear
22. Second sun gear
25. Ring gear
26. Carrier
36. First DC electric motor
37. Second DC electric motor
38. Battery

(19)

[see source for figures]

Figure 1

Figure 2

[see source for figures]

Figure 3

X axis: Speed ratio

Y axis: DC Electric Motor Speed Ratio

Figure 4

X axis: Speed Ratio

Y axis: Efficiency

Figure 5

X axis: Electrical Portion Power Transfer Efficiency

Y axis: Stall Torque Ratio

Figure 6

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(1) Application Copy 1

~~( ) Request for examination of the application 1~~

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(3) Figures 1

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特　許　願

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特許庁長官　三宅　幸　夫　殿

1．発明の名称
　　複合電気自動車の歯車伝動装置

2．特許請求の範囲に記載された発明の数

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明　細　書

1．発明の名称

複合電気自動車の歯車伝動装置

2．特許請求の範囲

太陽歯車、キャリヤおよびリング歯車の各回転要素から成る遊星歯車機構中の一軸を第1切替クラッチを介して原動機関の出力軸側に連結し、その第2軸を発電機軸に連動結合しその第3軸を車両の推進軸側に連結した構成において、上記第3軸側に歯車噛合伝動によって電動機軸を連結して電動機のみによるMモード運転系を形成し得ると共に上記発電機および電動機間に蓄電池とコントローラを配設してこれらを電気的に結合することによって原動機関と電動機による複合回転伝動を可能なM－Eモード運転系を形成させ、更に上記第2軸上か或は第1軸と第3軸間に第2切替クラッチを係着せしめることによって原動機関によるEモード運転系を形成するようにしたことを特徴とする複合電気自動車の歯車伝動装置。

3．発明の詳細な説明

本発明は複合電気自動車の歯車伝動装置に関するものである。ガソリンエンジンやディーゼルエンジンによる自動車の排気ガスは大気汚染の一原因であるとしてマスキー法案にみられる如く排気ガス規制が厳しくなりつつある。そこで排気ガスを出さずに走行できる電気自動車が内外で注目されてきているが、一充電走行距離が短いとか重量が大きくなる等の欠点によりまだ従来の内燃機関にとってかわるまでに至っていない。そこで内燃機関と蓄電池を併用してあるときは蓄電池で電動機を駆動し（以後Mモードと呼ぶ）、あるときは内燃機関、電動機双方で駆動しそのとき内燃機関の動力の一部を発電機で電気エネルギーに変換して蓄電池を充電し（以後M－Eモードと呼ぶ）、またあるときには内燃機関のみで駆動（以後Eモードと呼ぶ）して走行できる複合電気自動車が注目を集めてきている。すなわちこのM，M－E，Eの各モードを都市内、郊外等で使い分けることによって排気ガスが特に問題となる場所ではそれを低減しようというものである。

この複合電気自動車に関する歯車伝動装置については、いくつかの公知技術が散見されるが比較的複雑な歯車伝動装置を用いているのでクラッチの数が多くなってしまうもの、あるいは全く単純な蓄電池と内燃機関の複合方式であるため電動機に大きな負担がかかるもの等に止まりまだ満足できるものは少い。

本発明は上記公知技術の欠点に鑑み、改良された複合電気自動車の歯車伝動装置を提供するものである。すなわち本発明の目的は歯車機構の連続構成が比較的簡単でありまたクラッチ等摩擦係合装置も比較的少く、簡単な構成でしかも良好に作動する複合電気自動車の歯車伝動装置を提供することである。本発明に係る歯車伝動装置を用いれば電動機は常に電動機として、発電機は常に発電機として作動するのでコントローラの負担が少く、また完全な無段変速が可能であり時に応じM，M－E，E各モードをそれぞれの運動態様に従って使いわけられる利益がある。そして動力伝達効率を上昇させるためにオーバドライブさせることも可能であり、走行速度が上昇する程動力伝達効率は上昇ししかもEモードにしたときが最高の動力伝達効率となるので安定高速走行が可能である。

本発明に係る歯車伝動装置の構成について添附図面により詳細に説明する。各実施例を第1図から第6図に示したが、第2図以降の実施例の基本的な構成は第1図のそれと類似しているので主として第1図について説明し、その他に関しては若干の補足を加える。まず第1図を参照されたい。

内燃機関10のクランク軸に連結した歯車伝動装置の入力軸1があり、これは第1モード切替クラッチ60を介して中間軸4に連結される。この入力軸1には歯車ポンプ等の油圧供給源3があり、内燃機関10の動力の一部で油圧を発生させてクラッチ等の係合を為す動力源となる。内燃機関10の動力によらないで別の小型電動機により走行中常に一定油圧を得る方法もあり、この場合には内燃機関10が停止していても常に油圧を発生できる利点がある。

中間軸4は遊星歯車機構50の遊星歯車53を回転自在に軸支するキャリア51に一体的に結合されており、遊星歯車53と噛合う太陽歯車52は中空回転軸の後端に一体的に取付けられている。そしてこの中空回転軸の前端は多板式変速用ブレーキを構成する第2モード切替クラッチ70の回転可能な摩擦板72に結合され、一方クラッチ70の固定摩擦板71はケースに固着されている。従って油圧によって第2モード切替クラッチ70が係合されると中空回転軸5はケース75に対し固定状態となる。この中空回転軸5にはスプライン嵌合された歯車23があり、この歯車23に噛合う歯車22の回転軸21は発電機20の軸となっている。遊星歯車機構50のリング歯車54は出力軸2上に取付けられ、この出力軸2上には歯車33がスプライン嵌合し、これに噛合う歯車32を介して電動機30と連結している。一方において、電動機30と発電機20とはそれぞれ蓄電池40を介して電気的に関係づけられる。すなわち配線43，44は励磁側に接続されており、コントローラ41，42は励磁電流を制御する。一方配線44，45は蓄電池40、発電機20、電動機30間の電力の受け渡しをする。

次に第2図の実施例について説明する。なお、第1図の実施例と同一の部品に関しては同じ参照番号を用いている。（以下第6図まで同様である。）第1図と異る点は遊星歯車機構~~450~~が2列で構成されていることである。すなわち前列遊星歯車機構150のリング歯車154は後列遊星歯車機構の遊星歯車157を軸支するキャリヤ155と一体になっており、しかもこれは出力軸102と連結している。また後列遊星歯車機構152のリング歯車158は常にケース174に固着されている。そしてその太陽歯車156と一体に結合した歯車133に噛合う歯車132の軸は電動機130と一体的に結合している。 3字削除 3字加入 3字加入

次に第3図の実施例を説明する。第1図の実施例では発電機20と連結する遊星歯車機構の太陽歯車52は一端をケース75に固着した第2モード切替クラッチ70に連結されていたが、この実施例では第2モード切替クラッチ270は遊星歯

車機構のキャリア251とリング歯車254の間、言い換えれば中間軸204と出力軸202の間に設けた点が異っている。第2モード切替クラッチ270を係合させれば中間軸204と出力軸202は一体となる。

次に第4図について説明する。この実施例では中間軸304は遊星歯車機構350の遊星歯車を軸支するキャリア354と一体的に連結している。リング歯車353は中空回転軸305と連結されておりこれに歯車323がスプライン嵌合されている。さらに歯車322を介して発電機320と連結されている。また第2モード切替クラッチ370は遊星歯車機構350のリング歯車353に連結されており、太陽歯車351は出力軸302と連結されている。

次に第5図の実施例を説明する。この実施例では遊星歯車機構450が2重遊星歯車で構成されている点が前記各実施例と異っている。中間軸404はリング歯車454と連結しており、太陽歯車451は第2モード切替クラッチ470と連結していて、2重の遊星歯車452，453を軸支するキャリヤ455は出力軸402に連結されている。

最後の実施例である第6図でも第5図と同様に2重遊星歯車を使用している。中間軸504はリング歯車554を連結し、太陽歯車551は出力軸502と連結している。2重の遊星歯車552，553を軸支するキャリア555は中空軸505を介して第2モード切替クラッチ570に連結され、この中空軸505に歯車523，522を介して発電機520が連結している。

以上本発明の歯車伝動装置の構成について説明したが、次いでその作動態様を詳細に述べる。各実施例について基本的な動作は類似する点が多いので主として第1図の実施例を中心として説明し、他の実施例については異った作動をするものについてのみ記載する。

再び第1図を参照されたい。前述の如く本発明によってM，M－E，Eの各モードをとることが可能である。すなわち油圧供給源5から油圧を制御回路（図示せず）を通して第1モード切替クラッチ60，第2モード切替クラッチ70に選択的に供給し或は排出してそれらの係合，解放によって下表の如くM，M－E，E各モードをとることができる。

	Mモード	M－Eモード	Eモード
第1モード切替クラッチ60	×	○	○
第2モード切替クラッチ70	×	×	○

○　係合

×　解放

上表のごとく、クラッチ60，クラッチ70をともに解放した状態ではMモードになる。内燃機関10は出力軸2と完全に切離されているので電動機30の駆動力のみで車両を駆動するわけである。また内燃機関10と発電機20の間も切離されているので、Mモードにおいては走行中発電機20によって蓄電池40を充電することは不可能である。しかし停車時に出力軸2を停止させておいてクラッチ60を係合させ内燃機関10の動力で発電機20を駆動し蓄電池を充電させることは可能である。

Mモードによる走行はコントローラ42による電動機30の回転数制御によって行なわれる。すなわち歯車32，33を介して出力軸に対しトルクを増大させて走行する。

第7図にMモードでの電動機回転数と車速の関係を示す。この関係は直線的でその傾きは歯車32と歯車33の歯数比に基づくものである。この歯数比を変化させることによって車速を上昇させることは可能であるが、実際上ある程度以上にするのは困難である。そこで歯車を2段にして歯数比を充分大きくとれるようにして電動機30を低トルクで高回転のものを使用可能にしたのが第2図の実施例である。前述の如くこの実施例では電動機130と出力軸102の間には歯車152，153に加えて遊星歯車機構180が一組設けられている。しかもリング歯車158は常にケースに固着され歯車153と太陽歯車156は一体であるから、

$$i = \frac{\text{歯車１３５の歯数}}{\text{歯車１３２の歯数}}$$

$$\rho = \frac{\text{太陽歯車１５６の歯数}}{\text{リング歯車１５８の歯数}}$$

とすれば電動機１３０の回転トルク T_M に対して出力軸の回転トルク T_O は

$$T_O = i \times \frac{1+\rho}{\rho} T_M$$

となり第１図の実施例に比して（$1+\rho$）／ρ 倍だけ回転トルクを上昇させ得るわけである。また電動機の回転トルク T_M はコントローラ１４２により励磁電流を変化させれば変化させることができ、したがって T_O も T_M に応じて制御されることになる。

Ｍモードに関して第５図から第６図の各実施例の歯車伝動装置は第１図の実施例と類似の態様で作動する。

再び第１図を参照されたい。ここまで説明したＭモードでは第１モード切替クラッチ６０，第２モード切替クラッチ７０共に解放状態であったが次に内燃機関１０を回転させておいてクラッチ60のみ係合させクラッチ７０を解放状態に保つ。このときには内燃機関１０と出力軸２は遊星歯車機構５０を介して連結されしかも電動機３０の動力も出力軸２に加わるから、全体として内燃機関と電動機の動力は複合伝達される。この状態はＭ－Ｅモードであり、このＭ－Ｅモードでは内燃機関１０の動力の一部が遊星歯車機構５０の太陽歯車５２から分流して歯車２３，２２を介して発電機２０を駆動する。すなわち発電機２０により電気的エネルギに変換されコントローラ４１で制御され蓄電池を充電する。電動機３０は蓄電池の電気エネルギによってコントローラ４２で励磁電流を制御することによって駆動される。一方キャブレータ絞り弁の開量を一定にすることにより内燃機関１０の出力を一定に保持しておいて、電動機30の回転速度のみの制御によって出力軸２の回転速度を変化させることが可能である。

Ｍ－Ｅモードにおいて内燃機関１０の回転速度と出力軸２の回転速度の比 e に対する発電機２０および電動機３０の内燃機関１０に対する各回転速度比 e_g，e_m との関係を第８図に示す。Ｍ－Ｅモードに移った時点（モード変換点と呼ぶ）の速度比を e^* とするとそのときの発電機２０の回転速度比 e_g はＢ点で示される。一方電動機３０の速度比 e_m はＡ点で示される。これら速度比は内燃機関１０の回転速度に対する比であるから、前述の如くキャブレータの絞り弁によって内燃機関１０の回転速度を一定にしておけば各速度比はそのまま電動機、発電機および出力軸の回転速度に対応する。

上記モード変換点よりコントローラ４１，４２を制御して e を徐々に大きくしてゆけば、第８図に示す如く電動機３０の回転速度の増大にしたがって、リング歯車５５とキャリア５４の間の差動的回転によって太陽歯車５２に連結した発電機20の回転速度は徐々に減少してゆく。すなわち e を増大させるにしたがって歯車伝動機構において駆動力に占める内燃機関１０の占める割合は増大し、電動機３０の占める割合は減少してゆく。$e = e_{max}$（最大速度比と称する）になると発電機２０は全く回転を停止し、一方電動機３０は最大の回転速度となる。ただしこの場合電動機３０はその回転速度は大きくても駆動力としてはほとんど零になり、内燃機関１０のみによって駆動されていることに注意する必要がある。またこのとき後述する如く入力軸１と出力軸２の間でオーバドライブが達成さるべき歯車構成になっていることにも注意する必要がある。

$e = e_{max}$ の時点では前述の如く遊星歯車機構５０の太陽歯車５２は停止するのでこのとき第２モード切替クラッチ７０に油圧を供給しこれを係合させる。クラッチ７０のブレーキ作用によって発電機２０は全く作動しなくなり、また蓄電池40から電動機３０への電気エネルギの供給も断たれ、電動機３０も自由回転しているだけなので内燃機関１０によって純機械的に出力軸は連結され駆動される。すなわちこれがＥモードである。このと

き前述の如く

$$\rho = \frac{\text{太陽歯車の歯数}}{\text{リング歯車の歯数}}$$

とすれば

$$\text{歯数比} = \frac{1}{1+\rho}$$

となり回転速度比としては $1 + \rho$ のオーバドライブが達成される。

ここで e と動力伝達効率の関係をとったものを第9図に示す。e^* の時点までは第1モード切替クラッチ60が係合していないので電動機20の駆動力の増大と共に動力伝達効率は上昇する。M－Eモードに移る時点 e^* で動力伝達効率が不連続になるのはクラッチ60の係合によって発電機20へ駆動力が分流するからであり、その後は e の増大と共に発電機20へ分流する駆動力は減少し動力伝達効率は上昇する。e_{max} では発電機20の回転は全く停止し損失は純機械的なもののみとなり動力伝達率は最大となる。以上のことは第2図および第4図から第6図の各実施例においても第1図の実施例と類似である。

しかし第3図の実施例はそれらと若干異った作動をするので説明を加える。第3図の実施例では前述の如く第2モード切替クラッチ270はその一端でケースに対し固着されておらず、中間軸204と出力軸202の間にある。このクラッチ270は入力軸201と出力軸202の間を純機械的に直結させるためのものである。すなわちクラッチ270を係合させると遊星歯車機構250は入力軸201と一体になって回転し入力側の駆動力は出力軸へ直結される。ここで同時に電動機230への電気エネルギの供給を絶てばこれが第3図の実施例におけるEモードとなる。この場合クラッチ270にブレーキ作用はなくクラッチ270を係合させても発電機220は回転したままである。さらに車速を上昇させるためには、第2モード切替クラッチ270を解放し、遊星歯車機構250におけるリング歯車254とキャリア251の間の差動回転によって発電機220がさらに減少するように電動機230を回転させてオーバドライブ状態を達成させれば良い。

第3図の実施例での動力伝達効率を第9図に示す。$e = 1$ の時点で動力伝達効率が特異点となるのがこの実施例で特に変っている点である。

これまで本発明の歯車伝動装置についてその構成，作動態様を説明したが次に実際の走行中でのM，M－E，E各モードの使用，切替の態様を説明する。

Mモードは低速域すなわち車両のスタート時からある程度の車速になるまでに用いる。また内燃機関は完全に停止しており、排気ガスは全く発生しないから、都市内走行など低速で充分でしかも排気ガスの規制が厳しい場所で継続的に用いるのにも適している。また電動機の回転方向をコントローラで逆回転させれば後進可能になる。

都市内でMモードで走行し郊外に出てM－Eモードに切替えるときにはまず内燃機関を始動させる。内燃機関10の動力によって入力軸1が回転し、ポンプ5は油圧を発生する。この油圧によって第1モード切替クラッチを係合させる。このとき予め設定した内燃機関の回転速度まで一気に上昇させる。このモード切替時点を設定した速度比とするなら、その時の内燃機関の回転速度は一意的に決るから、そこまで上昇させるように制御系で制御する。これによって電動機に回転速度変化を与えることなく連続的にM－Eモードに移ることができる。一度M－Eモードに入ってしまったら、相当低速まではMモードに戻らないようにする制御系は実用上設ける必要がある。

M－Eモードでは、発電機はコントローラ41で制御されつつ発電作用を為すが、Mモードにおいても蓄電池を使用するのであるから発電機の性能は適切なものを選ぶ必要がある。また公害対策上内燃機関は最も排気ガスの少い回転速度で一定にしておくという方法は極めて有効である。

M－EモードからMモードの切替時には、まず第1モード切替クラッチに加わっている油圧を排出して解放状態にし、次に内燃機関を停止させれ

ば良い。

M・Eモードから Eモードへの切替時には、発電機が停止した時点を感知し第2モード切替クラッチを係合させれば良い。Eモードは高速道路等で高速，一定の走行に適している。このとき歯車伝動装置の動力伝達効率は最高であるから経済的走行が可能である。

その他本発明によれば、コントローラによって電動機の回転速度を連続的に変化させて完全な無段変速走行を為すことができるという利点もある。

4. 図面の簡単な説明

第1図は本発明の第1の実施例を示す歯車伝動装置の概略図、第2図は第2の実施例を示す歯車伝動装置の概略図、第3図は第3の実施例を示す歯車伝動装置の概略図、第4図は第4の実施例を示す歯車伝動装置の概略図、第5図は第5の実施例を示す歯車伝動装置の概略図、第6図は第6の実施例を示す歯車伝動装置の概略図、第7図はMモード時の電動機回転速度と車速の関係、第8図は入，出力軸の回転速度比eと、入力軸と電動機および発電機の回転速度比e_m, e_g の関係図、第9図は第1図，第2図，第4図から第6図の各実施例の歯車伝動装置における入，出力軸回転速度比eと動力伝達効率の関係図、第10図は第3図の実施例の歯車伝動装置における入，出力軸回転速度比eと動力伝達効率の関係図。

1‥‥入力軸、 2‥‥出力軸、 3‥‥油圧ポンプ、 4‥‥中間軸、 5‥‥中空回転軸、 10‥‥内燃機関、 20‥‥発電機、 30‥‥電動機、 40‥‥蓄電池、 41，42‥‥コントローラ、 50‥‥遊星歯車機構、 60‥‥第1モード切替クラッチ、 70‥‥ 第2モード切替クラッチ。

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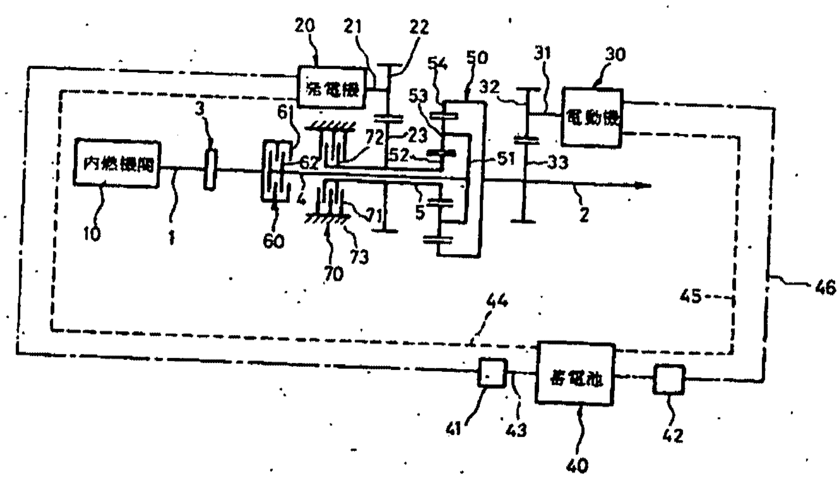
第1図



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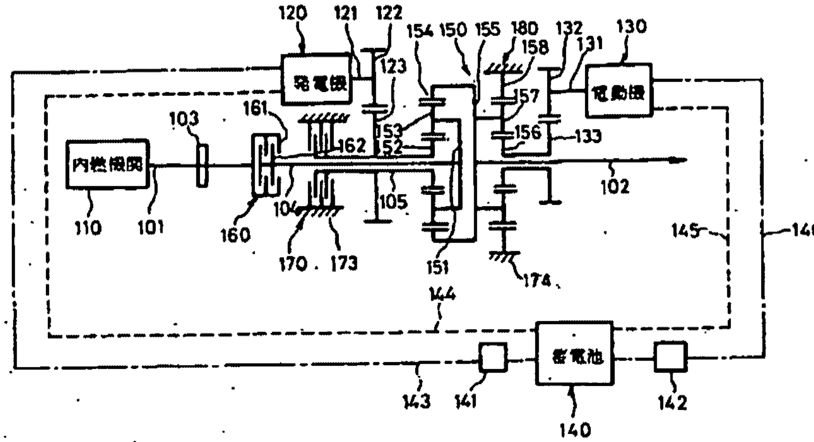
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電動機
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蓄電池
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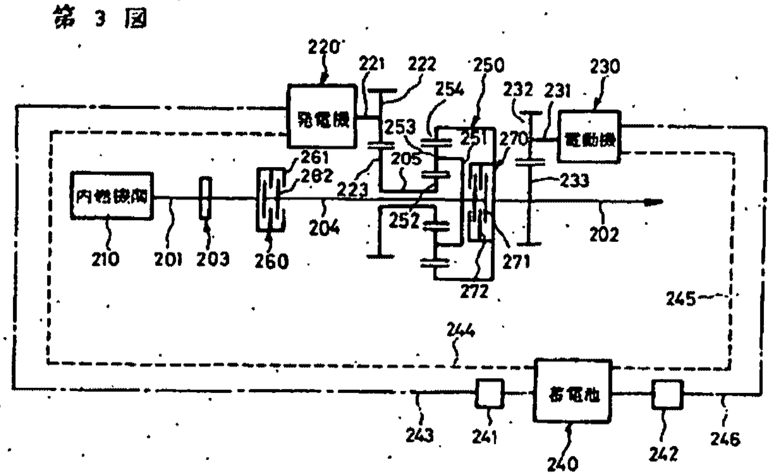
第 3 図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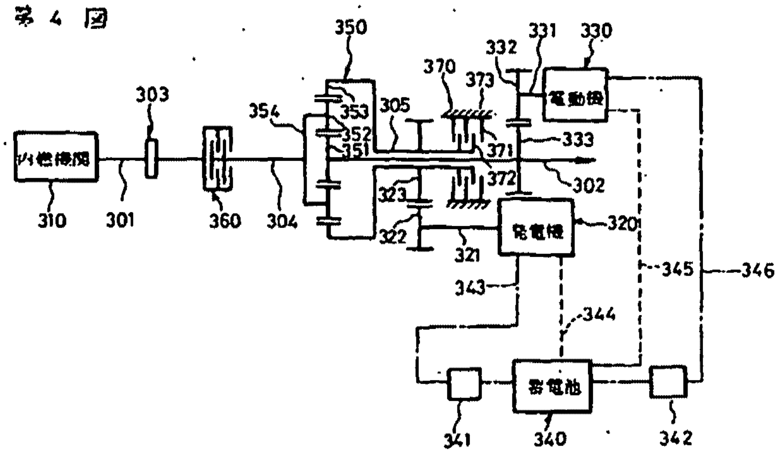
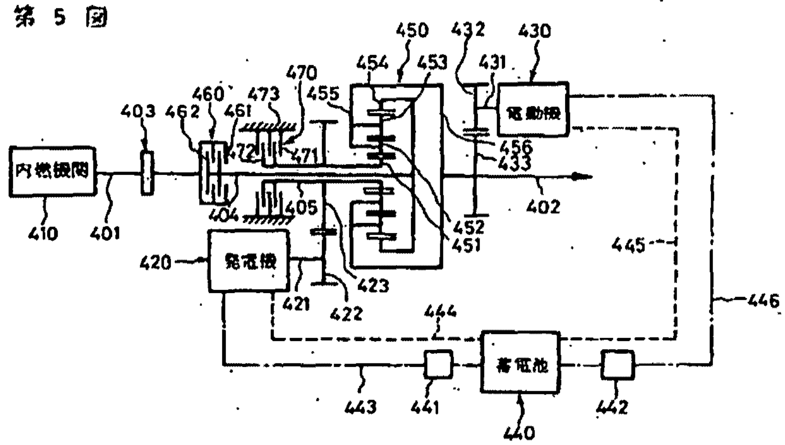
第 4 図



第 5 図



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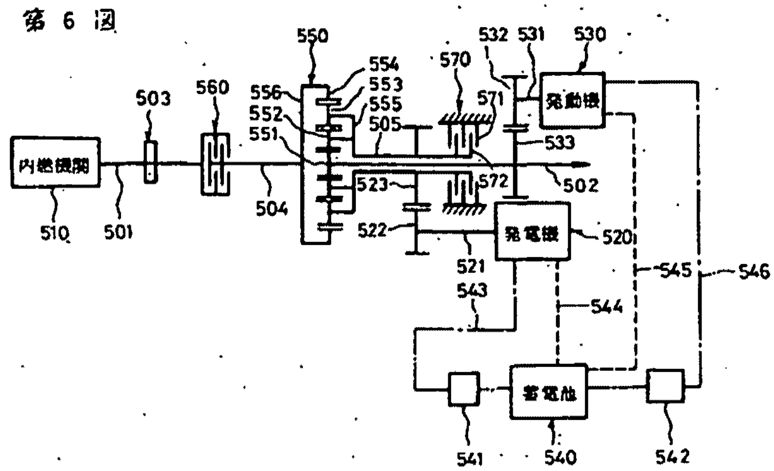
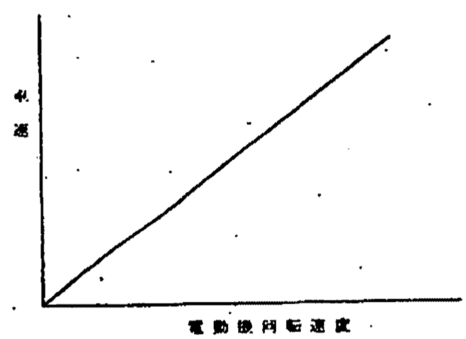
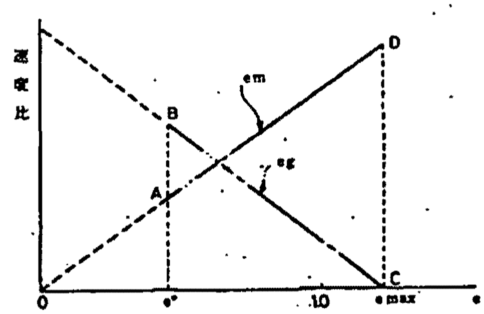
第 6 図



第 7 図



第 8 図



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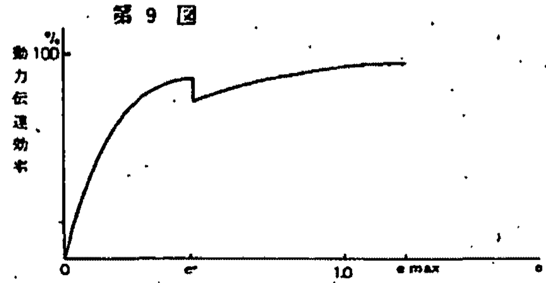

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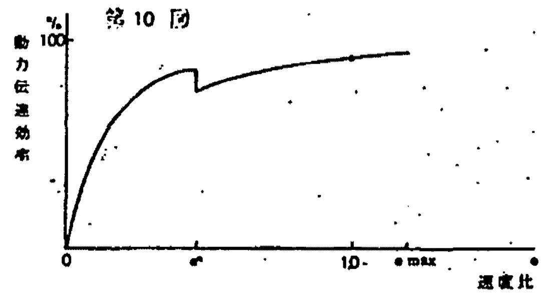

6. 添附書類の目録

(1) 願 書 副 本	1 通
(2) 明 細 書	1 通
(3) 図 面	1 通
(4) 委 任 状	1 通

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CERTIFICATION OF TRANSLATION

I, Christopher Field, a professional Japanese translator accredited by the American Translators Association, hereby attest that the attached translations from Japanese have been faithfully prepared to the best of my ability.

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Patent examiner: Yukio Miyake

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2. Number of Inventions Described in the Range of Patent Claims:___

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Specification

1. Name of Invention

Hybrid Electric Vehicle Gear Transmission Device

2. Claim

A hybrid electric vehicle gear transmission device in which one shaft of a planetary gear mechanism comprising the rotational elements of a sun gear, a carrier, and a ring gear is connected to the output shaft side of an engine through a first switching clutch, a second shaft thereof is connected to an electric generator, and a third shaft thereof is connected to the vehicle propelling shaft side, an M-mode drive system based on only the electric motor can be formed, in which the electric motor shaft is linked by the gear engagement transmission on the above third shaft side, while an M-E mode drive system can be formed using a hybrid rotation drive based on an engine and an er and electric motor by disposing a storage battery and a controller between the above generator and electric motor and electrically linking these [elements]; furthermore by inserting a second switching clutch on the above second shaft, or between a first shaft and a second shaft, and E mode drive system based on an engine can be formed.

3. Detailed Explanation of Invention

The present invention relates to gear transmission devices for hybrid electric vehicles. Vehicle exhaust gases from gasoline engines and diesel engines are the primary sources of air pollution, and regulations pertaining to exhaust gases are becoming stricter, as seen in the Muskie Act. Given this, even though there is considerable interest, both in Japan and overseas, in electric vehicles that are able to travel without producing exhaust gases, weaknesses, such as the short distance that can be traveled on a single charge, and the increased weight [of the electric vehicles] have prevented electric vehicles from reaching the point wherein they can replace conventional internal combustion engines. Given this, attention has focused on hybrid electric vehicles that can travel in a so-called M mode wherein an electric motor is driven by a storage battery when a storage battery is used in parallel with an internal combustion engine, an M-E mode wherein, at some time, power is provided by both the internal combustion engine and the electric motor, where, at such times, a portion of the power from the internal combustion engine is converted into electrical energy in an electric generator and is stored in the storage battery, and can travel in an E mode wherein the propulsion is by the internal combustion engine alone. In other words, by using the M, M-E, and E modes selectively for urban driving or suburban driving it is possible to reduce exhaust gases in the places wherein the exhaust gases are particularly problematic.Although a variety of prior art can be found regarding gear transmission devices relating to these hybrid electric vehicles, these make use of relatively complex gear transmission devices, and therefore have large numbers of clutches, or use extremely simplistic battery and internal combustion engine hybrid methods, placing large loads on the electric motor; thus there are still few cases wherein [performance] is satisfactory.

In consideration of the weaknesses in the prior art, described above, the present invention provides an improved gear transmission device for a hybrid electric vehicle. In other words, the object of the present invention is to provide a gear transmission device for a hybrid electric vehicle that has excellent operation using relatively simple drive train, or with relatively few clutch or other friction engagement devices. When the gear transmission device according to the present invention is used, the electric motor always operates as an electric motor, and the electric generator always operates as an electric generator, so the load on the controller is reduced; fully infinitely variable transmission is possible, with the benefit that at different times the M, M-E, and E modes can be used selectively, depending on the driving conditions. Furthermore, it is also possible to engage an overdrive in order to increase the power transmission efficiency; power transmission efficiency increases as the driving speed increases, and the optimal power transmission efficiency will be in the E mode, thus providing stable high-speed travel.

The structure of the gear transmission device according to the present invention will be explained in detail using the attached drawings. Figures 1 through 6 show the various example embodiments, where the basic structure in the example embodiments in Figure 2 and above are similar to those in Figure 1, and are primarily explained using Figure 1, where minor changes have been made regarding the others. First, let us reference Figure 1.

There is an input shaft 1 for the gear transmission device connected to the crankshaft of an internal combustion engine 10, where this [input shaft 1] is connected to an intermediate shaft 4 through a first-mode switching clutch 60. This input shaft 1 has a lubrication supply source 3, such as a pump, where a portion of the power of the internal combustion engine 10 generates oil pressure to be the motor source for the meshing of the clutch, etc. There are also other methods, not using power from the internal combustion engine, for obtaining a constant oil pressure during travel using a small electric motor, in which case there is a benefit in that it is always possible to generate the oil pressure, even if the internal combustion engine 10 is stopped.

The intermediate shaft 4 is integrated with a carrier 51, which supports a planetary gear 53, in such a way that [said planetary gear 53] can rotate freely, in a planetary gear mechanism 50, where a sun gear 52, which meshes with [said] planetary gear 53, is affixed to the back end of a hollow rotating shaft. Furthermore, the front end of this hollow rotating shaft is connected to a rotating friction plate 72 in a second-mode switching clutch 70 which forms a multi-plate gear shift brake, while the stationary friction plate 71 of the clutch 70 is attached to the case. Therefore when the second mode switching clutch 70 is hydraulically engaged, the hollow rotating shaft 5 becomes fixed with respect to the case 73. The hollow rotating shaft 5 has a spline-engaged gear 23, and the rotating shaft 21 on the gear 22 which engages the gear 23 serves as the generator 20 shaft. The planetary gear mechanism 50 ring gear 54 is attached over the output shaft 2, and a gear 33 is spline-engaged on this output shaft 2, linked to an electric motor 30 via a gear 32 which engages thereto. At the same time, the electric motor 30 and the generator 20 are respectively electrically connected via the storage battery 40. In other words, wiring 43, 46 is connected on the exciter side, and controllers 41, 42 control the excitation current. Wiring 44, 45, meanwhile, hands off electrical power between the storage battery 40, the generator 20, and the electric motor 30.

We next explain the Fig. 2 embodiment. Those parts which are the same as Fig. 1 are referred to using the same reference numerals. (The same is true up to Fig. 6). Points which differ from Fig. 1 reflect the fact that the planetary gear mechanism has a double row configuration. In other words, the front-row planetary gear mechanism ring gear 154 is an integral piece with the carrier 155 which supports the rear-row planetary gear mechanism sun gear 157, and is further linked to an output shaft 102. The rear-row planetary gear mechanism 180 ring gear 158 is always affixed to a case 171, and the shaft of gear 132 which engages the gear 133, integral with the sun gear 157, is integrally linked to an electric motor 130.

We next explain the Fig. 3 embodiment. In the Fig. 1 embodiment, the solar gear 52 of the planetary gear mechanism which is linked to the generator 20 was linked to the second mode switching clutch 70, one end of which was affixed to the case; what is different in this embodiment is that the second mode switching clutch 270 is disposed between the planetary gear mechanism carrier 251 and the ring gear 254, which is to say between the intermediate shaft 204 and the output shaft 202. When the second mode switching clutch 270 is engaged, the intermediate shaft 204 and the output shaft 202 are made integral.

We next explain Fig. 4. In this embodiment, the intermediate shaft 304 is integrally linked with the carrier 354 which supports the planetary gear mechanism 350 planetary gear. The ring gear 353 is linked to the hollow rotating shaft 305; a gear 323 is spline-engaged thereto, and is further linked to the generator 320 via a gear 322. Also, the second mode switching clutch 370 is linked to the planetary gear mechanism 350 ring gear 353, and the sun gear 351 is linked to the output shaft 302.

We next explain the Fig. 5 embodiment. This embodiment differs from each of the previous ones in that the planetary gear mechanism 450 comprises a double planetary gear. The intermediate shaft 404 is linked to the ring gear 454, and the sun gear 451 is linked to the second mode switching clutch 470, while the carrier 455, which supports the double planetary gears 452, 453 is linked to the output shaft 402.

In the last embodiment, Fig. 6, a double planetary gear is used as in Fig. 5. The intermediate shaft 504 is linked to the ring gear 554, and the sun gear 551 is linked to the output shaft 502. The carrier 555 which supports the double planetary gears 552, 553 is linked to the second mode switching clutch 570 via the hollow shaft 505, and the generator 520 is linked to this hollow shaft 505 via the gears 523 and 522.

We have explained above the constitution of the gear transmission device of the present invention; next we shall explain the operation thereof in detail. There are many points of similarity in the operation of the various embodiments, so we shall primarily focus on the Fig. 1 embodiment, noting only the operations which differ from that of the other embodiments.

Again, please refer to Fig. 1. As previously discussed, it is possible with the present invention to adopt each of the M, M-E, and E modes. That is to say, it is possible by selectively supplying or removing hydraulic pressure from hydraulic supply source 3 through a control circuit (not shown) to the first mode switching clutch 60 [and] second mode switching clutch 70, and, by the engagement or release thereof, to adopt the M, M-E, or E modes according to the table shown below.

	M mode	M-E mode	E mode
First-mode switching clutch 60	X	O	O
Second-mode switching clutch 70	X	X	O

O: Engaged

X: Disengaged

As shown in the table above, the M mode occurs when the clutches 60 and 70 are both released. The internal combustion engine 10 is completely isolated from the output shaft 2, so the vehicle is driven by the drive force of the electric motor 30 only. There is also isolation between the internal combustion engine 10 and the generator 20, making it impossible to charge the storage battery 40 with the generator 20 in M mode. However, by stopping the output shaft 2 when halted and causing the clutch 60 to engage, the generator 20 can be driven by the motive force of the internal combustion engine 10 so as to charge the storage battery.

Running in M mode is accomplished by rpm control of the electric motor 30 using the controller 42. In other words, travel is brought about by increasing torque to the output shaft via the gears 32, 33.

Fig. 7 shows the relationship between the electric motor rpm and vehicle speed in the M mode. This relationship is linear, and the slope thereof is based on the gear ratio between gear 32 and gear 33. Vehicle speed can be increased by changing that gear ratio, but it is difficult in reality to push this above a certain level. A two-stage gear is therefore adopted so as to obtain a sufficiently large gear ratio, thus enabling high revolutions at low torque by the electric motor 30, as shown in the Fig. 2 embodiment. As described above, a pair of planetary gear mechanisms 180 is disposed in addition to the gears 132, 133 between the electric motor 130 and the output shaft 102. Moreover, the ring gear 158 is constantly affixed to the case, and the gear 133 and sun gear 156 are integral, so that assuming

i = (number of teeth in gear 133) / (number of teeth in gear 134)

and

p = (number of teeth in the sun gear 156) / (number of teeth in the ring gear 158),

the rotational torque To of the output shaft, relative to the rotational torque Tm of the electric motor 130 will be as follows:

$$T_O = i \times \frac{1+\rho}{\rho} T_M ,$$

and rotational torque can be increased by a power $(1+\rho)/\rho$ compared to the Fig. 1 embodiment. It is also possible to increase the electric motor rotational torque TM by changing the excitation current using the controller 142, and therefore TO is also controlled in accordance with TM.

In the M mode, the gear transmission devices in the embodiments of Figs. 3 through 6 operate in a similar way to that of the Fig. 1 embodiment.

Again, please refer to Fig. 1. In the M mode discussed thus far, both the first mode switching clutch 60 and the second mode switching clutch 70 were in a released state; next the internal combustion engine 10 is rotated and only the clutch 60 is engaged, leaving the clutch 70 in a released state. At this point, the internal combustion engine 10 and the output shaft 2 are linked via the planetary gear mechanism 50, and motive power is applied to the electric motor 30 output shaft 2, so in an overall sense motive power from the internal combustion engine and the electric motor is transferred in a hybrid manner. This state is the M-E mode; in this M-E mode a portion of the internal combustion engine 10 motive power is split off from the planetary gear mechanism 50 planetary gear 52 to drive the generator 20 via the gears 23, 22. In other words, the [motive force] is converted to electrical energy by the generator 20, controlled by the controller 41, and used to charge the storage battery. The electric motor 30 is driven using control of the excitation current from storage battery electrical energy using the controller 42. The internal combustion engine 10 output is held fixed by holding a fixed throttle opening on a carburetor, so that the rotational speed of the output shaft 2 can be varied by controlling only the electric motor 30 rotational speed.

In the M-E mode, the relationships between the ratio e of the internal combustion engine 10 rotational speed and the output shaft 2 rotational speed and each of the rotational speed ratios e_g, e_m of the internal combustion engine 10 with respect to the generator 20 and the electric motor 30 are shown in Fig. 8. Assuming that e* is the speed ratio at the point of transition to the M-E mode (called the "mode exchange point"), the rotational speed ratio e_g at that point for the generator 20 is shown by point B. The electric motor 30 speed ratio e_m is shown by point A. These speed ratios are ratios with respect to the internal combustion engine 10 rotational speed, and therefore by holding the internal combustion engine 10 rotational speed steady using the carburetor as described above, each speed ratio will correspond as is to the electric motor, the generator, and the output shaft rotational speeds.

By gradually increasing e from the above mode exchange point under the control of controllers 41, 42, a differential rotation between the ring gear 55 and the carrier 54 results in a gradual decrease in the rotational speed of the generator 20 linked to the sun gear 52 as the electric motor 30 rotational speed grows, as shown in Fig. 8. In other words, as e is increased, the proportion of motive force contributed by the internal combustion engine 10 in driving the gear transmission device increases, and the proportion of the electric motor 30 decreases. When e = Max (referred to as the maximum speed ratio), rotation of the generator 20 stops completely, while the electric motor 30 reaches maximum speed. However, it must be noted that while the rotational speed of the electric motor 30 is high, its drive force is virtually zero, and driving is done by the internal combustion engine 10 only. It must also be noted that the gear structure is arranged so that overdrive can be achieved between the input shaft 1 and the output shaft 2, as will be explained below.

At the point at which e = emax, the sun gear 52 on the planetary gear mechanism 50 stops, as explained above; it is here that hydraulic pressure is applied to the second mode switching clutch 70 and [the clutch] is caused to engage. The braking effect of the clutch 70 causes the generator 20 to stop operating completely, and the supply of electrical energy from the storage battery 40 to the electric motor 30 is interrupted; the electric motor 30 is simply freely rotating, so the output shaft is linked and driven in a purely mechanical way by the internal combustion engine 10. This is the E mode. At this point, as noted above, if we assume that

p = (number of teeth in the sun gear) / (number of teeth in the ring gear),

we have

gear ratio = 1/1+p,

and a 1+p overdrive is achieved as the rotational speed ratio.

The relationship between e and drive transmission efficiency is shown in Fig. 9. Up until the point e*, the first mode switching clutch 60 is not engaged, so motive force transmission efficiency increases with the increase in the generator 20 drive force. The reason the motive force transmission efficiency becomes discontinuous at the point e* of transition to the M-E mode is that the drive force to the generator 20 is diverted by the engagement of the clutch 60; thereafter the drive force diverted to the generator 20 rises along with the increase in e. At emax, rotation of the generator 20 stops altogether, and losses are purely mechanical; drive force efficiency is at a maximum. The above elements are similar in each of the embodiments of Figs. 4 through 6 to the Fig. 1 embodiment.

However, the Fig. 3 embodiment operates slightly differently from those, as we shall now explain. In the Fig. 3 embodiment, the second mode switching clutch 270 is not fixed to the case at one end, as explained above; it is [disposed] between the intermediate shaft 204 and the output shaft 202. The purpose of this clutch 270 is to make a purely mechanical link between the input shaft 201 and the output shaft 202. In other words, when the second mode switching clutch 270 is engaged, the planetary gear mechanism 250 forms an integral piece with the shaft 201 and rotates, so that the input-side drive force is directly connected to the output shaft. The E mode of the Fig. 3 embodiment is here obtained by simultaneously stopping the supply of electrical energy to the electric motor 230. In this case there is no brake effect on the clutch 270, and even if the clutch 270 is engaged, the generator 220 will keep rotating. To further increase vehicle speed, the second mode switching clutch 270 should be released and the electric motor 230 further rotated and placed in an overdrive state so that [rotation of the] generator 220 is further reduced by the differential rotation between the ring gear 254 and the carrier 251 in the planetary gear mechanism 250.

The motive force transmission efficiency of the Fig. 3 embodiment is shown in Fig. 9. The aspect of particular difference in this embodiment is that the point of singularity in motive force transmission efficiency occurs at the point e = 1.

Up until now we have explained the constitution and operating states of the gear transmission device of the present invention. We shall now explain the use and switching states of the M, M-E, and E modes in actual travel.

M mode is used during low speeds, in other words, from the time the vehicle starts until it has reached a certain speed. In addition, the internal combustion engine is completely stopped and there are no emissions of exhaust gasses. The vehicle's low speed is sufficient for in-city driving and is suited for continual use in areas where exhaust gas regulations are strict. By controlling the rotating direction of the electric motor, traveling in reverse is also possible.

M mode is for in-city driving; the internal combustion engine starts when the engine switches to M-E mode when driving in the suburbs. The power of the internal combustion engine 10 rotates the input shaft 1 and the pump 3 generates hydraulic pressure. The hydraulic pressure engages the first mode switch clutch. At that time, the rotation of the internal combustion engine immediately increases to the velocity configured in advance. When switching modes at the configured speed, the rotational velocity of the internal combustion engine is uniquely determined, therefore, the control system controls the increase to that point. The transition to M-E mode is continuous as the rotational velocity of the electric motor does not change. Once in M-E mode, a control system is necessary to ensure that the motor does not return to M mode until reaching the proper low speed.

In M-E mode, the controller 41 controls and operates the generator. However, it is necessary to select a generator with proper capabilities as a battery is used in M mode. In addition, the method of constantly maintaining the rotation of the internal combustion engine at a velocity that keeps exhaust gases to a minimum is extremely effective as a measure for environmental pollution control.

When switching from M-E to M mode, the hydraulic pressure from the first mode switch clutch is firstly discharged and released. The internal combustion engine is then stopped.

Switching from M-E to E mode, the second mode switch clutch should be engaged when the generator is sensed as stopped. E mode is suited for constant high speed driving, such as on highways. As the drive train efficiency of the gear drive is maximized, driving becomes economical

This invention is beneficial as the controller continuously changes the rotational velocity of the electric motor and makes completely variable speed driving possible.

4 Brief Explanation of Figures

Figure 1 is the schematic diagram of the gear drive mechanism displaying the first example of this invention. Figure 2 is the schematic diagram of the gear drive mechanism displaying the second example of this invention. Figure 3 is the schematic diagram of the gear drive mechanism displaying the third example of this invention. Figure 4 is the schematic diagram of the gear drive mechanism displaying the fourth example of this invention. Figure 5 is the schematic diagram of the gear drive mechanism displaying the fifth example of this invention. Figure 6 is the schematic diagram of the gear drive mechanism displaying the sixth example of this invention. Figure 7 describes the relationship between the electric motor's rotational velocity and the speed of the vehicle during M mode. Figure 8 is the correlation diagram between the revolution velocity ratio of the input/output shafts and the revolution velocity ratio e_m and e_f of the input shaft, electric motor, and generator. Figure 9 is the correlation diagram between the input/output revolution velocity ratio e and drive train efficiency, for the gear drive mechanisms of each example in Figures 1, 2, 4, 5, and 6. Figure 10 is the correlation diagram between the input/output revolution velocity ratio e and drive train efficiency, for the gear drive mechanism of the example in Figure 3.

1: Input Shaft; 2: Output Shaft; 3: Hydraulic Pump; 4: Intermediate Shaft; 5: Hollow Rotating Shaft; 10: Internal Combustion Engine; 20: Generator; 30: Electric Motor; 40: Battery; 41 and 42: Controller; 50: Planet Gear Mechanism; 60: First Mode Switch Clutch; 70: Second Mode Switch Clutch

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Figure 1
[see source for figure]

Generator

Electric Motor

Internal Combustion Engine

Battery

Figure 2
[see source for figure]

Generator

Electric Motor

Internal Combustion Engine

Battery

Figure 3
[see source for figure]

Generator

Electric Motor

Internal Combustion Engine

Battery

Figure 4

[see source for figure]

Electric Motor

Internal Combustion Engine

Generator

Battery

Figure 5

[see source for figure]

Electric Motor

Internal Combustion Engine

Generator

Battery

Figure 6

[see source for figure]

Electric Motor

Internal Combustion Engine

Generator

Battery

Figure 7

[see source for figure]

[vertical axis] Vehicle's Speed

[horizontal axis] Rotational Velocity of Electric Motor

Figure 8

[see source for figure]

[vertical axis] Rate of Velocity

Figure 9

[see source for figure]

[vertical axis] Drive Train Efficiency

Figure 10

[see source for figure]

[vertical axis] Drive Train Efficiency

[horizontal axis] Rate of Velocity

6. Listing of Appendices

(1) Copy of Application 1

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(4) Power of Attorney 1

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(54) Vehicle powerplant featuring thermal and electrical drive means

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Description

The present invention relates to a vehicle powerplant comprising thermal and electrical drive means variously connectable to the input shaft of the transmission as well as to a countershaft controlling accessory devices on the vehicle.

Vehicles of the aforementioned type are employed over mixed routes allowing of little or no emission, or over which normal emission is permitted. Over the first type, the vehicle is driven solely by the electrical drive means or in controlled manner by the thermal means, whereas, over the second, the thermal drive means are operated normally. Vehicles of this type invariably feature accessory devices (e.g. hydraulic power steering pump, brake and conditioner compressors, auxiliary alternators), and at times also special-purpose devices powered by the above drive means for performing special functions for which the vehicle is designed. Both the accessory and special-purpose devices frequently demand far greater power than that required for operating the vehicle under various driving conditions.

On one known powerplant of this type, the thermal drive means comprise a combustion engine connected mechanically to the transmission input shaft by a propeller shaft fitted with a clutch designed to assume a first and second position wherein the combustion engine is respectively connected to and disconnected from the transmission input shaft.

A countershaft for powering the vehicle accessory devices is connected by a system of gears to the propeller shaft, downstream from the clutch.

The electrical drive means normally consist of a unit designed to operate as both an electric motor and current generator. The rotor element of the unit is connected to the countershaft in such a manner as to be driven by it when the unit is operated as a current generator, and to drive it for rotating the transmission input shaft when the unit is operated as a motor.

Alternatively, the rotor element of the unit is connected directly to the propeller shaft to form a single drive line between the combustion engine and the transmission input shaft, in which case, the drive line is fitted with a second clutch downstream from the unit.

The powerplant also comprises a storage battery to which current is fed by the unit when operated as a generator, and from current is drawn when the unit is operated as a motor.

Powerplants of the type briefly described above provide for two operating modes. In a first, the combustion engine is operated and the clutch (or both clutches, in the case of the alternative configuration described above) is set to the first engaged position, so that both the transmission input shaft and the countershaft are driven by the combustion engine, while the rotor element of the unit, set to generator mode, is rotated by the countershaft for charging the batteries. In the second operating mode, the clutch is set to the second release position, and the unit alone is operated as an electric motor, the rotor element of which thus provides for powering both the transmission input shaft and the countershaft.

Powerplants of the aforementioned type present numerous drawbacks.

Firstly, in the second operating mode, i.e. when operated electrically, the accessory devices are driven solely by the power supplied by the battery, which, if of normal weight and size for the vehicle, provides for accumulating only a limited amount of energy.

Secondly, in the second operating mode, wherein the combustion engine is idle and disconnected from the drive line, current can only be generated for charging the battery when braking the vehicle, and if the unit is designed to operate as a brake, for recovering the energy produced during braking and converting it at least partially into electrical energy.

As a result, the operating range of the powerplant is fairly limited.

In FR-A-2415022 is described a vehicle powerplant comprising a combustion engine connected mechanically by a first clutch to a drive line transmitting the motion to the wheels of the vehicle and an electric motor connected to said drive line by a second clutch. Said electric motor is driven by the current supplied through an overhead connection to the public power supply. A powerplant of this type can be used only in the case in which an overhead connection is available and presents some of the drawbacks before exposed.

It is an object of the present invention to provide a powerplant of the aforementioned type designed to overcome the aforementioned drawbacks.

According to the present invention, there is provided a vehicle powerplant according to the features of claim 1, comprising first thermal drive means and second electrical drive means; said first and second means being activated for transmitting motion to the drive wheels of the vehicle via a transmission; said first drive means comprising a combustion engine connected mechanically to said wheels by a drive line fitted with said transmission and with a first clutch located between said engine and said transmission and which clutch may be set to a first and second position wherein said combustion engine is respectively connected to and disconnected from said transmission;

a current generator for supplying electric current to a storage battery, and the rotor element of which is connected to said drive line upstream from said first clutch;

said electrical drive means comprising an electric motor, the rotor element of which is connected by a first drive to said drive line downstream from said first clutch, said electric motor being driven by the current supplied by said battery,

a second clutch located between the rotor element of said electric motor and said drive line, and which may be set to a first and second position wherein said rotor element of said motor is respectively connected to and disconnected from said drive line;

a shaft connected to said drive line upstream from said first clutch by a second drive, and which provides for a power takeoff for operating the accessory devices of said vehicle in addition to the generator; the rotor element of said current generator being connected to said shaft;

said current generator being also arranged and installed to be operable as an electric motor; said second drive presenting a third clutch designed to assume a first position wherein said shaft connected to said rotor element of said current generator is also connected to said drive line, and a second position wherein said shaft is disconnected from said drive line; the arrangement being such that said accessory devices can be driven by said current generator when the current generator is disconnected from said drive line.

The design and operation of the powerplant according to the present invention will be described by way of example with reference to the accompanying drawings, in which:

Fig.1 shows a schematic view of a first configuration of the powerplant according to the present invention;

Fig.s 2 and 3 show a further two configurations of the Fig.1 powerplant.

The powerplant according to the present invention comprises a combustion engine 1, e.g. a diesel engine; and a transmission 2, the input shaft of which is connected mechanically to engine 1 by a propeller shaft 3 fitted with a clutch, e.g. a friction clutch, 4. Clutch 4, which is operable in any manner, e.g. directly by the driver and/or by means of any type of actuator, is designed to assume two positions: an engaged position (Fig.1) wherein the up- and downstream portions of shaft 3 are connected; and a release position (Fig.s 2 and 3) wherein said portions are disconnected.

As shown clearly in the accompanying drawings, the powerplant also comprises a countershaft 5 connected mechanically to shaft 3, upstream from clutch 4, by a drive consisting, for example, of gears 6.

A current generator 7 supplies electric current to a storage battery 8, and presents a rotor element (not shown) connected to and rotated by countershaft 5.

Countershaft 5 or another shaft upstream from clutch 4 also provides for a power takeoff 9 for operating the accessory devices on the vehicle. These, in addition to standard industrial vehicle devices, such as the power steering pump, brake and conditioner compressors and auxiliary alternators, may also consist of special-purpose devices, such as compactors, in the case of refuse collection and disposal vehicles.

The powerplant according to the present invention also comprises an electric motor 10 powered by the current supplied by battery 8, and the rotor element (not shown) of which is connected to propeller shaft 3, downstream from clutch 4, by a second drive consisting, for example, of gears 11. A second clutch 12, which may be the same type as clutch 4, is located between the rotor element of motor 10 and drive 11, and is designed to assume a first engaged position (Fig.3) wherein the rotor element of motor 10 is connected to drive 11, and a second release position (Fig.s 1 and 2) wherein the rotor element and drive 11 are disconnected.

For the reasons explained later on, current generator 7 may conveniently be designed to also operate as an electric motor powered by battery 8, in which case, drive 6 is provided with a clutch 5a of any type, designed to assume a first and second position wherein shaft 5 of generator-motor 7 is respectively connected to and disconnected from drive line 3 immediately downstream from engine 1. Clutch 5a may conveniently be housed in one of the gears of drive 6, as shown schematically in the accompanying drawings.

The powerplant may also comprise a further drive 2a forming part of and possibly comprising pairs of gears housed inside transmission 2, for transmitting motion from drive line 3 to shaft 5 connected to power takeoff 9. Drive 2a is activated exclusively, in known manner, with the gear lever in neutral, so that no motion is transmitted to the wheels of the vehicle.

According to a variation not shown, drive 11 may be driven from a point on drive line 3 downstream from transmission 2, as opposed to upstream as shown in the accompanying drawings, for reducing the size, particularly lengthwise, of the powerplant and so enabling troublefree installation on certain types of vehicle.

The powerplant according to the present invention operates as follows.

In a first operating mode (Fig.1), combustion engine 1 is operated with clutch 4 in the first (engaged) position and clutch 12 in the second (release) position, so that the vehicle is driven by engine 1 connected by shaft 3 to the input shaft of transmission 2. In this mode, clutch 4 is operated normally for shifting transmission 2.

At the same time, drive 6 rotates countershaft 5, which in turn rotates the rotor element of current generator 7 for charging battery 8, and operates the accessory devices on the vehicle connected to power takeoff 9.

This first operating mode therefore provides, thermally, for running the vehicle normally, operating the accessory devices, and charging the battery, and may conveniently be employed over routes involving no particular control of emission.

In a second operating mode, combustion engine 1 is again operated, but with clutch 4 in the second (release) position (Fig.2), so that only countershaft 5 and consequently generator 7 and the auxiliary devices are operated thermally. In this mode, means for controlling the speed and fuel supply of engine 1 may be provided for minimizing emission, thus enabling temporary stoppage of the vehicle for operating the accessory devices and/or charging battery 8.

In a third operating mode (Fig.3), combustion engine 1 is again operated, but with clutch 4 in the second (release) position, clutch 12 in the first (engaged) position, and electric motor 10 activated, so that shaft 3 is disconnected from engine 1 and drive 6, the input shaft of transmission 2 is powered by motor 10 via drive 11, and the vehicle is driven entirely electrically by the power drawn from battery 8. If combustion engine 1 is activated, current generator 7 is also operated simultaneously for charging battery 8, which thus acts as a flywheel for the power supplied by engine 1 and drawn off by electric motor 10.

In this third mode, operation of engine 1 is so controlled as to maintain substantially constant engine speed and output combined with a high degree of efficiency and minimum emission for driving along controlled-emission routes.

An important point to note is that, in all three configurations described, the accessory devices are operated thermally, that is, under high power conditions, with no limitation in terms of autonomy.

Nevertheless, when drive 11 is driven from a point along line 3 upstream from transmission 2, if the power required in said third mode for operating the accessory devices is not such as to limit autonomy, and/or peak power is demanded of takeoff 9 in excess of the average designed for effectively controlling combustion engine 1 (for achieving high efficiency and minimum emission), power takeoff 9 (and, hence, shaft 5) may be controlled by drive 2a transmitting motion from transmission 2 to shaft 5 and so electrically controlling power takeoff 9.

When absolutely no emission is permitted, a fourth operating mode may be employed, which consists in de-activating engine 1 and operating the powerplant as described with reference to Fig.3, in which case, the vehicle is operated entirely electrically by battery 8.

In fourth mode (with engine 1 de-activated), power takeoff 9 may still be controlled electrically, as required for at least operating the accessory devices governing the driveability of the vehicle, such as the power steering pump and brake system devices.

For this purpose, clutch 5a is released and generator 7 set to motor mode and supplied by battery 8 for electrically powering takeoff 9.

When electrically operating the vehicle (third and fourth mode), transmission 2 can only be operated normally by means of clutch 12 if drive 11 is located upstream from the transmission. Moreover, if also designed to function as a current generator, electric motor 10 may provide for electrically braking the vehicle and at least partially recovering and converting the energy produced when braking into electrical energy, which is stored in battery 8.

To those skilled in the art it will be clear that changes may be made to the powerplant as described and illustrated herein without, however, departing from the scope of the present invention.

The above further embodiment of the powerplant obviously operates in exactly the same way as described with reference to the accompanying drawings.

Claims

1. A vehicle powerplant comprising:
   - first thermal drive means and second electrical drive means; said first and second means being activated for transmitting motion to the drive wheels of the vehicle via a transmission (2); said first drive means comprising a combustion engine (1) connected mechanically to said wheels by a drive line (3) fitted with said transmission (2) and with a first clutch (4) located between said engine (1) and said transmission (2) and which clutch may be set to a first and second position wherein said combustion engine (1) is respectively connected to and disconnected from said transmission (2);
   - a current generator (7) for supplying electric current to a storage battery (8),

   said electrical drive means comprising an electric motor (10), the rotor element of which is connected by a first drive (11) to said drive line (3) downstream from said first clutch (4),
   - a second clutch (12) located between the rotor element of said electric motor (10) and said drive line (3), and which may be set to a first and second position wherein

said rotor element of said motor (10) is respectively connected to and disconnected from said drive line (3); characterized in that

the rotor element of said current generator is connected to said drive line (3) upstream from said first clutch (4); said electric motor (10) is driven by the current supplied by said battery (8); and

a shaft (5) connected to said drive line (3) upstream from said first clutch (4) by a second drive (6), and which provides for a power takeoff (9) for operating the accessory devices of said vehicle in addition to the generator; the rotor element of said current generator (7) being connected to said shaft (5);

said current generator (7) being also arranged and installed to be operable as an electric motor; said second drive (6) presenting a third clutch (5a) designed to assume a first position wherein said shaft (5) connected to said rotor element of said current generator (7) is also connected to said drive line (3), and a second position wherein said shaft (5) is disconnected from said drive line (3); the arrangement being such that said accessory devices can be driven by said current generator when the current generator is disconnected from said drive line.

2. A powerplant as claimed in one of the foregoing Claims, characterized by the fact that said first (11) and second (6) drives are gear drives.

3. A powerplant as claimed in one of the foregoing Claims, characterized by the fact that said first drive (11) is connected to said drive line (3) upstream from said transmission (2).

4. A powerplant as claimed in one of the foregoing Claims from 1 to 3, characterized by the fact that said first drive (11) is connected to said drive line (3) downstream from said transmission (2).

5. A powerplant as claimed in one of the foregoing Claims, characterized by the fact that said second clutch (12) is located between said rotor element of said electric motor (10) and said first gear drive (11).

6. A powerplant as claimed in one of the foregoing Claims, characterized by the fact that it comprises a third drive (2a) for connecting said transmission (2) to said shaft (5) providing for said power takeoff (9).

7. A powerplant as claimed in one of the foregoing Claims, characterized by the fact that said electric motor (10) is also designed to operate as a current generator, for electrically braking said vehicle and generating electric current which is supplied to said battery (8).

Patentansprüche

1. Fahrzeugantrieb der folgendes aufweist:
   - eine erste thermische Antriebseinrichtung und eine zweite elektrische Antriebseinrichtung; wobei die erste und die zweite Einrichtung zum Übertragen von Bewegung zu den Antriebsrädern des Fahrzeuges über ein Getriebe (2) aktiviert werden; wobei die erste Einrichtung einen Verbrennungsmotor (1) aufweist, der mechanisch mit den Rädern durch eine Transmission (3) verbunden ist, die mit dem Getriebe (2) und mit einer ersten Kupplung (4) eingerichtet ist, die zwischen dem Motor (1) und dem Getriebe (2) angeordnet ist, und wobei die Kupplung in eine erste und eine zweite Stellung gebracht werden kann, in welcher der Verbrennungsmotor (1) jeweils mit dem Getriebe (2) verbunden und von diesem getrennt wird;
   - einen Stromgenerator (7) zur elektrischen Stromversorgung einer Speicherbatterie (8), wobei die elektrische Antriebseinrichtung einen Elektromotor (10) aufweist, dessen Rotorelement durch einen ersten Antrieb (11) mit der Transmission (3) stromabwärts von der ersten Kupplung (4) verbunden ist, und
   - eine zweite Kupplung (12), die zwischen dem Rotorelement des Elektromotors (10) und der Transmission (3) angeordnet ist und welche in eine erste und eine zweite Stellung gebracht werden kann, wobei das Rotorelement des Motors (10) jeweils mit der Transmission (3) verbunden oder von dieser getrennt wird;

   dadurch **gekennzeichnet**, daß
   - das Rotorelemet des Stromgenerators mit der Transmission (3) stromaufwärts von der ersten Kupplung (4) verbunden ist;
   - der Elektromotor (10) von dem von der Batterie (8) zur Verfügung gestellten Strom angetrieben wird;
   - eine Welle (5), die mit der Transmission (3) stromaufwärts von der ersten Kupplung (4) durch einen zweiten Antrieb (6) verbunden ist, und die für einen Antrieb (9) zum Betreiben der

Nebeneinrichtung des Fahrzeuges zusätzlich zum Generator vorgesehen ist; wobei das Rotorelement des Stromgenerators (7) mit der Welle (5) verbunden ist; wobei der Stromgenerator (7) auch als ein Elektromotor betreibbar angeordnet und installiert ist; wobei der zweite Antrieb (6) eine dritte Kupplung (5a) aufweist, die so konstruiert ist, eine erste Position einzunehmen, bei der die Welle (5), die mit dem Rotorelement des Stromgenerators (7) verbunden ist, auch mit der Transmission (3) verbunden ist und eine zweite Stellung, bei der die Welle (5) von der Transmission (3) entkoppelt ist; wobei die Anordnung derart ist, daß die Nebeneinrichtungen von dem Stromgenerator angetrieben werden können, wenn der Stromgenerator von der Transmission entkoppelt ist.

2. Antrieb nach einem der vorhergehenden Ansprüche gekennzeichnet durch die Tatsache, daß die Erst-(11) und Zweit(12) -antriebe Getriebe-Antriebe sind.

3. Triebwerk nach einem der vorhergehenden Ansprüche, gekennzeichnet durch die Tatsache, daß der erste Antrieb (11) mit der Transmission (3) stromaufwärts von dem Getriebe (2) verbunden ist.

4. Triebwerk nach einem der vorhergehenden Ansprüche 1-3, gekennzeichnet durch die Tatsache, daß der erste Antrieb (11) mit der Transmission (3) stromabwärts von dem Getriebe (2) verbunden ist.

5. Triebwerk nach einem der vorangehenden Ansprüche gekennzeichnet durch die Tatsache, daß die zweite Kupplung (12) zwischen dem Rotorelement des Elektromotors (10) und dem ersten Getriebeantrieb (11) angeordnet ist.

6. Triebwerk nach einem der vorhergehenden Ansprüche gekennzeichnet durch die Tatsache, daß es einen dritten Antrieb (2a) zur Verbindung des Getriebes (2) mit der Welle (5), die den Antrieb (9) bereitstellt, umfaßt.

7. Triebwerk nach einem der vorhergehenden Ansprüche gekennzeichnet durch die Tatsache, daß der Elektromotor (10) auch so ausgelegt ist, daß er als ein Stromgenerator zum elektrischen Bremsen des Fahrzeuges und zum Erzeugen elektrischen Stromes, welcher der Batterie (8) zur Verfügung gestellt wird, arbeitet.

Revendications

1. Système de propulsion pour véhicule comprenant:
   - des premiers moyens thermiques d'entraînement et des deuxièmes moyens d'entraînement électriques; ces premiers et seconds moyens étant actionnés pour transmettre un mouvement aux roues motrices du véhicule par l'intermédiaire d'une boîte de vitesses (2); les premiers moyens d'entraînement comprenant un moteur à combustion (1) relié mécaniquement à ces roues par une ligne de transmission (3) équipée de ladite boîte de vitesses (2) et d'un premier embrayage (4) placé entre le moteur (1) et la boîte de vitesses (2), lequel embrayage peut être mis dans une première ou une seconde position dans laquelle le moteur à combustion (1) est respectivement relié à la boîte de vitesses (2) ou débrayé de celle-ci ;
   - une génératrice de courant (7) pour fournir du courant électrique à une batterie d'accumulateurs (8),

   les moyens électriques d'entraînement comprenant un moteur électrique (10), dont le rotor est connecté par une première boîte de transmission (11) à la ligne de transmision (3) en aval du premier embrayage (4) et
   - un second embrayage (12) placé entre le rotor du moteur électrique (10) et la ligne de transmission (3) et qui peut être mis dans une première et une seconde position dans lesquelles le rotor du moteur (10) est respectivement relié à la ligne de transmission (3) ou débrayé de celle-ci ;

   système de propulsion de véhicule caractérisé en ce que le rotor de la génératrice de courant est relié à la ligne de transmission (3) en amont du premier embrayage (4); le moteur électrique (10) est entraîné par le courant fourni par la batterie (8) et l'on prévoit un arbre (5) relié à la ligne de transmission (3) en amont du premier embrayage (4) par une seconde boîte de transmission (6) et qui comprend une prise de force (9) pour faire fonctionner les appareils accessoires du véhicule en plus de la génératrice; le rotor de la génératrice de courant (7) étant relié à l'arbre (5); la génératrice de courant (7) étant également agencée et installée de manière à pouvoir fonctionner en moteur électrique; la seconde boîte de transmission (6) présentant un troisième embrayage (5a) conçu pour prendre une première position dans laquelle l'arbre (5), relié au rotor de la génératrice de courant (7), est également relié à la ligne de transmision (3) et une seconde position dans laquelle l'arbre (5) est débrayé de la ligne de transmission (3); la disposition étant telle que les appareils accessoires puissent être entraînés par la génératrice de courant quand elle est débrayée de la ligne de transmission.

2. Système de propulsion tel que revendiqué dans la revendication 1, caractérisé par le fait que la première boîte de transmission (11) et la seconde boîte de transmission (6) sont des boîtes à engrenages.

3. Système de propulsion selon l'une des revendications précédentes, caractérisé par le fait que la première boîte de transmission (11) est reliée à la ligne de transmission (3) en amont de la boîte de vitesses (2)

4. Système de propulsion selon l'une des revendications précédentes, caractérisé par le fait que la première boîte de transmission (11) est reliée à la ligne de transmission (3) en aval de la boîte de vitesses (2)

5. Système de propulsion selon l'une des revendications précédentes, caractérisé par le fait que le second embrayage (12) est placé entre le rotor du moteur électrique (10) et la première boîte de transmission à engrenages (11).

6. Système de propulsion selon l'une des revendications précédentes, caractérisé par le fait qu'il comprend une troisième boîte de transmission (2a) servant à relier la boîte de vitesses (2) à l'arbre (5) prévu pour actionner la prise de force (9).

7. Système de propulsion selon l'une des revendications précédentes, caractérisé par le fait que le moteur électrique (10) est également conçu pour fonctionner en génératrice de courant, pour freiner électriquement le véhicule et produire du courant électrique qui est fourni à la batterie (8).

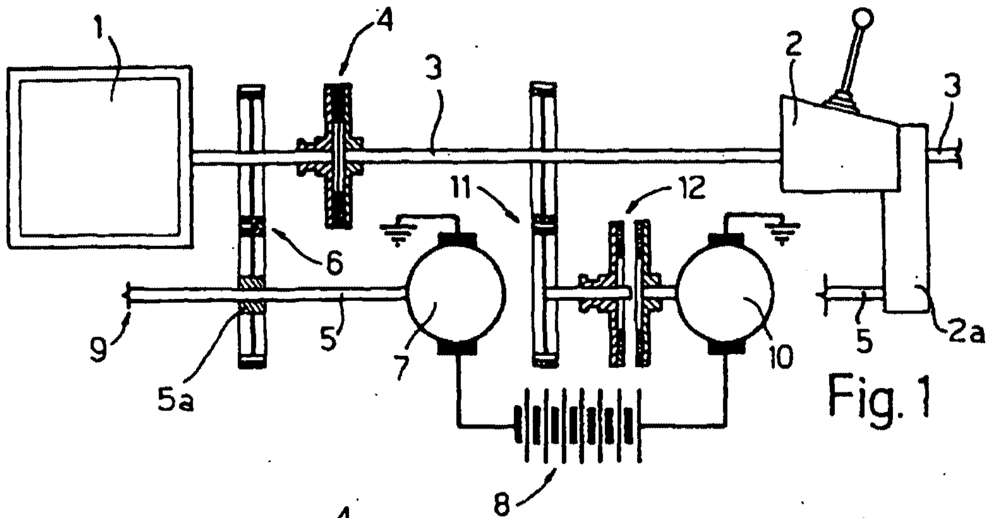

Fig. 1

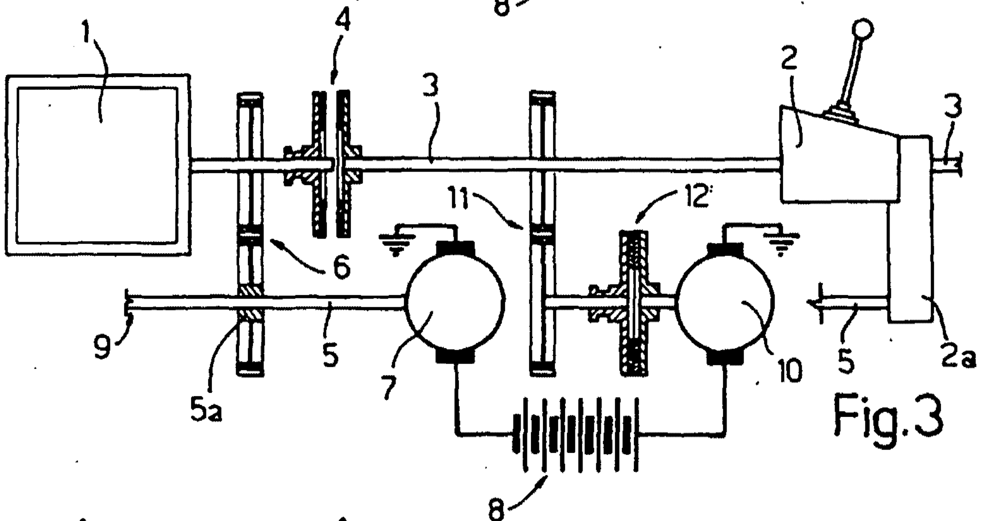

Fig.3

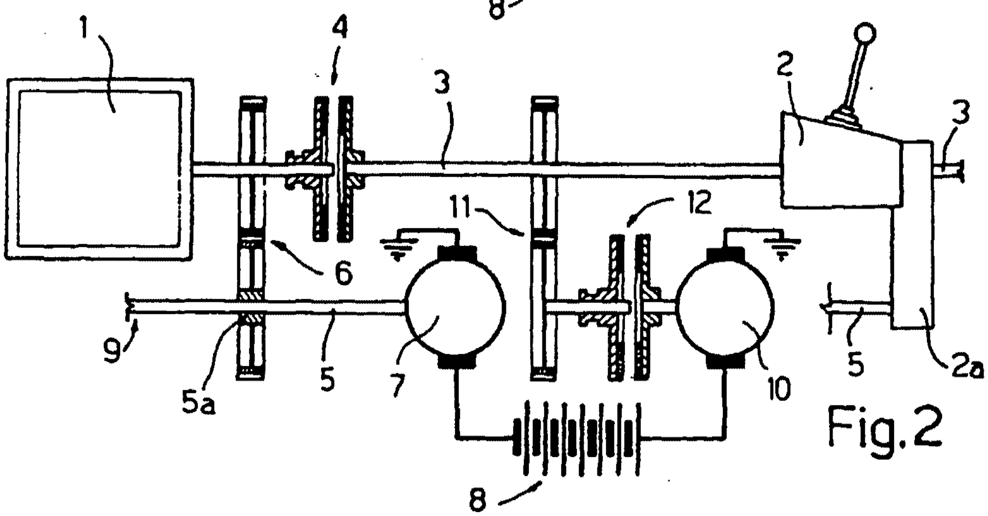

Fig.2

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(54)【発明の名称】　シリーズ、パラレル複合ハイブリッドカーシステム

(57)【要約】
【目的】回生制動時のモータの高回転側の回生制動トルク不足を解消し、低速回転から高速回転までほぼ一定の回生制動トルクを得ることができるシリーズ、パラレル複合ハイブリッドカーシステムを提供する。
【構成】エンジン１、発電機３、走行用のモータ９、バッテリ１７を備え、かつ、エンジン１とモータ９との間に無段変速機５を設けるとともに、モータ９の高回転側の回生制動トルク不足分をエンジン１のフリクショントルクと発電機３の回生制動トルクとの合成トルクで補うように前記無段変速機５を制御する制御手段１８を備えた。

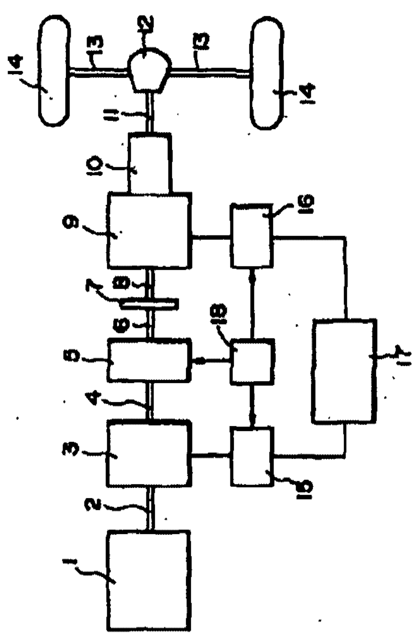


図１

【特許請求の範囲】

【請求項1】エンジンと、このエンジンにより駆動される発電機と、走行用のモータと、前記発電機とモータとの間で電力の授受を行うバッテリと、前記エンジンとモータとの間に設けられたクラッチと、前記エンジン、発電機、クラッチ及びモータとの間で互いにトルク伝達を行うトルク伝達手段と、前記モータの回転トルクを車輪に伝達するトルク伝達手段とを備えたシリーズ、パラレル複合ハイブリッドカーシステムにおいて、前記エンジンとモータとの間に無段変速機を設け、かつ、前記モータの高回転側の回生制動トルク不足分をエンジンのフリクショントルクと発電機の回生制動トルクとの合成トルクで補うように前記無段変速機を制御する制御手段を備えたことを特徴とするシリーズ、パラレル複合ハイブリッドカーシステム。

【発明の詳細な説明】

【0001】

【産業上の利用分野】この発明は、エンジンとモータにより駆動されるシリーズ、パラレル複合ハイブリッドカーシステム、特にモータの高回転側のトルク不足をエンジンのトルクで補うことができるシリーズ、パラレル複合ハイブリッドカーシステムに関するものである。

【0002】

【従来の技術】近年、省資源、大気汚染や騒音の防止に対する要求が社会的に益々高まりつつある。このような要求に応えるものとして、エンジンと、このエンジンにより駆動される発電機とともに、走行用のモータ及びこのモータに電力を供給するバッテリなどを備えたハイブリッドカーシステム、すなわち複合電気自動車が注目されている。このようなハイブリッドカーシステムとして、従来、実開昭51－103220号、実開平2－77702号、及び実開昭53－55105号公報などに開示された構成の装置が開発されている。上記各公報には、いずれも、走行用のモータとエンジンとがクラッチを介して回転軸で連結された電気自動車の構成が記載されている。

【0003】すなわち、実開昭51－103220号公報の第1図には、モータとエンジンとが回転軸とクラッチを介して連結され、かつ、増速機構を介してエンジンにより駆動される発電機と、この発電機により充電されるとともに、前記モータに電力を供給してこれを駆動する蓄電池を備えた構造の複合電気自動車が記載されている。この装置はクラッチを備えているので、クラッチを切り離したときにはシリーズ走行モード、すなわち、エンジンで駆動される発電機で発電した電力を一旦蓄電池に蓄え、この蓄電池から供給される電力により走行用のモータを回転させる走行モードをとることになる。また、クラッチを接続したときにはパラレル走行モード、すなわち車両をエンジンとモータの両方で駆動し、しかも発電機による発電作用も行う走行モードをとることができるものである。

【0004】

【発明が解決しようとする課題】従来の課題

上記従来の装置においては，以上のように、クラッチの切り替えによりパラレル走行とシリーズ走行の切り替えが随時可能な構成になっているが、エンジンとモータの結合状態を負荷に応じて変化させ、モータのトルクに応じてエンジンのトルクを制御してエンジンの負荷領域を一定にするような装置は装着されていなかった。

【0005】確かに、パラレル走行モードでは、エンジンの出力とモータの出力とを同時に使用可能であり、加速時や登坂時などのように大きなトルクを必要とする場合に有利であるが、一般に回転数（回転速度）に対するエンジンとモータの最大効率点は等しくなく、モータが比較的高い回転数で高い効率を示すのに対し、エンジンは比較的低い回転数で高い効率が得られる。従って、モータとエンジンとを固定ギア比で連結した場合、エンジンの負荷領域がかならずしも最良な状態にならず、燃費向上の点で好ましくない。

【0006】また、シリーズ走行モードでは、エンジンを発電のためだけに用いるので、エンジンの負荷領域を燃費の良い領域に設定できる反面、車両の駆動用として走行用のモータの出力だけしか使えないので、加速性能が悪くなるという問題点があった。

【0007】更に、モータが、比較的高速回転をしている状態で制動をかける場合、図3（a）に示すように、走行用のモータによる回生制動トルクaが高回転側で大きく低下するので、理想トルク線bに対して図で斜線を施したトルク不足分cだけトルク不足を生じ、ブレーキの効きが悪くなるという問題点があった。従って、上記問題点を解消しなければならないという課題がある。

【0008】発明の目的

この発明は、上記課題を解決するためになされたもので、回生制動時のモータの高回転側の回生制動トルク不足を解消し、低速回転から高速回転までほぼ一定の回生制動トルクを得ることができるシリーズ、パラレル複合ハイブリッドカーシステムを提供することを目的とする。

【0009】

【課題を解決するための手段】本発明に係るシリーズ、パラレル複合ハイブリッドカーシステムは、エンジンと、このエンジンにより駆動される発電機と、走行用のモータと、前記発電機とモータとの間で電力の授受を行うバッテリと、前記エンジンとモータとの間に設けられたクラッチと、前記エンジン、発電機、クラッチ及びモータとの間で互いにトルク伝達を行うトルク伝達手段と、前記モータの回転トルクを車輪に伝達するトルク伝達手段とを備えている。また、前記エンジンとモータとの間に無段変速機を設け、かつ、前記モータの高回転側の回生制動トルク不足分をエンジンのフリクショントル

クと発電機の回生制動トルクとの合成トルクで補うように前記無段変速機を制御する制御手段を備えたものである。

【0010】

【作用】次に、本発明の作用を説明する。本発明によるシリーズ、パラレル複合ハイブリッドカーシステムは、まず、エンジンにより駆動される発電機により発電し、得られた電力を一時バッテリに蓄え、次いで、このバッテリに蓄えられた電力を走行用のモータに給電、駆動し、車両を走行させる。バッテリは、前記発電機とモータとの間で電力の授受を行う。前記エンジンとモータとの間に設けられたクラッチを接続すると、前記エンジン、発電機、クラッチ及びモータとの間で互いにトルク伝達が行われ、更に、前記モータの回転トルクを車輪に伝達することにより、エンジンとモータの両方の駆動トルクにより車両が駆動される。また、前記エンジンとモータとの間には無段変速機が設けられており、かつ、この無段変速機を、前記モータの高回転側の回生制動トルク不足分をエンジンのフリクショントルクと発電機の回生制動トルクとの合成トルクで補うように制御手段により制御し、回生制動トルクを一定にすることにより、回生制動時のモータの高回転側の回生制動トルク不足を解消することができる。

【0011】

【実施例】以下、この発明の一実施例を図面に基づいて説明する。図1は、この発明によるシリーズ、パラレル複合ハイブリッドカーシステムの一実施例の基本概念を示す構成図である。

【0012】同図において、1はエンジンであり、出力軸2を介して発電機3に連結され、さらに出力軸4、6、8などからなるトルク伝達手段を介して無段変速機（CVT）5、クラッチ7、走行用のモータ9が順次連結され、互いにトルク伝達されるように形成されている。また、モータ9の回転トルクは、変速機10、出力軸11、差動歯車装置12、アクセル軸13からなるトルク伝達手段を介して車輪14に伝えられる。

【0013】無段変速機5は、出力軸4と6の回転数の比を後述する制御手段により適宜連続的に変えることを可能にするCVT（Continuous Variable Transmission）である。また、出力軸6、8の間に設けられたクラッチ7は、出力軸6と8との間を接続したり、切り離したりする働きをするものである。更に、モータ9は、出力軸8と11との間に変速機10と共に組み込まれ、走行用の電動装置として車輪14を駆動する。

【0014】発電機3は、電力変換器15を介してバッテリ17に接続されて、エンジン1の回転エネルギや車輪14からトルク伝達手段を介して伝達される制動エネルギを電気エネルギに変換し、バッテリ17に貯蔵する。モータ9は、走行時、電力変換器16を介してバッテリ17から電力の供給を受けると共に、回生制動時、電力変換器16を介してバッテリ17に制動エネルギを回生する。18は無段変速機5と電力変換器15、16を制御する電子制御装置（ECU）である。

【0015】図2に示すように、エンジン1とモータ9とは効率最良領域が異なっており、パラレル走行をする場合にエンジン1とモータ9とを直結、または固定ギア比で結合していたのでは、必ずしもエンジン1をその燃費最良領域で動作させることができない。そこで、この発明では、エンジン1の負荷領域が燃費最良領域をとるように電子制御装置18で無段変速機5の変速比を最適に制御し、エンジン1を動力源として走行する場合にも常に最良の燃費で走行が可能な構成となっている。

【0016】つまり、図2（b）の動作点Aでモータ9が駆動されているときに、登坂や急加速などのためにパワーが必要になったとき、従来技術では図2（a）の動作点Aでそのままエンジン1を駆動することになり、燃料効率が悪くならざるを得なかった。しかし、この発明による上記実施例によれば、無段変速機5のギア比を電子制御装置18によって適正に制御することにより、エンジン1の動作点を図2（a）の点Bにずらすことが可能となり、最良の燃料効率が得られる。

【0017】従って、上記装置を使用する場合、通常はモータ9のみで走行するシリーズ走行モードをとり、また、比較的エンジン1の効率がよい定常走行時や、モータ9だけではパワーが不足する加速時及び登坂時にはクラッチ7を係合してパラレル走行モードとし、かつ、無段変速機5の変速比を適正に制御することにより、駆動力をエンジン1から効率的に供給することになる。

【0018】一方、回生制動時のモータ9のトルク特性は図3（a）の実線部aのようになるのに対し、制動力としての理想的な要求トルク特性は回転数にかかわらず破線部bのようになるから、結局、モータ9の高速回転側で図で斜線を施したトルク不足分cだけ制動力不足となる。そこで上記実施例では、図3（b）に示すエンジン1のフリクショントルクdと発電機3の回生トルクeとの合成トルクfを高回転側で大きなトルクが得られるように無段変速機5の変速比を電子制御装置18によって最適に制御し、前記モータ9の高回転側での制動力不足を補うことができる。

【0019】次に、電子制御装置18による無段変速機5の制御動作について図4、図5を参照して説明する。

【0020】まず、ステップ101でアクセル信号がOFFになると、ステップ102で、現在の車速に対応するモータ9の回転速度が定格回転速度Vnより大きいか否かを判断し、もしYESの場合、直ちにステップ103に進みクラッチ7をONする。続くステップ104では、ステップ103におけるクラッチON動作より時間的にやや遅れて無段変速機5のギヤ比を設定した後、ステップ105でブレーキ信号をONし、制動トルクを発

生させる（ステップ１０６）。一方、ステップ１０２でモータ９の回転速度が定格回転速度Ｖｎより小さい場合は直ちにステップ１０５にジャンプしてブレーキ信号をＯＮし、制動トルクを発生させる。

【００２１】他方、アクセル信号がＯＮになると、順次、クラッチ７、ブレーキ信号がＯＦＦとなり、モータ９の制動トルクの発生も停止される。

【００２２】以上説明したように、上記実施例は、回生制動時のモータの高回転側の回生制動トルク不足を解消し、低速回転から高速回転までほぼ一定の回生制動トルクを得ることができる。

【００２３】また，パラレル走行の場合には、エンジン１とモータ９の両方を効率最良領域で動作させることができるとともに、低速及び定常走行時にクラッチ７を切ってシリーズ走行をすることにより、回生制動時のエネルギ回収量をエンジンのフリクションの分だけ多くすることが可能である。

【００２４】更に、加速時以外は常にバッテリを充電する状態にしておくことが可能なので、深い放電が少なくなり、バッテリの寿命を向上させることができる。

【００２５】以上この発明の実施例について説明したが、この発明は上記実施例に何等限定されるものではなく、例えば、発電機３をエンジン１及びモータ９と同一軸上に設置せず、適当な増速歯車装置を介して出力軸２に対し並列的に配置するなど、この発明の要旨を逸脱しない範囲内において種々の態様で実施し得ることは勿論である。

【００２６】

【発明の効果】以上説明したように、本発明によるシリーズ、パラレル複合ハイブリッドカーシステムは、エンジンとモータとの間に無段変速機を設け、かつ、モータの高回転側の回生制動トルク不足分をエンジンのフリクションパトルクと発電機の回生制動トルクとの合成トルクで補うように前記無段変速機を制御する制御手段を備えた構成により、回生制動時のモータの高回転側の回生制動トルク不足を解消し、低速回転から高速回転までほぼ一定の回生制動トルクを得ることができる効果を有する。

【図面の簡単な説明】

【図１】この発明のシリーズ、パラレル複合ハイブリッドカーシステムの一実施例の基本概念を示す構成図である。

【図２】（ａ）はエンジンの回転数とトルク及び等燃費率との関係を示す特性図、（ｂ）はモータの回転数とトルク及び効率との関係を示す特性図である。

【図３】（ａ）はモータの回転数と回生制動トルクとの関係を示す線図、（ｂ）はエンジンの回転数とフリクショントルク、発電機の回生トルク、及びそれらの合成トルクとの関係を示す線図である。

【図４】この発明によるシステムの動作を示すフローチャートである。

【図５】この発明によるシステムの動作タイミングを示すタイムチャートである。

【符号の説明】

１　エンジン
２，４，６，８，１１　出力軸
３　発電機
５　無段変速機（ＣＶＴ）
７　クラッチ
９　モータ
１０　変速機
１４　車輪
１５，１６　電力変換器
１７　バッテリ
１８　電子制御装置（ＥＣＵ）

【図５】

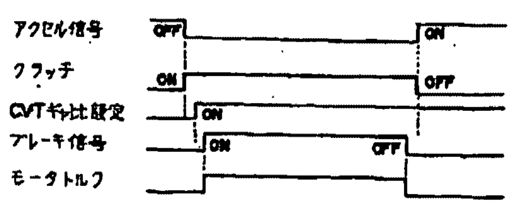


図５

【図1】

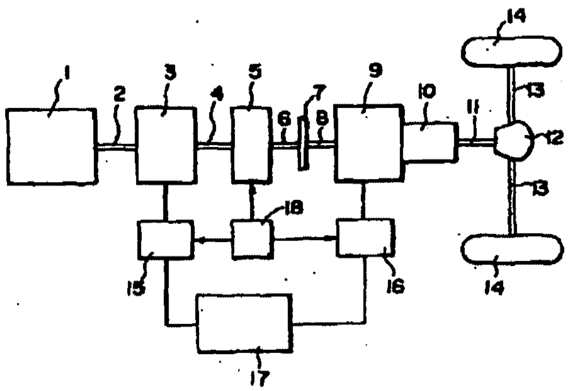
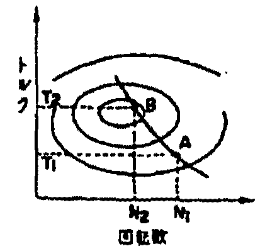
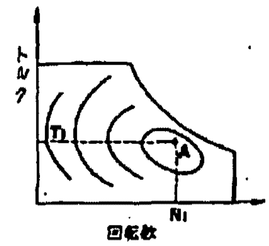


図1

【図2】



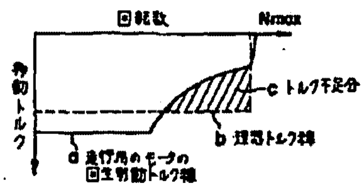
(a) エンジン



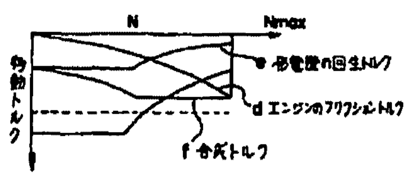
(b) モータ

図2

【図3】



(a)



(b)

図3

【図4】

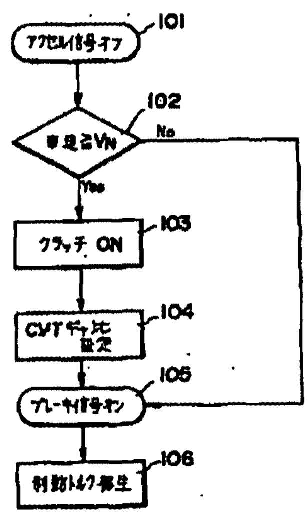


図4 フローチャート

フロントページの続き

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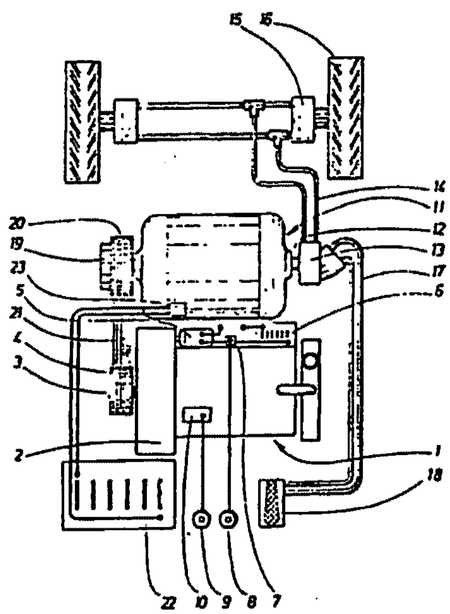

(57) Abstract

Propulsion arrangement for vehicles comprising a first machine (1) arranged as propulsion engine driven by combustion of a propellant and a second machine (11) arranged as alternative propulsion motor driven by means of electricity from a battery (22). The battery is arranged so as to be charged with current generated by the work of the first machine. The propulsion arrangement is designed to work alternatively in a first operational state with the first machine as drive source for vehicle operation and for generation of current for charging the battery and a second operational state in which the second machine functions as drive source for the vehicle with supply of current from the battery. The second machine (11) is so arranged that during the first operational state it acts as generator and is thereby driven by means of the first machine (1) during generation of the said current for charging up the battery (22).

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Propulsion arrangement for vehicles

Technical field:

The present invention related to a propulsion arrangement for vehicles and comprises an initial machine in the form of a motor arranged to be driven by combustion of a propellant and a second machine arranged to be driven by means of electricity from a battery or to function as a generator. The object is preferably a propulsion arrangement for load trucks for handling goods both in the open air and inside buildings.

Background:

The propulsion of vehicles by an internal combustion engine has certain advantages. The main one appears to be that the operating time between refuelling operations can be long and that the actual fuel filling operation can take place rapidly, which taken together provide long operating times; if so required practically the entire day can be utilised for operation. Another important advantage is that the weight per horse-power for the motor and requisite fuel volume is low. Disadvantages which are linked with internal combustion engines are mainly that they give off harmful and dirty gases and have a relatively high sound level. In spite of these disadvantages, internal combustion engine operation for vehicles is accepted outdoors, whilst there is an ever increasing tendency to prohibit and depart from its use indoors. An alternative propulsion system in which the said disadvantages are practically eliminated is propulsion by means of one or more electric motors, which for vehicle operation must be battery-driven. This method is often employed for load carrying vehicles, e.g. trucks, which are employed indoors or in any case for the most part indoors. However the disadvantage does arise that with reasonable battery size energy extraction between charges must be restricted whilst at the same time a major part of the day has to be reserved for battery charging. Furthermore the costs for maintenance and replacement of the batteries if operations are conducted solely with these is relatively high. As such a high weight - and this is incurredbecause of the batteries - is not a direct disadvantage for load-carrying trucks such as fork-lift trucks, because in any event a counterweight is essential, but even so energy extraction during a working day between re-charging periods often has to be restricted below the desirable level.

The said disadvantages of electric motor-driven vehicles are generally not particularly accentuated if these are operated solely indoors, because the rolling resistance and differences in level are relatively slight, whilst at the same time the distance traversed during a working day is relatively short. Furthermore if operations are conducted solely indoors there is hardly any other alternative. In the case of vehicles for combined outdoor and indoor operation however the conditions become more difficult. As already mentioned there is a tendency no longer to accept internal combustion engine operation for indoor use, whilst at the same time the demand for energy and power are high as a result of outdoor operation. During outdoor runs it is often necessary to traverse longer distances on uneven surfaces and with load-carrying trucks the weight of the goods tends to be greater with outdoor operation than when operations are conducted solely inside buildings.

To solve the problem of being able to utilise the environmentally preferable method of electrical operation in doors, whilst at the same time having adequate energy and power available, the use has been proposed of hybrid machines for propulsion of vehicles. With these there is both an internal combustion engine and at least one electric motor, the said motors being capable of being used alternatively. The present invention relates to such a hybrid system and more particularly concerns a system in which the internal combustion engine is employed both for propulsion during certain operating periods and simultaneously for charging up the batteries which are provided for operation of the electric motor, which in turn are only employed for propulsion of the vehicle during limited periods, mainly during periods when the internal combustion engine is shut down. During outdoor operation the internal combustion engine is thus employed, whereby the batteries are charged at the same time, whilst during indoor operation solely the electric motor is used. When the power output is particularly high, possibly both machines can be employed.

On the other hand the invention does not relate to systems of the type "diesel-electric operation", i.e. constant propulsion with electric motors which are supplied with electricity from a generator driven by an internal combustion engine and, in periods when this is shut down, from batteries.

Technical problem:

However, the fact has emerged that such hybrid systems are inflexible when changing over between the methods of drive, so that the vehicle has to be stopped when switching over and the purpose of the present invention is to provide a hybrid system of the above-mentioned type in which the changeover between operation with the electric motor to operation with the internal combustion engine and vice versa can take place in a very flexible manner and whilst the vehicle is in motion.

Another objective is to provide an arrangement for switching over between the two modes of operation which is simple and ensures reliable operation.

The solution:

The solution in accordance with the invention involves the second machine, as motor, operating within a lower speed range, the first machine operating as motor within a higher speed range located above the lower speed range, the first machine being arranged to drive the second machine, and whereby a speed sensing arrangement is provided to switch over the second machine from motor operation to generator operation when, as a result of the operation of the first machine, the speed rises to the higher speed range, and to switch in the second machine as motor within the lower speed range.

Brief description of drawings:

The appended diagrams illustrate an embodiment of the invention. Fig. 1 gives a schematic view of the driving machinery for a load-carrying truck and fig. 2 illustrates an electrical circuit diagram for the propulsion arrangement in accordance with the invention.

Best mode of carrying out the invention:

In accordance with fig. 1 the propulsion arrangement for a vehicle, preferably a load-carrying truck, comprises an internal combustion engine 1 with a flywheel casing 2, from which a drive shaft 3 proceeds on which a belt pulley 4 is fastened. A starting motor 5, which can be driven by the current from a battery 6, is provided to start the engine. A starting relay 7 is arranged in the battery lead for actuation of the starting motor 5, and this relay can be actuated from a starting controller 8, e.g. a press-button. Furthermore there is a stop button 9, by means of which the motor can be stopped by influencing its injection pump or ignition arrangement 10, in the case of diesel engines or Otto engines.

Furthermore the propulsion arrangement comprises an electric motor 11 with a drive shaft 12 which has shaft journals at both ends of the motor. One shaft journal is connected to an hydraulic pump 13 which by means of pipes 14 is connected to hydraulic motors 15, which are arranged to propel the propulsion wheels 16 of the truck. Furthermore, for regulating the flow from the hydraulic motor 13, there are actuation pipes 17 which extend up to an actuating valve 18 designed as a pedal. A free wheel 19 via which a belt pulley 20 which is connected by belts 21 with the belt pulley 4 can drive the shaft 12, is arranged at the other end of the shaft 12.

The shaft 12 which must always rotate during operation of the hydraulic pump 13 and thus during propulsion of the vehicle by means of the hydraulic motors 15 has a defined direction of rotation. The free wheel 19 is thereby so arranged that it is engaged when the internal combustion engine 1, which also has a certain drive direction on its output shaft 3, drives the belt pulley 20 in the same direction as the defined direction of rotation of the shaft 12. This signifies also that the free wheel free-wheels in the opposite relative direction of rotation, which means that for its part the shaft 12 cannot drive the belt pulley 20 and hence certainly not the internal combustion engine 1 during independent operation in the defined direction of rotation. In other words: if the internal combustion engine is in operation, but not the electric motor 11, the internal combustion engine drive the shaft 12 and thus the hydraulic pump 13, whilst on the other hand if the internal combustion engine 1 is not in operation, whilst the electric motor 11 is in operation, then the electric motor will run freely without entraining the internal combustion engine.

A battery 22 which can be connected by means of a relay 23 to the electric motor is provided for operation of the electric motor 11. The functioning of this relay will be explained later.

In what has been stated above the electrical machine provided has been designated as the electric motor 11. As such it is also envisaged to operate as a motor. However it is arranged to be able to function alternatively as generator, and it is then so connected to the battery 22 that the latter can be charged during operation of the generator. To draw attention to this point, in future the motor-generator will be designated as "the electrical machine 11". Such a changeover can be performed relatively simply, generally by certain windings of the electrical machine being magnetised by supplying a field current, whilst at the same time other windings are connected up for electricity output. The relay 23 is provided for this changeover. When the relay 23 is engaged for motor operation, electricity is thus taken from the battery 22 so that the machine 11 is driven, whilst during generator operation current is fed to the battery 22 to charge this up.

Characteristic of the invention is the fact that this changeover between motor and generator operation is controlled by a speed-sensing arrangement. This can consist of a special speed-sensing arrangement, e.g. on the shaft 12, and this has been designated as 24 in the circuit diagram in fig. 2. Alternatively, speed indication can be undertaken by recording the currents which flow through the windings of the electrical machine 11. Simultaneously with the fact that the relay is arranged to be controlled during its changeover of machine 11 between motor and generator operation as a function of speed, the actual machine is arranged to operate within a certain speed range as motor, and at another speed range which lies above this speed range as generator. Speed control of the relay is thereby so arranged that the changeover to generator takes place when the rotational speed of the shaft 12 of machine 11 passes from the lower speed range up to the higher speed range, whilst changeover to motor operation takes place when the speed drops from the higher speed range to the lower speed range. Furthermore motor operation is obtained during starting up and the supply of current to the machine from the battery 22, i.e. when starting from zero and passing to the lower speed range. Furthermore one of the characteristics of the invention is that the internal combustion engine 1 is arranged to drive the system within the higher speed range at the envisaged normal load range. In the embodiment illustrated thus the transmission ratio via the belt pulleys 4 and 20 is so adapted to the speed of the internal combustion engine 1 that during operation of the internal combustion engine the shaft 12 is driven at a rotational speed located within the higher speed range.

In fig. 2 the arrangement is illustrated in the form of an electrical circuit diagram where the components described previously are reproduced with the same notation numbers. Furthermore, as mentioned, a speed sensing arrangement 24 is specified, which is shown in fig. 2 as being connected to the shaft 12. This can consist of some known arrangement of the centrifugal, eddy-current type or the like, which is capable of imparting a control signal in a conductor 25 to the changeover relay 23. In turn the relay 23 cannot have solely a changeover function, but must also function as charging relay, so as to provide suitable charging of the battery 22. It is not necessary to describe in greater detail the starting arrangement for the internal combustion engine 1. The method is already known of arranging a small electric motor for starting up internal combustion engines. In the embodiment shown the starting motor 5 is connected to a special battery 6 and a special generator is then provided for charging up this battery. Thus the internal combustion engine 1 is quite simply a standard engine with associated starting equipment of the standard type. As such it is possible, within the framework of the invention, to combine the two electrical installations illustrated in fig. 2, e.g. by connecting the starting motor 5 to the battery 22. It is also possible to allow the motor 11 to function as starting motor, although then the free-wheel 19 must be replaced by some controlled shaft coupling. During the development of the invention however the method illustrated was found to be the most suitable.

As shown by the foregoing the drive thus takes place from the shaft 12 either by means of the electrical machine or the internal combustion engine. The drive power output is transmitted to the hydraulic pump 13 for which flow control arrangements are provided. This can for example be of the type which has a swivelling plate by means of which the stroke length of the pistons can be controlled, whereby the outgoing flow can be varied infinitely even with constant speed of the input shaft. The pressure medium from the hydraulic pump is transmitted via pipes 14 to the two motors 15 and thus when the shaft rotates the wheels 16 are driven. Preferably the system is also provided with changeover valves so that reverse motion is possible. Such infinitely variable hydraulic systems form state of the art and do not need to be described in detail here. Flow regulation takes place by means of the said foot pedal via a remote actuation control arrangement which as shown in the diagram can be of the hydraulic type. The control range for pump 13 should be such that it should be possible to achieve the desired speed range during propulsion of the truck, regardless of whether the drive machinery, i.e. the shaft 12, operates within the previously mentioned lower speed range during electrical operation, or the higher speed range during internal combustion engine operation. In other words it must be possible, by regulating the pump within the control range provided for it, to compensate for differences in the speed of rotation of shaft 12 within both these speed ranges in such a manner that the speed of rotation of the wheels 16 can be maintained constant.

If we assume that the truck is to be started indoors, the battery 22 is connected to the electrical machine 11, which thereby rotates the shaft 12 and drives the pump 13. By means of control valve 18 the speed of wheels 16 can be controlled, so that it is possible to regulate the speed of the truck between zero up to thehighest envisaged speed. During rotation of shaft 12 the free wheel 19 is disengaged, so that the belt pulley 20 remains stationary and the internal combustion engine 1 is not

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affected. During electric motor operation the speed control arrangement ensures that an adequate coupling is obtained so that current is supplied from the battery 22 to the machine 11 which functions as a motor. As shown by the foregoing this takes place at the lower speed range and, as long as this is complied with, the relay 23 ensures the said motor coupling.

If, for example, when driving out of the building internal combustion engine operation is required the engineis started in the conventional manner with its starting motor 5 by actuation of the starter control 8. As a result the engine 1 is started up and reaches its speed and the belt pulley 4 drives belt pulley 20. Since the belt pulley 20 is driven at a higher speed than the speed maintained by shaft 12 during electric motor operation, the free-wheel 19 is engaged and the shaft 12 increases its speeds to the higher speed range. As a result relay 23 is actuated by the said speed-sensing arrangement. This results in the machine 11 being switched over to generator operation. During this its field windings are energised and it starts to generate current which, via the relay 23 which functions as charging relay, is transmitted to the battery 22 to charge this up. At the same time the pump 13 also starts to be driven at higher speed and the wheels 16 also try to be driven at higher speed from the hydraulic motors 15. As soon as the driver senses this he can compensate for the increasing speed of shaft 12 by releasing pressure slightly on the pedal to the control valve 18. This reduces the flow of pump 13, so that the desired speed of rotation of wheels 16 is obtained. Very often however the situation is that a higher speed is required when driving outdoors and naturally actuation of the pedal takes place in accordance with the driver's required running speed. As indicated however there is a possibility of speed compensation and for maintaining a uniform speed.

If the internal combustion engine 1 is overloaded, either because the drive resistance on wheels 16 becomes excessive or because any ancillary equipment present in the form of load-handling arrangements such as lifting forks or cranes is heavily loaded, the speed of the enginewill drop. If this occurs to such an extent that the speed of rotation of shaft 12 passes out of the specified higher speed range, then first of all generator operation of machine 11 will be disconnected, which signifies a lower loading. If the speed drops down to the lower speed range the relay 23 will change over machine 11 to motor operation and thus provides operation from both the internal combustion engine 1 and the electricalmachine 11. As indicated, the two speed ranges can be located one after the other with an intermediate range in which the machine 11 is completely disengaged. The two ranges can also occur directly one after the other so that the relay is switched over between generator and motor operation without any neutral position. Preference should be given to the latter.

If the vehicle is to be driven into a building once more the engine 1 is stopped using the stop control arrangement 9. As a result the speed drops to the lower speed range and the relay 23 now engages the machine 11 for motor operation with current being taken from the battery 22. As soon as the shaft 12 starts to rotate more rapidly than the belt pulley 20, the free-wheel 19 is disengaged and the shaft 12 can rotate freely without being affected by the engine1. The drive of pump 13 thus occurs by electric motor operation. The reduction in the flow from the pump which takes place during the transition to the lower speed range can thus be compensated, as described above, by means of the control valve 18 which is provided with a pedal, if so required.

Industrial applicability:

Within the framework of the invention, as defined in the following patent claims, the arrangement can be varied beyond what has been stated in the previous description. Thus the engine 1 does not need to be an internal combustion engine of the type most widely employed now, i.e. a piston engine of the diesel or Otto type. It is also feasible for it to be a Stirling engine, combustion turbine or a steam engine. The essential thing is that the one drive source has characteristics which are not appropriate for driving in enclosed premises, whilst on the other hand it can easily be provided with the necessary drive means. These circumstances prevail with all types of engines and machines which are driven by combustion of a fuel in some manner or other.

The connection illustrated, via a through shaft to the electrical machine, is not essential to the invention. For example a connection is feasible where the two machines are connected in parallel with the power transmission. The latter also does not need to be of the hydraulic type, but some form of control of the transmission ratio should be provided to compensate for operation within the two speed ranges. It is also possible to provide the arrangement with an element which automatically changes over the transmission ratio on changing from one drive speed to another.

Patent claims:

1. Propulsion arrangement for vehicles and comprising a first machine (1) arranged as propulsion motor and thereby driven by combustion of a propellant and a second machine (11) arranged partly as alternative propulsion motor, thereby driven by means of electricity from a battery (22) and partly as generator, thereby driven by means of the first machine (1) during generation of electricity to charge up the battery (22) whereby the propulsion arrangement is designed to alternatively function in a first operating state with the first machine as drive source for operating the vehicle and, if this be required, for generation of electricity for charging up the battery by operation of the second machine acting as generator, and a second operational state in which the second machine functions as drive source for the vehicle with . supply of electricity from the battery, characterised in that the second machine (11) is so arranged that in the second operational state as motor it operates within a lower speed range, that the first machine (1) is so arranged that in the first operational state it functions as motor within a higher speed range which is located above the lower speed range, that the first machine is arranged to drive the second machine during its operation as propulsion motor and that a speed-sensing arrangement (23) is provided to change over the second machine from motor operation to generator operation when, as a result of the work of the first machine, the speed rises to the higher speed range, and to engage the second machine as motor when the speed is located within the lower speed range, so that of the two operational states the first can be achieved by bringing the first machine (1) into operation, whereby the higher speed range is normally reached and the second machine (11) functions as generator, or by shutting down the first machine whereby the second operational state involving the lower speed range is adopted and the second machine operates as motor.

2. Propulsion arrangement as in claim 1 characterised in that the first machine (1) is arranged so that at heavy loading it can operate in the lower speed range whereby when the lower speed is adopted under load the second machine (11) is caused by the speed-sensing arrangement (23) to change from generator operation to motor operation, by this means supporting the work of the first machine.

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3. Propulsion arrangement as in claims 1 or 2, characterised in that the first machine (1) and the second machine (11) are coupled in drive connection with the same output drive shaft (12) whereby the first machine is coupled to the drive shaft by means of a free-wheel coupling (19) in such a way that when the first machine is in operation this can drive the output shaft via the free-wheel coupling, whilst when it is not in operation the output shaft can rotate in the drive direction free-wheeling from the drive connection with the first machine.

4. Propulsion arrangement as in claims 1, 2 or 3 characterised in that the first machine (1) and the second machine (11) are arranged to drive the propulsion mechanism of the vehicle via an hydraulic power transmission (13,15) which is infinitely adjustable over at least a part of its speed range

5. Arrangement as in claim 4, characterised in that the hydraulic power transmission (13,15) is infinitely adjustable within a range such that the envisaged difference in speed between driving by means of the first machine (1) with its higher speed and driving by means of the second machine (11) with its lower speed can be compensated for by varying the transmission ratio in the hydraulic power transmission in such a way that the speed of propulsion of the vehicle can be maintained unchanged within the envisaged normal range of drive speed when changing over between the two machines as propulsion source.

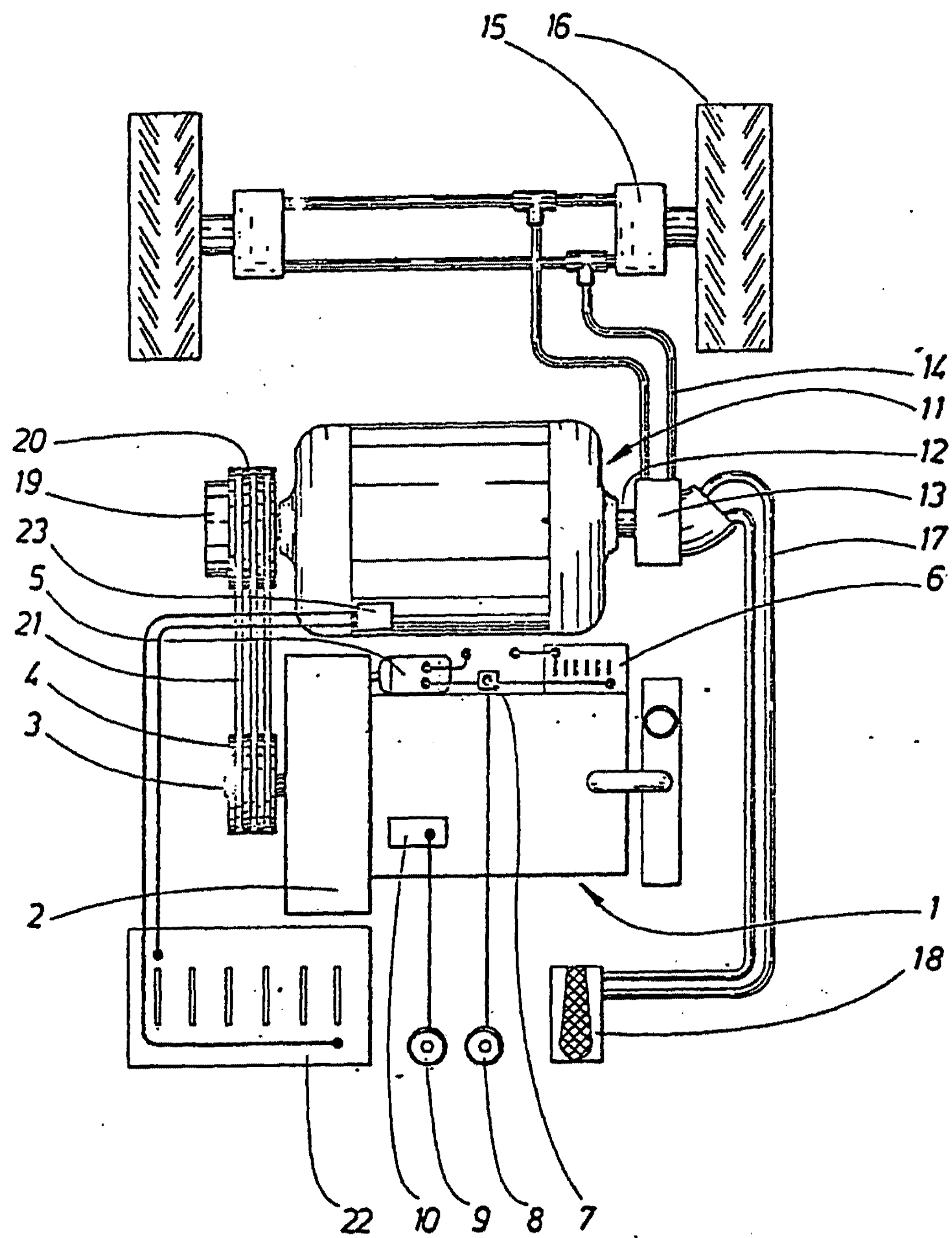

FIG. 1

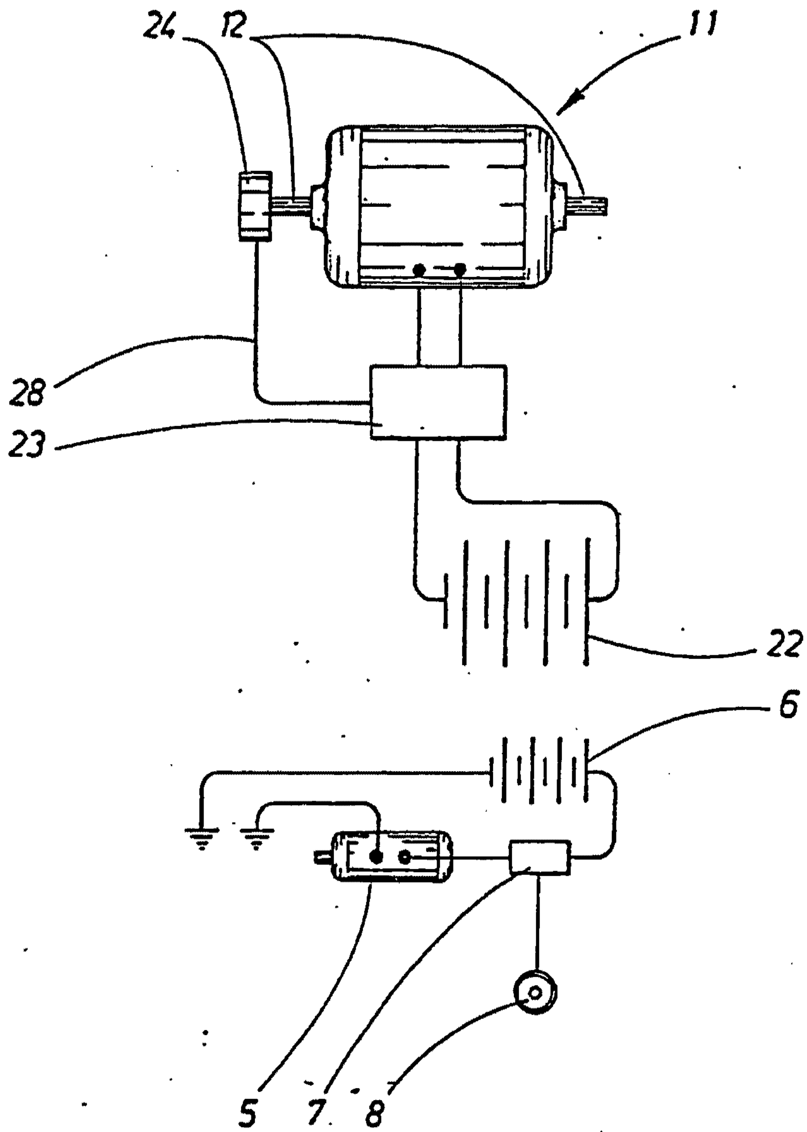

FIG. 2

BEST AVAILABLE COPY

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE81/0028[illegible]

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC 3

B 60 L 11/12

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC 3	B 60 L 11/00-18, B 63 H 23/12, 24
US Cl	180-65
National Cl	63c:1/06; 201:7/02, 10

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
Y	US, A, 3 543 873 (LEWIS G HARMON) 1 December 1970 (01.12.70)	1-5
Y	US, A, 3 970 163 (NISSAN MOTOR CO LTD) 20 July 1976 (20.07.76)	1-5
Y	GB, A, 1 390 088 (ROBERT BOSCH GmbH) 9 April 1975 (19.04.75)	1-5
A	US, A, 4 165 795 (GOULD INC) 28 August 1979 (28.08.79)	
A	US, A, 3 791 473 (PETRO-ELECTRIC MOTORS LTD) 12 February 1974 (12.02.74)	

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
1981-12-03	
International Searching Authority [1]	**Signature of Authorized Officer**
Swedish Patent Office	Håkan Sandh

Form PCT/ISA/210 (second sheet) (October 1981)

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/382,577	03/07/2003	Alex J. Severinsky	PAICE201.DIV	9389

7590 10/26/2005

Michael de Angeli
60 Intrepid Lane
Jamestown, RI 02835

EXAMINER	
DUNN, DAVID R	
ART UNIT	**PAPER NUMBER**
3616	

DATE MAILED: 10/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Supplemental Notice of Allowability	**Application No.** 10/382,577	**Applicant(s)** SEVERINSKY ET AL.	
	Examiner David Dunn	**Art Unit** 3616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed 2/22/05 and telephone interview of 10/24/05*.

2. ☒ The allowed claim(s) is/are *82-122*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 7/01/05
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

David Dunn
Primary Examiner
Art Unit 3616

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Michael de Angeli on October 24, 2005.

The application has been amended as follows:

In claim 82, line 19, after "when torque", --required to be-- has been inserted.

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Dunn whose telephone number is 571-272-6670. The examiner can normally be reached on Mon-Fri, 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Dickson can be reached on 571-272-6669. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

David Dunn
Primary Examiner
Art Unit 3616

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201.DIV	APPLICATION NUMBER: 10/382,577
	APPLICANT: Severinsky et al	
	FILING DATE: 3/7/2003	GROUP ART UNIT: 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	5844342	12/1998	Miyatani et al			
DD	5804947	9/1998	Nii et al			
DD	5457363	10/1995	Yoshii et al			
DD	5907191	5/1999	Sasaki et al			
DD	5914575	6/1999	Sasaki			
DD	6005297	12/1999	Sasaki et al			
DD	6166499	12/2000	Kanamori et al			
DD	5801497	9/1998	Shamoto et al			
DD	5909720	6/1999	Yamaoka			
DD	5698955	12/1997	Nii			
DD	5428274	6/1995	Furutani et al			
DD	6077186	6/2000	Kojima et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	2419832	3/1978	France			X	
DD	3124201	10/1989	Japan			X	
DD	51103220	2/1975	Japan			X	
DD	H564531	9/1984	Japan			X	
DD	S4849115	10/1971	Japan			X	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Winkelman et al, SAE paper 730511, "Computer Simulation...." (1973)
DD	Berman et al, IEEE VT-23, NO. 3, pp. 61-72 "Propulsion Systems...."(1974)
DD	Berman SPC-TUE-2 "Battery Powered Regenerative SCR Drive"(1970)
DD	Gelb et al "Performance Analyses..." ACS pub (1972), pp 977-988
DD	Berman SPC-TUE-1 "Design Considerations...." (1971)
DD	Berman SPC-TUE-2" All Solid State Method....." (1971)

EXAMINER	DATE CONSIDERED 10/12/05

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	5991683	11/1999	Takaoka et al			
DD	5473228	12/1995	Nii			
DD	5927415	7/1999	Ibaraki et al			
DD	5928301	7/1999	Soga et al			
DD	6176807	1/2001	Oba et al			
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DD	5789877	8/1998	Yamada et al			
DD	6087734	7/2000	Maeda et al			
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DD	5988307	11/1999	Yamada et al			
DD	5991683	11/1999	Takaoka et al			
DD	5818116	10/1998	Nakae			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	S 50 3 0 2 2 3	7/1973	Japan			X	
DD	WO 82 0 11 7 0	4/1982	PCT				
DD	0510582	12/1995	EPO				
DD	4297330	3/1991	Japan				X

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Minorikawa et al, "Current Status and Future Trends...." (Undated)
DD	Baum et al "Semiconductor Technologies..." (Undated)
DD	Chen "Automotive Electronics in the Year 2000..." (Apparently 1992)
DD	Brusaglino, SAE paper 910244 "Electric Vehicle Development..." (1991)
DD	Anderson et al, SAE paper 910246 "Integrated Electric..." (1991)
DD	~~Burke,~~ SAE paper 911914 "Battery Availability for Near-Term..." (1991)

EXAMINER [signature] DATE CONSIDERED 10/12/05

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD		Chang, IEEE AES Magazine (1993) "Recent Developments of Electric ..."
DD		Kamiyama et al, IEEE 0-7803-0582-5 (1992) "Application Trends...."
DD		Sen, IEEE Trans. Ind. Elec. (1990) "Electric Motor Drives..."
DD		Wang et al, PCSC '71 Record, "Analysis of SCR Chopper Drive" (1971)
DD		EPRI Report TR-101264 "Assessment of Electric Motor Technology (1992)
DD		Berman et al, SAE paper 720111 "Electric Car Drives...." (1972)

EXAMINER DD | DATE CONSIDERED 10/12/05

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	WO9924280	11/1997	PCT			X	
DD	EP0743211	5/1996	EP				
DD	EP0839683	10/1997	EP				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Gelb et al, "The Application of Solid Electrolyte Batteries..." (Undated)
DD	Miller, "Integrated Power Module Requirements for Automotive..." (Undated)
DD	Vukosavic et al, IEEE Trans. Ind. App. "SRM Inverter Topologies..." (1991)

EXAMINER [signature] DATE CONSIDERED 10/12/05

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination
	10/382,577	SEVERINSKY ET AL.
	Examiner	Art Unit
	David Dunn	3616

ISSUE CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
180	65.2	180	65.4						
INTERNATIONAL CLASSIFICATION		701	54						
B 6 0 K	6/02								
	/								
	/								
	/								
	/								

(Assistant Examiner) (Date)

(Legal Instruments Examiner) (Date)

David R. Dunn

(Primary Examiner) (Date)

Total Claims Allowed: 41

O.G. Print Claim(s)	O.G. Print Fig.
1	4

☒ **Claims renumbered in the same order as presented by applicant** ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		31		61		91		121		151		181
	2		32		62		92		122		152		182
	3		33		63		93		123		153		183
	4		34		64		94		124		154		184
	5		35		65		95		125		155		185
	6		36		66		96		126		156		186
	7		37		67		97		127		157		187
	8		38		68		98		128		158		188
	9		39		69		99		129		159		189
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	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

Search Notes	Application No.	Applicant(s)
	10/382,577	SEVERINSKY ET AL.
	Examiner	Art Unit
	David Dunn	3616

SEARCHED			
Class	Subclass	Date	Examiner
180	65.2 65.3 65.4 65.8 165	11/29/2004	DD
60	706 711 716		
	718		
290	17 40R 40C		
322	16		
477	2 3		
UPDATE	SEARCH	3/16/05	DD
701	54	"	"
Updated		10/29/05	DD

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
180	65.2	3/16/05	DD
	65.4		
Updated		10/29/05	DD

SEARCH NOTES (INCLUDING SEARCH STRATEGY)	DATE	EXMR
EAST text search	11/29/2004	DD

PRINTER RUSH
(PTO ASSISTANCE)

IFW

Application :	10/382577	**Examiner :**	DUNN	**GAU :**	3616
From:	TW	**Location:**	IDC FMF FDC	**Date:**	1-6-06

Tracking #: 6109169 Week Date: 5-23-05

DOC CODE	DOC DATE	MISCELLANEOUS
☐ 1449		☐ Continuing Data
☐ IDS		☐ Foreign Priority
☐ CLM		☐ Document Legibility
☐ IIFW		☐ Fees
☐ SRFW		☐ Other
☒ DRW	3-7-03	
☐ OATH		
☐ 312		
☐ SPEC		

Attn: Chief Draftsperson

[RUSH] **MESSAGE:**

In the Formal Drawings submitted on 3-7-03 the Figure 3 drawing has crossed out data, handwritten data and has data cut off at the bottom of the sheet.

Please supply a corrected drawing

Thank You
TW

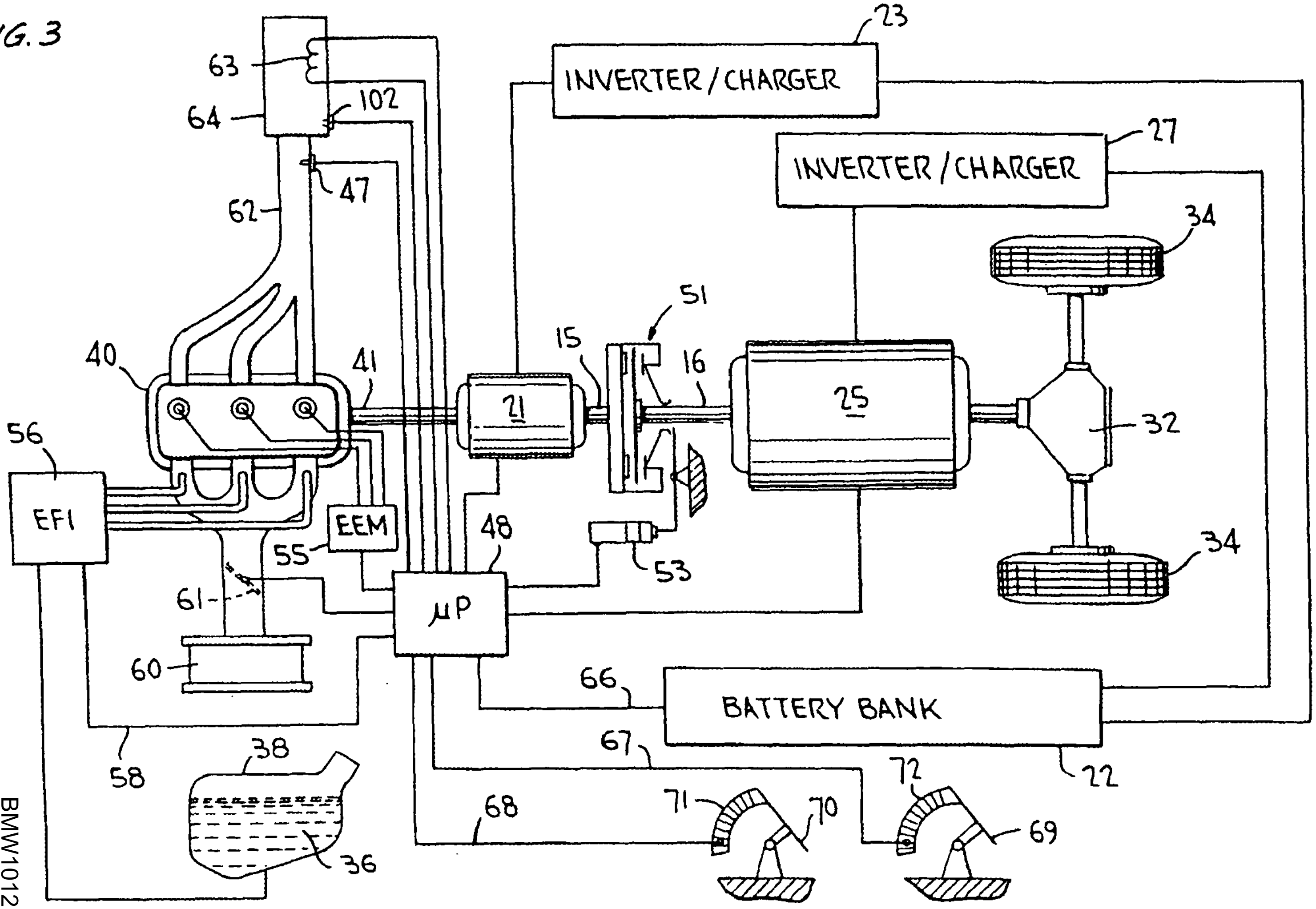
[XRUSH] **RESPONSE:**

Dwg corrected

INITIALS: DJS

NOTE: This form will be included as part of the official USPTO record, with the Response document coded as XRUSH.
REV 10/04

FIG. 3



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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	:	
Severinsky et al	:	Examiner: David Dunn
Serial No.: 10/382,577	:	Group Art Unit: 3616
Filed: March 7, 2003	:	Att.Dkt.:PAICE201.DIV
For: Hybrid Vehicles		

FAX RECEIVED
JAN 19 2006
OFFICE OF PETITIONS

PETITION UNDER 37 C.F.R § 1.313(c)(2)
TO WITHDRAW ALLOWED APPLICATION FROM ISSUE

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is a petition under 37 C.F.R. § 1.313(c)(2) for withdrawal from issue of an application in which the issue fee has been paid. Applicants respectfully request that the captioned application be withdrawn from issue to permit consideration of an Information Disclosure Statement under 37 C.F.R. § 1.97. The Information Disclosure Statement (IDS) contains materials from a recent jury trial, conducted December 6 - 20, 2005, involving the patents from which the present application claims priority. Concurrently with the present petition, Applicants have filed a Request for Continued Examination (RCE) under 37 C.F.R. § 1.114 along with the IDS mentioned above, copies of which are attached hereto. Applicants respectfully request the Office of Petitions to grant the present petition and hence allow for entry of the RCE and IDS in the present case.

The Commissioner is authorized to charge the petition fee of $130.00 (pursuant to 37 C.F.R. § 1.17(h)) to Deposit Account No. 04-0401 of the undersigned. If any extension of time (under 37 C.F.R. § 1.136) is necessary to prevent the above referenced application from becoming abandoned, Applicants hereby petition for such extension. The Commissioner is also authorized to charge any extension fee or other fees which may be necessary to the same account number.

As indicated above, enclosed herewith are the following items:

01/26/2006 CKHLOK 00000001 040401 10382577

01 FC:1464 130.00 DA

☒ Request for Continued Examination

☒ Information Disclosure Statement

The Information Disclosure Statement includes a PTO-1449 form listing materials that will be being submitted to the Examiner for consideration. The volume of these materials makes their submission with this Petition infeasible.

Should any questions remain, the Petitions Examiner is invited to telephone the undersigned at the number given below.

Grant of the above Petition, withdrawal of the application from issue, entry of the Request for Continued Examination, and return of the application to the Examiner for consideration of the Information Disclosure Statement are earnestly solicited.

Respectfully submitted,

Dated: Jan. 19, 2006

Michael de Angeli
Reg. No. 27,869
60 Intrepid Lane
Jamestown, RI 02835
401-423-3190

**** CERTIFICATE OF FACSIMILE TRANSMISSION ****

I hereby certify that this correspondence is being transmitted via facsimile to the United States Patent and Trademark Office (Fax No. 571-273-0025) on the date shown below:

Michael de Angeli
Name of Registered Representative

Signature — January 19, 2006
Date

MICHAEL M. DE ANGELI, P.C.
ATTORNEY AT LAW
60 INTREPID LANE
JAMESTOWN, RHODE ISLAND 02835
(401) 423-3190

FAX RECEIVED
JAN 19 2006
OFFICE OF PETITIONS

REGISTERED PATENT ATTORNEY

ADMITTED TO BARS OF PA & MD
NOT ADMITTED IN RI

FAX: (401) 423-3191
E-MAIL: MDEANGE@COX.NET

FACSIMILE TRANSMISSION

To: Petitions Examiner Wan Laymon
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Fax Number: 571 273-0025 Date: January 19, 2006

Re: Ser. No. 10/382,577

Total Pages (including this sheet): 8

Dear Ms. Laymon:

Attached pursuant to our conversation of yesterday are a Petition to Withdraw this application from issue, together with a Request for Continued Prosecution, and an Information Disclsoure Statement, with one sheet of PTO-1449.

Please contact me if there are any questions concerning this Petition or the supporting documents.

Very truly yours,

Michael de Angeli

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	:	
Severinsky et al	:	Examiner: David Dunn
Serial No.: 10/382,577	:	Group Art Unit: 3616
Filed: March 7, 2003	:	Att.Dkt.:PAICE201.DIV

For: Hybrid Vehicles

REQUEST FOR CONTINUED EXAMINATION OF APPLICATION

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is a request for continued examination of the above identified application, pursuant to 37 C.F.R. § 1.114. This request is being filed together with a Petition under 37 C.F.R. § 1.313(c)(2) for withdrawal from issue of an application in which the issue fee has been paid, in order to permit consideration of an Information Disclosure Statement under 37 C.F.R. § 1.97, both being filed concurrently herewith, as attached.

The following are the elements of the application enclosed:

1. Filing Fee:
   - ☐ A Fee Authorization is enclosed.
   - ☒ The Commissioner is hereby authorized to charge the RCE fee of $790.00 required under 37 C.F.R. § 1.17(e) to Deposit Account No. 04-0401 of the undersigned.
2. Submission under 37 C.F.R. § 1.114(c):
   - ☒ Information Disclosure Statement (IDS), with PTO-1449 listing materials to be subsequently provided
   - ☐ Copies of IDS Citations
3. Amendments
   - ☐ A preliminary amendment is enclosed.
   - ☐ Enter the unentered amendment previously filed on _____ under 37 C.F.R. § 1.116.
   - ☐ An amendment and response are attached hereto.
   - ☐ Please consider the arguments in the response filed on _____ under 37 C.F.R. § 1.116.
   - ☐ Please consider the arguments in the Appeal Brief or Reply

01/26/2006 CKHLOK 00000001 040401 10382577

02 FC:1801 790.00 DA

Brief filed on _____.

4. ☐ Please enter the enclosed affidavits or declarations.
5. ☐ Return Receipt Postcard
6. ☐ Other: ____________________________

If any extensions of time (under 37 C.F.R. § 1.136) are necessary to prevent the above referenced application(s) from becoming abandoned, Applicants hereby petition for such extensions.

The Commissioner is hereby authorized to charge any fees which may be required or credit any overpayment to Deposit Account No. 04-0401 of the undersigned.

Respectfully submitted,

Dated: Jan. 19, 2006

Michael de Angeli
Reg. No. 27,869
60 Intrepid Lane
Jamestown, RI 02835
401-423-3190

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of

Severinsky et al	Examiner: David Dunn
Serial No.: 10/382,577	Group Art Unit: 3616
Filed: March 7, 2003	Att.Dkt.:PAICE201.DIV
For: Hybrid Vehicles	

FAX RECEIVED

JAN 1 9 2006

OFFICE OF PETITIONS

Hon. Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

FOURTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

Applicant submits this Information Disclosure Statement for consideration by the Examiner. The issued patents from which this application claims priority have been asserted against Toyota Motor Corporation, Toyota Motor North America, Inc. and Toyota Motor Sales, USA, Inc. (collectively "Toyota") in civil action 2:04-CV-211 in the United States District Court for the Eastern District of Texas. A jury trial was recently conducted December 6 - 20, 2005, and a verdict holding the parent patents valid but not infringed was returned.

Applicants submit herewith materials from this litigation for the purpose of full disclosure. Applicants respectfully request the Examiner to fully review and consider these materials in determining patentability of the present application. The materials submitted include transcripts of the trial and deposition testimony of the witnesses on whom Toyota relied for prior art assertions, with any confidential material redacted therefrom, together with copies of the documentary evidence discussed therein.

The Examiner is respectfully requested to consider these materials, to indicate that he has done so in the file of this application, and to then issue a second Supplemental Notice of Allowance.

The materials also include a copy of the Court's *Markman* ruling construing the claims of the parent patents.

Should the Examiner have any questions concerning the materials submitted, he is invited to telephone the undersigned at the number given below.

A Supplemental Notice of Allowability is earnestly solicited.

Respectfully submitted,

Dated: 1/19/2006

Michael de Angeli
Reg. No. 27,869
60 Intrepid Lane
Jamestown, RI 02835
401-423-3190

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

FAX RECEIVED
JAN 1 9 2006
OFFICE OF PETITIONS

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

Trial and deposition transcripts of witnesses relied upon to assert invalidity of parent patents in Civil Docket No. 2:04-CV-211-DF (E.D. Texas), with documentary evidence made of record therein

Claim construction order entered September 28, 2005 in Civil Docket No. 2:04-CV-211-DF (E.D. Texas)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

MICHAEL DE ANGELI
60 INTREPID LANE
JAMESTOWN, RI 02835

COPY MAILED

JAN 2 6 2006

OFFICE OF PETITIONS

In re Application of :
Alex J. Severinsky et al :
Application No. 10/382,577 : ON PETITION
Filed: March 7, 2003 :
Attorney Docket No. PAICE201.DIV :

This is a decision on the petition under 37 CFR 1.313(c)(2), filed January 19, 2006, to withdraw the above-identified application from issue after payment of the issue fee.

The petition is **GRANTED**.

The above-identified application is withdrawn from issue for consideration of a submission under 37 CFR 1.114 (request for continued examination). See 37 CFR 1.313(c)(2).

Petitioner is advised that the issue fee paid on July 1, 2005 in the above-identified application cannot be refunded. If, however, the above-identified application is again allowed, petitioner may request that it be applied towards the issue fee required by the new Notice of Allowance.[1]

Telephone inquiries should be directed to Wan Laymon at (571) 272-3220.

This matter is being referred to Technology Center AU 3616 for processing of the request for continued examination under 37 CFR 1.114.

Wan Laymon
Wan Laymon
Petitions Examiner
Office of Petitions

---

[1] The request to apply the issue fee to the new Notice may be satisfied by completing and returning the new Issue Fee Transmittal Form PTOL-85(b), which includes the following language thereon: "Commissioner for Patents is requested to apply the Issue Fee and Publication Fee (if any) or re-apply any previously paid issue fee to the application identified above." Petitioner is advised that, whether a fee is indicated as being due or not, the Issue Fee Transmittal Form **must** be completed and timely submitted to avoid abandonment. Note the language in bold text on the first page of the Notice of Allowance and Fee(s) Due (PTOL-85).

ZJW

OIPE IAP14 MAR 28 2006 PATENT & TRADEMARK OFFICE

MICHAEL M. DE ANGELI, P.C.
ATTORNEY AT LAW
60 INTREPID LANE
JAMESTOWN, RHODE ISLAND 02835
(401) 423-3190

REGISTERED PATENT ATTORNEY

ADMITTED TO BARS OF PA & MD

NOT ADMITTED IN RI

FAX: (401) 423-3191
E-MAIL: MDEANGE@COX.NET

March 27, 2006

Examiner David Dunn
United States Patent and Trademark Office
Group Art Unit 3616
P.O. Box 1450
Alexandria, VA 22313-1450

BY HAND

RE: Ser. No. 10/382,577

Dear Examiner Dunn:

Enclosed please find a Fourth Supplemental Information Disclosure Statement for this application. The documents being thus made of record are provided on a CD-ROM, for convenience, and are listed on eight sheets of PTO-1449 form. For your convenience, a second copy of the PTO-1449s is enclosed, showing the DTX (Defendants' trial exhibit) numbers, by which the documents (other than transcripts, and the Court's Claim Construction Order) are indexed on the CD-ROM.

Please feel free to call if there are any questions.

Very truly yours,

Michael de Angeli

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	:	
Severinsky et al	:	Examiner: David Dunn
Serial No.: 10/382,577	:	Group Art Unit: 3616
Filed: March 7, 2003	:	Att.Dkt.:PAICE201.DIV
For: Hybrid Vehicles		

Hon. Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

FOURTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

Applicant submits this Information Disclosure Statement for consideration by the Examiner. The issued patents from which this application claims priority have been asserted against Toyota Motor Corporation, Toyota Motor North America, Inc. and Toyota Motor Sales, USA, Inc. (collectively "Toyota") in civil action 2:04-CV-211 in the United States District Court for the Eastern District of Texas. A jury trial was recently conducted December 6-20, 2005, and a verdict holding the parent patents as valid but not infringed was returned.

Applicants submit herewith materials from this litigation for the purpose of full disclosure. Applicants respectfully request the Examiner to fully review and consider these materials in determining patentability of the present application. The materials submitted include transcripts of the trial and deposition testimony of the witnesses on whom Toyota relied for prior art assertions, with any confidential material redacted therefrom, together with copies of the documentary evidence discussed therein.

The materials also include a copy of the Court's Markman ruling construing the claims of the parent patents.

The Examiner is respectfully requested to consider these materials and indicate that he has done so in the file of this application.

Should the Examiner have any questions concerning the materials submitted, he is invited to telephone the undersigned at the number given below.

A Supplemental Notice of Allowability is earnestly solicited.

March 27, 2006
Dated:

Respectfully submitted,

Michael de Angeli
Reg. No. 27,869
60 Intrepid Lane
Jamestown, RI 02835
401-423-3190

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	5371412	12/1994	Iwashita			
	5412251	5/1995	Furutani			
	5993169	11/1999	Adachi et al			
	6007451	12/1999	Matsui et al			
	6032753	3/2000	Yamazaki et al			
	6155364	12/2000	Nagano et al			
	5539318	7/1996	Sasaki			
	5680050	10/1997	Kawai et al			
	5964309	10/1999	Kimura et al			
	5883496	3/1999	Esaki et al			
	5905360	5/1999	Ukita			
	6158541	12/2000	Tabata et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

	Trial and deposition transcripts of witnesses relied upon to assert invalidity of parent patents in Civil Docket No. 2:04-CV-211-DF (E.D. Texas)
	Claim construction order entered September 28, 2005 in Civil Docket No. 2:04-CV-211-DF (E.D. Texas)
	Toyota Hybrid System, Toyota Press Information, Tokyo, 1997
	Prius Hybrid EV, Toyota brochure, undated

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	5253929	10/1993	Ohori			
	5326158	7/1994	Ohori			
	5476151	12/1995	Tsuchida et al			
	5569995	10/1996	Kusaka et al			
	5637977	6/1997	Saito et al			
	5789935	8/1998	Suga et al			
	5895100	4/1999	Ito et al			
	5951115	9/1999	Sakai et al			
	5973463	10/1999	Okuda et al			
	6053841	4/2000	Koide et al			
	5929594	7/1999	Nonobe et al			
	5924395	7/1999	Moriya et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	0136055	03.04.85	European Patent Office				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

	Miller et al, "Starter-Alternator for Hybrid Electric Vehicle.." (1996)
	Johnston et al, "The Design and Development of the [UC Davis].." (No date)
	Johnston et al, "The Design and Development of the [UC Davis].." (1997)
	Alexander et al, "A Mid-Sized Sedan Designed for High Fuel..." (No date)
	"PRIUS New Car Features", (Toyota manual) (1998)
	TRW Systems Group, "Analysis and Advanced Design Study..." (1971)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	4646896	3/1987	Hammond et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	0769403	23.4.1997	European Patent Office				
	7172196	29.9.1994	Japan			X	
	9170533	9.5.1996	Japan			abst.	
	5319110	5.19.1992	Japan			abst.	
	3273933	12.5.1991	Japan			abst.	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

	Gelb, "An Electromechanical Transmission for Hybrid Vehicle..." (1971)
	Hirose et al, "The New High Expansion Ratio Engine..." (1997)
	Hong, "Toyota's Hybrid Program", *Road & Track*, August 1997
	Law, "Toyota Tech", *Car & Driver*, August 1997
	"Dual-Engine Fuel Saver", *Popular Mechanics*, July 1997
	"Toyota Launches Break-Through Hybrid EV", *Motor Trend*, September 1997

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	7268922	10.17.1995	Japan			abst.	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

	"Toyota touts advances in safety, emissions", *Automotive News*, 4/28/97
	"'96 North Wind Performance", undated
	Wakefield, "History of the Electric Automobile - Hybrid Electric Vehicles" (1998)
	"Escort 92-94", undated
	"Near-Term Hybrid Vehicle Program", General Electric Company (1979)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

OIPE IAP14
MAR 2 8 2006
PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

	"Guidelines for Electric Vehicle Safety", SAE J2344 (1998)
	"Intrepid", (undated)
	"COE's Team Paradigm challenged to build FutureCar" (1995)
	Butler et al, "A Versatile Computer Simulation Tool.." SAE 970199 (1997)
	Crumbley, "Hybrid vehicle designed", (1994)
	Brokaw, "Students Pick up the Challenge", (1997)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	5412293	5/1995	Minesawa et al			
	5883484	3/1999	Akao			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	8214592	8.20.1996	Japan			abst.	
	10663833	3.6.1998	Japan			abst.	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

Cuddy et al, "Analysis of the Fuel Economy Benefit..." SAE 970289 (1997)

"Team Paradigm Shines in FutureCar Competition" (1996)

Takaoka et al, "Study of the Engine Optimized for Hybrid System" (undated)

Gelb et al, "Cost and Emission Studies of a Heat Engine/Battery.." (1972)

Gelb et al, "Design and Performance Characteristics..." SAE 690169 (1969)

"Electric/Hybrid Vehicles: Alternative Powerplants..." SAE SP-1284 (1997)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	913846	3/1909	Pieper			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

"Electric and Hybrid Vehicle Design Studies", SAE SP-1243 (1997)

Gelb, "The case for Constant Speed Accessory Drives", (1975)

Sasaki, "Toyota's Newly Developed Hybrid Powertrain", (1998)

"Near-Term Hybrid Vehicle Program, Phase 1", General Electric Co. (1979)

"Near-Term Hybrid Vehicle Program, Phase 1, App. A.", Gen'l Elec. (1979)

"Joint Feasibility Study of Hybrid Vehicle, Final Report (1982)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

OIPE IAP14
MAR 2 8 2006
PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

		North American Technology Seminar plans, April 1997
		Hermance, THS Technical Explanation (undated)
		"Toyota" brochure describing Prius (undated)
		Hermance, "Toyota Hybrid System" (undated)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

BMW1012
Page 1103 of 1654

ARTIFACT SHEET

Enter artifact number below. Artifact number is application number + artifact type code (see list below) + sequential letter (A, B, C ...). The first artifact folder for an artifact type receives the letter A, the second B, etc.. Examples: 59123456PA, 59123456PB, 59123456ZA, 59123456ZB

10/382 577 UA

Indicate quantity of a single type of artifact received but not scanned. Create individual artifact folder/box and artifact number for each Artifact Type.

[1] CD(s) containing:

- computer program listing [ ]
  Doc Code: Computer — Artifact Type Code: P
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  Doc Code: Artifact — Artifact Type Code: S
- content unspecified or combined [1]
  Doc Code: Artifact — Artifact Type Code: U

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March 8, 2004

This form is to be used for application in IFW with a status of 20 and above.

Amended Compact Discs

EXAMINER NOTE: THIS PAPER IS AN INTERNAL WORKSHEET ONLY. DO NOT ENCLOSE WITH ANY COMMUNICATION TO THE APPLICANT. ITS PURPOSE IS ONLY THAT OF AN AID IN HIGHLIGHTING A PARTICULAR PROBLEM IN A COMPACT DISC.

THE ATTACHED CD (COPY 1) HAS BEEN REVIEWED BY OIPE FOR COMPLICANCE WITH 37 CFR 1.52(E).

Date: 5/2/06

Serial No./Control No. 10/382,577

Reviewed By: Kathy Nelson Phone: (703) 308-9210 ext 123

- ☐ The compact discs are readable and acceptable.
- ☐ Copy 1 and Copy 2 of the compact discs are not the same.
- ☐ The compact discs are unreadable.
- ☑ The files on the compact discs are not in ASCII.
- ☐ The compact discs contain at least one virus.
- ☑ The compact discs are not proper subject matter.
- ☐ Other:

1 CD

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 10/382577

CLAIMS AS FILED – PART I

FOR	NUMBER FILED (Column 1)		NUMBER EXTRA (Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE		OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE (37 CFR 1.16(a))					$	OR		$750
TOTAL CLAIMS (37 CFR 1.16(c))	7	minus 20 =	*	X $ =		OR	X $18. =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	3	minus 3 =	*	X $ =		OR	X $84. =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))				+ $ =		OR	+ $ =	
				TOTAL		OR	TOTAL	750

* If the difference in column 1 is less than zero, enter "0" in column 2.

CLAIMS AS AMENDED – PART II

2-22-05

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE		OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 41	Minus	** 126	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(b))	* 2	Minus	*** 11	=	X $ =		OR	X $ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

10/382577

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE		OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 421	Minus	** 126	= —	X $ =	—	OR	X $ = —	
Independent (37 CFR 1.16(b))	* 2	Minus	*** 3	= —	X $ = —		OR	X $ =	—
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	—

AMENDMENT C

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE		OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(b))	*	Minus	***	=	X $ =		OR	X $ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	5338	((180/65.2) or (180/65.3) or (180/65.4) or (180/65.8) or (180/165) or (60/706) or (60/711) or (60/716) or (60/718) or (290/17) or (290/40R) or (290/40C) or (322/16) or (477/2) or (477/3) or (701/54)).CCLS.	US-PGPUB; USPAT	OR	OFF	2006/07/07 10:45
L2	159115	electric adj motor$1	US-PGPUB; USPAT	OR	OFF	2006/07/07 10:46
L3	298597	battery	US-PGPUB; USPAT	OR	OFF	2006/07/07 10:46
L4	376092	engine	US-PGPUB; USPAT	OR	OFF	2006/07/07 10:46
L5	597317	controller	US-PGPUB; USPAT	OR	OFF	2006/07/07 10:46
L6	248375	torque	US-PGPUB; USPAT	OR	OFF	2006/07/07 10:47
L7	29	2 with 3 with 4 with 5 with 6	US-PGPUB; USPAT	OR	OFF	2006/07/07 10:47

JFW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	
Severinsky et al	Examiner: N/A
Serial No.: 10/382,577	Group Art Unit: 3616
Filed: March 7, 2003	Att. Dkt.: PAICE201.DIV
For: Hybrid Vehicles	

Hon. Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

As discussed in the Preliminary Amendment dated August 11, 2003 in this application, applicants have performed additional searching for new patents possibly relevant to the subject matter of this application as amended, and other new patents and other documents have also come recently to applicants' attention. A number of patents and other documents thus located are listed on attached PTO-1449 forms, and are discussed below. Citation of a document herein should not be considered an admission that the disclosure thereof is indeed relevant to the invention defined by the claims, nor that the document thus made of record is indeed effective as prior art under 35 USC '102.

A correction is also desirable with respect to a statement made in an earlier Information Disclosure Statement (IDS). In the IDS filed on November 18, 1999 in grandparent application Ser. No. 09/264,817, which has been incorporated by reference to form part of the IDS for the present application, Taniguchi patent 5,846,155 was described as showing "a parallel hybrid of generally conventional topology, that is, comprising an ICE [internal combustion engine] and an electric motor connected to the road wheels of the vehicle through a continuously-variable transmission, but discloses a relatively sophisticated operational scheme, wherein the source of propulsive torque varies in accordance with the road load and the state of charge of the battery bank ('SOC')".

This could be misunderstood to suggest that Taniguchi suggests control of the hybrid vehicle's operating mode responsive to the road load and SOC. In fact, Taniguchi does not teach selection of the source of vehicle propulsive torque, much less the operating mode, in accordance with the road load and SOC, but in response to vehicle speed and accelerator pedal position. See col. 8, lines 13 - 40:

> Moreover, the individual engagement means, as shown in FIGS. 4 and 5, are operated as shown in the operation diagram of FIG. 6. *In the power split mode, the split drive unit 9 functions at the start and at a low/medium speed.* The output of the engine 2 is transmitted to the ring gear R through the input clutch Ci. On the other hand, the rotor 5a of the motor-generator 5 is connected to the sun gear S to charge the engine output partially or to output it as the motor so that the composed force is output from the carrier CR to the CVT input shaft 7a.
>
> On the other hand, *the parallel hybrid mode functions in a medium/high speed range*. In this state, the rotary elements of the planetary gear 6 are rotated together, and the output of the engine 2 is fed as it is to the CVT input shaft 7a. At the same time, the motor-generator 5 is connected to the input shaft 7a to assist the engine output or to charge the output partially.
>
> *The motor mode is in the state in which the accelerator opening is small and in which the revolution number is small, e.g., in which the engine 2 need not be used, such as in a traffic jam. Then, the motor-generator 5 is used as the motor to drive the vehicle*. In this state, the input clutch Ci is released to disconnect the engine 2 and the CVT input shaft 7a, and the direct-coupled clutch Cd is applied to output the revolution of the motor-generator rotor 5a directly to the input shaft 7a.
>
> *On the other hand, the engine mode functions during high speed cruising, and the vehicle is driven exclusively by the engine output without any participation of the motor-generator 5.* [Emphasis added].

The Examiner is respectfully requested to review the Taniguchi reference and confirm that in fact the road load is not used to determine the operating mode; in fact, Taniguchi controls the operation of the CVT, and the source of propulsive torque, in response to the vehicle speed and accelerator pedal position.

Turning now to new documents made of record hereby:

Abe 6,281,660 shows a battery charger for an electric vehicle.

Adler et al patent 5,515,937 claims a series hybrid where the power required by traction motors is drawn from either the batteries or directly from the engine/generator unit directly, depending on evaluation of their respective efficiencies and the batteries' state of charge, with respect to each new demand for power.

Barske patent 5,336,932 ties the operation of a generator used to charge a battery to specific fuel-consumption curves stored in ROM.

Bullock patent 6,170,587 shows a hybrid drive, all claims of which require at least three different types of energy storage, e.g., combustible fuel, battery, flywheel, or hydraulic accumulator.

Fattic et al patent 5,637,987 shows a hybrid vehicle in which an internal combustion engine and motor are coupled by controllable friction or electrical loading devices to control ratios.

Gray, Jr. patent 5,887,674 relates to a vehicle driven by a "fluidic motor", that is, having a hydraulic motor driving the wheels, in turn driven by a pump driven by an internal combustion engine.

Patent 4,762,191 to Hagin discloses a hybrid power train for a bus wherein multiple axles are driven via a driveshaft. Some of the dependent claims of the present application, recite connection of the combination of engine and first electric motor to a first set of wheels and connection of the second electric motor to a second set of wheels, which is quite different.

Hoshiya patent 6,315,068 shows a hybrid in which control of the torque provided by the motor is responsive to the torque provided by the engine, so that the engine can be operated at a target speed.

Ibaraki patent 5,856,709, discloses and claims a hybrid topology wherein an engine and a motor/generator are connected to different elements of a "synthesizing/distributing mechanism". A large number (nine or more) of operating modes are provided. The determination of the amount of torque required to propel the vehicle is apparently made in response to the position of the acclerator pedal; see col. 15, lines 59 - 61.

Patent 6,225,784 of Kinoshita claims a battery charge controller for a vehicle, wherein the level of charge above which further charging is permitted is varied based on the battery temperature. Patent 6,232,748 to the same inventor and assignee allows only discharge when the battery is above a specified temperature, and patent 6,204,636, again to the same inventor and assignee, controls the charging and discharge rate of the battery responsive to sensing of the "memory effect" of the battery. None of these expedients are claimed in the present application.

Four Lawrie and Lawrie et al patents, 5,993,350, 6,019,698, 5,979,257, and 6,006,620, and Reed et al 5,943,918 (et al here including Lawrie) are directed to transmissions for hybrids that combine the efficiency of manual transmissions with the convenience of automatic transmissions. Motors are used to operate the conventional "H"-pattern shifter, and a clutch, while the motor/generator present in a hybrid is employed to match the speeds of input and output shafts, to ensure smooth shifting. Finally, Reed, Jr. et al 6,332,257 claims a method of converting a manual transmission to automated operation.

Lovatt et al patent 6,291,953 shows an "electrical drive system", in some cases applied to a hybrid vehicle, requiring a lock-up torque converter.

Minowa et al patent 6,142,907 (Hitachi) claims a hybrid wherein either an engine or a motor is used to propel the vehicle. A generator is selectively connected to the wheels through a two-speed transmission. Patent 6,328,670 is a continuation.

Morisawa et al 5,984,034 discloses a hybrid wherein regenerative braking is used to oppose engine torque when idling to keep the vehicle stopped. Morisawa et al 6,119,799 issued on a continuation and discloses a hybrid offering control of braking responsive to "obstruction [e.g., a car ahead] detection". Another patent based on the same underlying document, no. 6,334,498, claims supplying power from a motor during upshifts of an automatic transmission being driven by an engine. None of these is a feature of the claimed invention.

Another Morisawa patent, no. 5,895,333, is limited to packaging details for a planetary gearbox for a hybrid vehicle. Still another Morisawa patent, no. 6,306,057, claims a complex planetary gearbox arranged so that the internal combustion engine is used to power the vehicle when reversing.

Nagano et al 6,344,008 discloses a hybrid wherein a transmission is coupled between an engine and a torque synthesizing device, which also accepts torque from a single motor.

Nakajima et al 6,090,007 shows a control scheme for a hybrid vehicle including a continuously variable transmission. Patent

6,328,671 to Nakajima et al is a continuation-in-part of the '007 patent and shows setting the "target drive power" based on the accelerator pedal position and vehicle speed.

Nekola patent 5,660,077 shows a variable-speed transmission stated to be useful in a hybrid vehicle, including a cone-shaped gear; the meshing gear slides along the conical gear to vary their relative speeds.

Nitta patent 6,321,150 shows an Aabnormality monitoring system@ that is responsive to faults in a very specific type of communication scheme that can be used for a hybrid vehicle. Another Nitta patent, no. 6,203,468, requires first and second motors on either side of a lock-up clutch, to smooth transitions between series and parallel operation.

Nogi et al patent application US 2001/0037905 is directed to lean-burn operation of a hybrid.

Omote patent 5,944,630 claims controlling torque applied by a motor during shifting operations, to smooth shift transitions.

Oyama patent 6,070,680 relates to prevention of stalling of the engine of a hybrid vehicle due to rapid deceleration; the traction motor provides torque to the engine in such cases.

Patent 6,123,642 to Saito claims a "speed change control apparatus" wherein a motor is connected to the wheels of a vehicle through a multispeed transmission; power to the transmission is cut during shifting.

Tabata et al patent 6,158,541 shows a hybrid vehicle wherein the battery is divided into several portions so that one or more can be completely discharged while the others remain partially charged.

A further Tabata et al patent, no. 5,847,469, is directed to a hybrid wherein the electric motor is employed for reversing if the battery is sufficiently charged, and the engine otherwise.

Another Tabata et al patent, no. 6,317,665, shows a hybrid in which a torque converter with lock-up clutch is disposed between the engine and motor and the wheels; the claims require the lock-up clutch to be released during mode switching to prevent rough running.

Another Tabata patent, no. 6,183,389, is directed to hybrids having "torque transmission systems" (i.e., torque converters; see col. 1, line 52) fitted with lock-up clutches; the invention has to do with the control system for the clutch.

Yet another Tabata et al patent, no. 5,873,426, claims a hybrid having an automatic transmission with differing shift patterns selected depending on the load; apparently, the engine is used as the only torque source in one mode and the engine and motor together in another.

Another Tabata et al patent, no. 5,923,093, recites in claim 1 that the automatic transmission is inhibited from shifting during regenerative braking, in claim 5 "braking shift control means" used when regenerative braking is not available, to downshift the transmission to increase engine braking, in claim 13 braking shift control means operated similarly prior to operation of regenerative braking, in claim 17 a clutch between transmission and engine that is engaged during regenerative braking, and in claim 23 means for preventing changing between engine and regenerative braking during a braking operation.

Still a further Tabata et al patent, no. 6,340,339, is limited to specific constructional details of a motor and transmission assembly for a hybrid.

In another Tabata et al patent, no. 5,935,040, claims 1, 5, 7, and 9 all require a manually-operated member for selecting drive modes, while claim 3 requires an automatic transmission operated so that the drive force remains constant in various drive modes as long as the required output remains constant.

Takaoka et al patent application US 2003/0085577 has claims drawn to control of gear selection in an automatic transmission for a hybrid based on engine efficiency; apparently, if the torque required cannot be supplied efficiently by the engine and motor working together, the transmission is downshifted.

Tuzuki et al patent 5,415,603 shows details of a hydraulic system for a hybrid vehicle in which the oil is used for cooling of a traction motor and lubrication of the transmission.

Wakuta et al patent 6,258,001 is directed to very narrow mechanical aspects of a motor and transmission assembly for a hybrid.

Woon et al patent 5,890,470 claims a method of controlling engine output power, evidently intended to improve on conventional governors as used on diesel engines to smooth throttle response and shifting. Claim 1 is typical and requires operating the engine at a constant horsepower value responsive to throttle position regardless of engine speed.

Yamada et al patent 6,328,122 discloses a series hybrid wherein the ICE can be used for vehicle propulsion only in the event of a failure in the charging system.

Nada patent 6,653,230 is also directed to operation of a hybrid after a particular failure.

Yamaguchi patent 5,915,489 shows a hybrid powertrain. It appears that the output torque is determined based on vehicle speed and accelerator pedal position; see col. 6, lines 17 - 21.

Yamaguchi et al patent 6,278,195 shows applying torque from the electric motor of a hybrid to quickly stop the engine.

Yamaguchi et al patent 6,247,437 claims control of the operation of a starter motor, e.g., for a hybrid, responsive to an engine parameter relevant to its startability. For example, if the engine is cold, fuel is supplied at a lower cranking RPM to limit the drain on the battery. A divisional application (not being supplied), Yamaguchi et al published patent application 2001/0022166, similarly claims a starting control for an engine, in which the rotating speed is limited when the engine is cold to avoid excessive use of battery power.

Yamaguchi patent 5,967,940 is directed to control of the power provided by the engine of a hybrid to prevent noise due to gear backlash.

Yamaguchi 6,135,914 discloses a method of control of a hybrid including an ICE and two motor/generators. The invention has to do with limiting the engine speed so that the first motor/generator is not rotated beyond its capability in the event of a failure The Yamaguchi system operates in engine-only, motor-only, and engine+motor modes (see col. 4, lines 46 - 54), but the method by which the choice between these is made is not explicit.

Field patent 5,081,365 discloses a hybrid vehicle wherein an engine is connected to road wheels through an electric motor, which is operated variously as traction motor or generator, depending on the batteries' state of charge and the vehicle operating mode; the operating mode is selected by the operator from an urban mode, a highway mode, an engine mode, and a cruise control mode. The selection is apparently to be made responsive to motor speed. Field acknowledges at col. 7, line 48 the desirability of operating the engine near its rated power to thus realize high efficiency; as discussed in detail below, Field suggest using an engine that is sized so that it operates at nearly maximum output during flat-highway, constant speed cruising. Such an engine would necessarily be too small to propel the vehicle up hills, so its performance would suffer under such circumstances.

Two additional patents to Field and Field et al, nos. 6,044,922 and 6,481,516, relate to developments of the system disclosed in the '365 Field patent above; the '516 patent is stated to be a continuation of the '922 patent, but their disclosures are not in fact identical. The vehicle described in these patents comprises two separate battery packs, a high-voltage battery pack for supplying power to the traction motor and a lower-powered accessory battery for operating usual vehicle ancillary components such as lights, radio, and the like.

Kubo patent 5,722,502 shows a hybrid vehicle comprising an ICE, a generator and a traction motor also operable as a generator. The vehicle can be operated in a variety of modes, include PEV ("pure electric vehicle", in which the ICE is not run at all; see col. 10, lines 18 - 28), SHV ("serial electric vehicle", wherein the ICE is run to drive the generator, which in turn supplies current to the traction motor to power the vehicle; see col. 5, lines 33 - 51), and "continuous-type PSHV" ("parallel-serial hybrid vehicle", where torque from the ICE is used to propel the vehicle and to drive the generator to power the traction motor to propel the vehicle if torque from the ICE is inadequate; see col. 5, lines 52 - 66). A distinction is drawn between this continuous-type PSHV and a "changeover-type PSHV", as exemplified by Japanese Laid-Open Publication 2-7702; see col. 3, lines 2 - 9 and col. 5, line 66 - col. 6, line 10.

The selection between the PEV mode and one or the other of the SHV and PSHV modes is made by the operator (see col. 10, line 47), while the selection between SHV and PHSV modes is made according to the battery's state of charge (SOC); see col. 6, lines 12 - 13. When the driver selects a mode other than the PEV mode, the engine is operated continuously (col. 11, lines 26 - 32), and may idle when not significantly loaded (col. 12, lines 31 - 32; col. 13, lines 51 - 52); if the battery is fully charged but braking is required, such that regenerative braking would be inappropriate, the engine can be operated as a mechanical brake (col. 11, lines 6 - 20).

In PSHV mode, an engine control unit (ECU) then determines whether torque is to be supplied from the traction motor, ICE, or both, depending on the accelerator pedal angle: "Further, if the change in accelerator pedal angle is too large for the torque to be supplied...by the ICE alone or...by the ICE alone because fuel consumption and emission are degraded, the ECU 20 controls the [inverter] to compensate by using the motor 10 for at least that part of the torque required at the driving wheels." (Col. 13, lines 32 - 39). At low speeds in PSHV mode, it appears that the ICE provides power to the traction motor through the first motor, being operated as a generator.

Tsukamoto et al 5,771,478 shows a hybrid vehicle in which the function of a clutch or torque converter, allowing slipping of an ICE with respect to the wheels of a vehicle, e.g., when accelerating from a stop, is provided by a gearbox connected between the ICE, wheels, and a motor-generator. Excess torque provided by the ICE at starting is absorbed by the motor-generator and stored in a battery; it can then be used to run accessories or propel the vehicle.

Tabata et al 5,833,570 relates to smoothing the shifting of an automatic transmission of a hybrid by application of torque from the traction motor. Tabata 5,951,614 is generally similar, but shows smoothing of shifting by reducing the torque supplied by either the motor/generator or ICE.

Hata et al 5,875,691 discloses and claims a specific arrangement of the components of a hybrid (ICE, motor, transmission) for packaging convenience.

Haka 5,931,271 shows a hybrid powertrain wherein one-way clutches are provided so that the same motor/generator can start an ICE and be disconnected therefrom for efficient regenerative braking.

Shibata et al patent 3,719,881 shows a battery charger arrangement especially for a serial hybrid vehicle, wherein an internal combustion engine is operated to drive a generator only above a minimum load, so as to reduce emissions, which increase at low loads.

Etienne patent 4,187,436 also shows a battery charging arrangement for a serial hybrid vehicle, which includes a first battery for powering the traction motor and a second battery for starting the ICE.

Lynch et al patent 4,165,795 shows a hybrid drive arrangement in which an ICE and a motor/generator are mechanically coupled to one another, and to the wheels of the vehicle, through a transmission. The engine is sized to provide the average power necessary for ordinary driving, and is operated near its optimal efficiency point at all times; the motor/generator is operated for load-leveling, that is, when the vehicle's torque requirements exceed the power provided by the engine the motor/generator adds torque, and when the engine's torque output exceeds the vehicle's torque requirement, the motor/generator operates as a battery charger. The difficulty with this approach is simply that the vehicle's torque requirements may vary by a factor of up to 1000%, or more, between city driving and highway driving, particularly when there are grades (using battery power to climb a grade of any length will quickly discharge any reasonably-sized battery bank) so this solution is not useful in "real-world" driving.

Hadley et al 5,283,470 shows an electric car, that is, without ICE, with regenerative braking. Hadley et al 5,406,126 is similar.

Schmidt 5,669,842 shows a hybrid drive in which either the ICE or one of several separate motors drive the accessories, depending on whether the engine is running. The engine and motors are arranged so that the engine and the mating member of the geartrain are driven at the same speed, allowing the clutch to be synchronously engaged.

Ibaraki et al 6,003,626 discloses a hybrid in which the engine normally propels the vehicle and charges the battery through a generator; if the generator fails, the engine propels the vehicle.

Takahara et al 6,009,365 discloses a hybrid with ICE and motor connected to the wheels through a continuously variable transmission (CVT). During coasting the actual torque being exerted is compared to a calculated desired torque and the actual torque adjusted accordingly.

Bower patent 6,231,135 relates to improvements in brake systems for hybrid vehicles. Although the present application is a division of an application which was a continuation-in-part of earlier applications, and which added disclosure of a new braking system to the disclosure of the parent application, no claims to that braking system are now being pursued in this application.

Soejima 5,951,118 discloses a vehicle braking system, not limited to hybrids, which includes a seating velocity reducing device for slowing the closing of a valve; this can be employed together with regenerative braking in a hybrid. Otomo et al 5,984,432 is similar. As above, no claims of the present application are directed to improvements in braking systems, although the parent was a C-I-P which added material relating thereto to the disclosure of the grandparent application.

Numazawa et al patent 5,497,941, Umebayahi et al patent 6,265,692, and Matsuda et al patent 6,357,541 all relate to improvements in HVAC systems. As in the case of the braking systems discussed above, no claims are currently being pursued to certain new material relating to HVAC systems that was added by the parent C-I-P application to the disclosure of the parent applications.

Takahara et al patent 6,064,161 shows operating a motor/generator of a hybrid to brake a slipping wheel. This is not a feature of the claimed invention. Takahara also shows that the vehicle operating mode can be controlled responsive to accelerator pedal position and vehicle velocity, in common with many other references. See Fig. 5.

Kaiser et al 5,979,158 suggests that emissions of an ICE on starting can be reduced by spinning the ICE to a speed approximating its idle speed, activating the ignition system for about a second, and only then activating the fuel supply. This is suggested to be useful in a hybrid. No claims of the present application are directed to high-rpm starting, although the advantages of doing so are discussed in the application. Kaiser also mentions preheating of the catalyst; this step is recited in claim 77, but is not solely relied upon for patentability. Claim 77 recites, *inter alia,* that the vehicle's operating mode is selected responsive to road load, which is not shown by Kaiser.

Salecker 5,983,740 discloses a system for controlling the engine speed during shifting of an automatic transmission to smooth transition between gears; there is a brief mention that this could be useful in a hybrid.

Salecker 6,006,149 has a closely related disclosure and claims continuing to monitor operating parameters, especially temperatures of various components, for a time (the example being one second) after the engine has been shut off.

Yang patent 5,562,566 is extremely difficult to understand, but appears to disclose a power unit combining an ICE and a motor, which is stated to be useful in vehicles, ships, aircraft, and in industrial and process equipment. The invention seems to be directed to a unit for combining the torque, but again the patent is extremely difficult to understand. Patents 5,547,433 and 5,549,524, also to Yang, appear to be directed to related inventions.

Origuchi patent 5,212,431 is directed to a serial electric hybrid vehicle wherein a generator, preferably to be driven by a gas turbine, is operated in response to monitoring of the battery's state of charge.

Antony et al 5,714,851 shows a serial hybrid with a bypass current path around the rectifiers and battery, to connect a generator driven by an ICE directly to a traction motor.

Horwinski patent 3,904,883 discloses a hybrid, wherein a single electric motor/generator is provided with separably rotatable armature and rotator, so that the unit can be operated as both motor and generator. An ICE is provided to drive the unit, and also to propel the vehicle under various conditions. Mode switching is apparently to be accomplished responsive to the battery's state of charge; see col. 5, lines 20 - 21 and col. 6, lines 64 - 66. The vehicle is intended to operate primarily as an electric car, with overnight charging from the power grid (see col. 6, lines 45 - 51) with the engine primarily provided as a range-extender, though, as noted, the engine can supply torque to the wheels; see col. 5, line 64 - col. 6 line 30.

Reichmann et al 5,851,698 and Venkatesan et al 5,856,047 are directed to nickel-metal hybride (NiMH) batteries optimized for hybrid vehicle applications.

Park 4,331,911 shows a method for equalizing the voltage across individual cells of storage batteries.

Miller et al 4,126,200 shows a vehicle having a flywheel for energy storage. Hagin et al 4,216,684 is similar. Matthews 4,591,016 shows recovering energy during regenerative braking by accelerating a flywheel. Michel 4,592,454 shows doing so employing a hydropneumatic accumulator.

Stuhr 4,674,280 shows an accumulator for the storage of energy in a hydraulic system.

Fiala 4,416,360 shows a vehicle powertrain in which a flywheel connected to the engine by a clutch is rotated by a starter motor, and then used to start the engine using rotational inertia stored in the flywheel; the "starter" motor can then be operated as a generator to recharge the battery.

Moore 4,090,577 shows a hybrid with a conventional engine/transmission assembly driving one pair of wheels, with a solar-charged battery and motor combination driving a second pair.

Walker 5,323,688 discloses hydraulic wheel motors stated to be capable of regenerative braking.

Coe 5,384,521 discloses flywheel energy storage for a vehicle, with electromagnetic couplers.

Boll et al 5,623,194 shows a charge information system for an electric or hybrid vehicle for monitoring battery status and advising the operator.

Weiss 5,947,855 shows a hybrid drive for a tractor or the like wherein torque from an ICE is combined with torque from an electric motor, driven by a generator powered by the ICE is combined individually at the drive wheels by a "Ravigneaux" summing gear set. This is stated to provide flexibility in control.

Smith 5,971,088 shows a battery charging apparatus for regenerative charging wherein the generator is built into the vehicle driveshaft and moves with it as the vehicle encounters bumps and the like.

Walker 5,971,092 shows a hybrid comprising two ICEs, sized to accomodate differing typical loads, plus a hydraulic accumulator. The engines are preferably two-strokes with "inertia pistons" sliding in bores in the main pistons.

Schulze et al 5,675,203 shows a motor/generator; the direction of rotation of the output shaft can be reversed by axial movement of a short-circuit winding.

Fliege 5,675,222 shows switchable winding motors for electric road vehicles.

Fliege 5,915,488 shows reducing the power supplied to switching components in a hybrid drive in response to detection of acceleration over a limiting value, e.g., to prevent sparking and erosion of switch contacts as they are jarred apart over bumps.

Lutz 5,679,087 and 5,685,798 disclose details of planetary gearboxes for vehicles.

Lutz 5,691,588 shows a clutch assembly for connecting motor and ICE of a hybrid, having separately-actuated friction plates on opposite sides of a hub forming part of the rotor.

Lutz et al patent 5,755,302 discloses a specific arrangement of a clutch connecting an engine, motor, and transmission of a hybrid - the rotor is attached to the transmission shaft and the stator to either the engine or the transmission housing, while the clutch also fits at least partially within the stator.

Fliege 5,678,646 discloses modular motors that can be stacked with interconnected coolant circuits to provide different power capacities, stated to be useful in hybrids.

Ruthlein et al 5,698,905 relates to emergency starting of a hybrid with a dead battery, by rearranging connections to allow starting by towing.

Lutz 5,713,427 shows a coupling structure for a hybrid comprising a deformable, resilient disc member.

Lutz 5,829,542 shows vehicles with separate motors on each wheel of at least one pair of wheels.

Welke patent 5,833,022 shows a specific constructional arrangement for a clutch and single traction motor of a hybrid vehicle. No operating scheme is discussed.

Adler et al 5,816,358 shows automatic disconnection of the current supply in the event of accident or the like in vehicles having relatively high current and voltage electric power supplies, e.g., hybrid vehicles.

Gardner 4,753,078 shows a hopelessly complicated hybrid vehicle design involving, among other impracticalities, "recovery of electricity from electromagnetic wind generators, gyrogenerators, and gravitational generators, and for the recovery of compressed air from air pumps...replacing the standard shock absorbers."

Wicks 5,000,003 shows a "combined cycle" engine wherein heat normally lost in the exhaust gases and rejected by heat exchange with cooling water from an ICE is recovered and used to drive a turbine or the like, and suggests that this might be especially suitable for use in a hybrid vehicle.

Lay 5,141,173 shows a vehicle capable of flight as well as travel along the ground. An ICE can propel the vehicle or drive a generator and thence electric motors, depending on the range and speed of intended travel.

Kutter 5,242,335 shows a drivetrain for a hybrid vehicle, shown in automobile and bicycle embodiments, wherein muscle power is combined with power from an auxiliary motor.

Kuang 5,264,764 shows use of an ICE as a power source to serve as a range extender for an electric car, that is, the ICE does not directly propel the vehicle.

Addie 3,699,351 shows a bi-modal vehicle, such as a rail car, which can be propelled by an external power source, such as a third rail, or by a prime mover, such as a gas turbine. A split torque device allows some of the turbine torque to be delivered to the output shaft and the remainder to a motor/generator combination.

Shibata et al 3,719,881 shows a series hybrid, that is, an electric car comprising an ICE arranged to charge a battery connected to a traction motor, wherein the battery's state of charge is monitored and used to control operation of the ICE; the load on the ICE is monitored and the ICE is shut off when the load drops below a predetermined value.

Berman patent 3,753,059 shows a control circuit for a motor operated in both propulsive and regenerative modes, as might be employed in the hybrid vehicle drive system of Berman patent 3,566,717, already of record. Berman 3,790,816 shows an "energy storage and transfer power processor" apparently intended for use with the same system.

Williams 4,099,589 shows a series hybrid wherein the preferred power path is from an ICE to an AC generator to an AC motor, to the wheels; a rectifier, battery and DC motor are also provided as an auxiliary or additional power source.

Rowlett 4,233,858 shows a vehicle propulsion system wherein two electric motors are provided. Torque from the two motors is combined; excess torque is stored in a flywheel, to provide load-leveling.

Dailey 4,287,792 shows a variable gear ratio transmission.

Fiala 4,411,171 shows a hybrid vehicle power train in which a single electric motor/generator and an ICE are coupled to the wheels of the vehicle. Various operating modes are described.

Tankersley et al patent 5,403,244 shows an electric vehicle with a planetary gearbox for reducing the shaft speed of an electric motor to a speed suitable for driving the wheels of the vehicle, and also providing a direct drive.

Hadley et al 5,406,126 shows another serial hybrid. The invention appears to have to do with the method of regenerative charging offered.

Westphal patent 5,570,615 shows a three-mass flywheel construction, with two of the masses connected by springs and the thrid by planetary gears for balancing of various moments and vibrations.

Nedungadi patent 6,110,066 shows a hybrid vehicle operating in four modes, as follows (col. 4, lines 25 - 38): "There are four modes of operation for the vehicle, namely: (a) electric; (b) charge; (c) assist; and, (d) regenerative. In the electric mode, only the motor is providing propulsion power to the vehicle. In the charge mode, part of the engine power drives the vehicle and the rest is absorbed by the motor (operating as a generator) to charge the batteries. In the assist mode, both the engine and the motor are providing power to propel the vehicle. In the regenerative mode, power from the decelerating wheels is diverted to the motor so that it can be used to charge the batteries. .... The controller selects the most appropriate mode depending upon the position of the accelerator pedal, the vehicle speed and the state of charge of the battery." Nedungadi makes it clear that the idea is to keep the engine "as loaded as possible" (col. 8, line 46). In assist mode, this is done by keeping the engine at maximum power; in the charge mode, the engine is maintained at its point of maximum fuel efficiency. See col. 5, lines 46 - 53.

Fini patent 6,387,007 shows several embodiments of hybrids. Mode control appears to be accomplished responsive to accelerator pedal position.

Tsai et al 6,592,484 shows a hybrid comprising an ICE and a single motor as prime movers. The invention is directed to a transmission including four clutches and two planetary gearsets. Some 13 operating modes are stated to be provided.

Horwinski patent 3,904,883 is essentially a predecessor of the Horwinski patent already of record.

Yamada patent 6,041,877 was recently cited in an Office Action issued against a Japanese application based on a PCT application with disclosure corresponding to the disclosures of the two parent applications. According to a non-certified translation of the Office Action, Yamada was cited because it shows "a hybrid vehicle in which a battery is configured as two separate battery sub-banks"; this was cited against a claim not corresponding to any now in this application, including a similar recitation. (Claim 29 of issued patent 6,209,672 includes a comparable limitation.) The disclosure of Yamada otherwise seems merely cumulative to numerous references of record. Japanese Utility Model Application No. 50-099456 (provided with a translated summary sheet only) was also cited in the same Office Action, the Japanese Examiner stating that "there is described a technology in which two battery groups in an electrically driven vehicle (B1 and B2, B4 and B3) are connected in series and the middle of the two battery groups is earthed to a vehicle chassis." Again, this is not relevant to any claim now being asserted herein.

Tabata patent 5,887,670 shows a single-motor hybrid. Mode determination is accomplished (see Fig. 7) responsive to a "currently required output Pd" which is determined responsive to pedal position, rate of change thereof, vehicle speed and trasnmission lever position (see col. 23, lines 20 - 26).

Otsu et al patent 6,123,163 shows a single-motor hybrid configured as a sort of city scooter. The vehicle operates in different modes depending on the "aimed" torque, which is determined responsive to accelerator opening and vehicle speed.

See Fig. 13, col. 10, lines 56 - 67 and col. 17, lines 11 - 33. Otsu 6,260,644 seems to have the same disclosure, and Suzuki 6,253,865 to relate to the same design.

Arai patent 6,435,296 shows a hybrid with an engine driving one set of wheels and a motor driving the other. In order that a DC motor can be used, avoiding the expense of an inverter, the motor is to be used as little as possible.

Sherman 5,789,823 shows both a torque converter and a friction clutch in a single motor hybrid. This is essentially an engine-assist arrangement; the engine can only be started when the vehicle transmission is in neutral (see col. 3, lines 30 - 38), so that it must be run at all times, and the motor/generator is stated to only assist the engine during times of peak power requirement (col. 4, lines 36 - 38). Another Sherman patent 5,258,651 is not directed to hybrid vehicles, but to a system for starting an ICE.

Onimaru 6,007,443 (Nippon Soken) shows a hybrid wherein an ICE is connected through a CVT and a clutch to a motor/generator, the output shaft of which drives the wheels. Above a minimum velocity, the engine is operated at a maximum speed. See col. 7, line 17. At lower vehicle speeds, the engine is permitted to idle; see col. 6, lines 9 - 23.

Ehsani et al, in "Propulsion System Design of Electric and Hybrid Vehicles", discuss determination of the sizes and capacities of an ICE and traction motor for a hybrid vehicle. This is generally relevant to the subject matter of claims 16 and 112. However, note that Ehsani fails entirely to address the relationship claimed between the voltage and current of the battery bank, as claimed. Ehsani et al, in "Parametric Design of the Drive Train of an Electrically Peaking Hybrid (ELPH) Vehicle", go into further detail, and indicate that the vehicle of concern is a single-motor hybrid wherein torque from the ICE and motor can be combined by a "matchgear", as in applicant's prior patent 5,343,970. Ehsani patent 5,586,613, apparently directed to the same work, is discussed in the application as filed.

Yamaguchi et al, "Development of a New Hybrid System - Dual System", SAE paper 960231 (1996) appears to be merely cumulative to numerous patents to the same inventors already of record. "Dual System - Newly Developed Hybrid System" (publication details not known), by some of the same authors, of which only a partial copy is available, is generally cumulative but does provide a diagram showing operation of the various components as a function of time

Takaoka et al, in "A High-Expansion-Ratio Gasoline Engine for the Toyota Hybrid System", discuss the details of an ICE designed for use in a hybrid vehicle. This paper states that "By using the supplementary drive power of the electric motor, the system eliminates the light-load range, where concentrations of hydrocarbons in the emissions are high and the exhaust temperature is low." (p. 57; a similar statement is made on p. 59) and "By allocating a portion of the load to the electric motor, the system is able to reduce engine load fluctuation under conditions such as rapid accleeration. This makes it possible to reduce quick transients in engine load so that the air-fuel ratio can be stabilized easily." (p. 58). The former statement simply emphasizes the fact that engines are operated more efficiently at higher loads, and the latter that stoichiometric combustion can be more nearly obtained if the engine's speed and/or load is varied as slowly as possible.

Sasaki et al, "Toyota's Newly Developed Electric-Gasoline Hybrid Powertrain System" (publication data not available) provides a mathematical analysis of the planetary gearbox.

PCT application PCT/SE81/00280, published as WO 82/01170, shows a hybrid vehicle wherein an ICE is used for propulsion under some circumstances and an electric motor under others, e.g., to provide a forklift truck that operates electrically when indoors and is driven by the ICE when outdoors. The change from one torque source to the other is made as a function of vehicle speed. See p. 3, lines 19 - 28.

Japanese utility model publication 53-55105 (of which only a partial translation is available) appears to show a hybrid vehicle having both an ICE and a motor as sources of propulsive torque, but the description provided is inadequate to understand how the two sources are to be operated. The disclosure of Japanese patent application publication 48-64626 (of which only a partial translation is available) seems to be similar.

Japanese unexamined patent application publication 4-67703 (of which only a partial translation is available) appears to relate to an electric vehicle.

Japanese patent application publication 4-297330 (of which only a partial translation is available) seems to relate to supplementing the regenerative braking available using a traction motor as the source of braking torque with regenerative braking from a generator attached to an ICE, and with friction from motoring the engine under braking.

Japanese patent application publication 55-110328 (of which only a partial translation is available) relate to a vehicle wherein a first pair of wheels is driven by a "main driving unit", a second pair being driven by an "auxiliary power unit", wherein the auxiliary power unit is controlled responsive to a difference in speed between the first and second pairs of wheels.

Japanese utility model publication 51-103220 (of which only a partial translation is available) describes a control system for a hybrid wherein the output shaft of an ICE is connected to that of an electric motor through a clutch, the clutch being controlled to operate when speed sensors on the shafts indicate that their rotational speeds are equal.

Japanese patent 49-29642 (of which only a partial translation is available) also shows a hybrid wherein the shaft of an ICE is connected by a clutch to that of an electric motor; in this case a one-way clutch is also provided.

Japanese patent publication 6-245317 (of which only a partial translation is available) relates to a device for preventing overcharging of the battery of an electric vehicle.

European patent application publication no. 510 582 shows a vehicle powerplant featuring both an ICE and an electric motor as sources of propulsion, and thus a hybrid of sorts, though the term is not mentioned. No suggestion is made that the control of operating mode is made other than by an operator; the determining factor seems to be whether emission must be completely prohibited, as in indoor operation.

European patent application publication no. 510 582 also shows a hybrid vehicle featuring both an ICE and an electric motor as sources of propulsion. Again there is no teaching of the specifics of switching operating mode; the invention has to do with loading the ICE by means of the generator so as to match the speed of the engine to the speed of a drive shaft driven by the traction motor before engaging a clutch connecting the two.

German OS 25 17 110, provided with an English-language abstract, is stated by the abstract to show a hybrid vehicle with a turbine engine. It appears that the vehicle is operated as an electric car until the current drawn exceeds a preset value, when the turbine is actuated; thereafter, the turbine is run at an "optimum setting", with the load split between battery charging and vehicle propulsion.

Mayrhofer et al, "A Hybrid Drive Based on a Structure Variable Arrangement" (1994), shows a hybrid vehicle design involving an ICE, two motor/generators, a planetary gearbox to enable combinations of sources of torque, and no less than four clutches, obviously much more complicated than would be desirable. Of interest with respect to the present invention is that in one operating strategy (see page 196) Mayrhofer et al suggest that the ICE should be activated only when the mean value of the power demanded exceeds a limit for more than a minimum time, 20 seconds being the example given. It is apparent that the ICE is thus to be used only for load-leveling and that mode changes are not being made based on the road load *per se*. In other strategies the engine operation appears to be even further afield from applicants' simple and direct strategy.

A December 1990 *Popular Science* article, "Diesel-Electric VW", describes a hybrid wherein an electric motor, also serving a generator and engine starter, is disposed between clutches connecting the motor to an ICE on one side and the vehicle wheels on the other. It is not clear what modes are provided, although some transitions are apparently made responsive to accelerator pedal position and vehicle velocity.

A May 1991 *Popular Science* article, "Electric Vehicles Only", addresses the then-current state of the art in electric vehicles and mentions hybrids only peripherally.

An April 1991 article appearing in *NASA Tech Briefs* discusses lead/acid batteries having woven electrodes.

As indicated, none of the newly-cited patents made of record hereby disclose or suggest the invention claimed herein. Early and favorable action on the merits of the application is earnestly solicited.

Respectfully submitted,

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Dated

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	6 2 8 1 6 6 0	08/2001	Abe			
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DD	5 3 3 6 9 3 2	4/1994	Barske			
DD	6 1 7 0 5 8 7	1/2001	Bullock			
DD	5 8 8 7 6 7 4	3/1999	Gray			
DD	4 7 6 2 1 9 1	8/88	Hagin et al			
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OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER	DATE CONSIDERED 11/24/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

CANCELLED

PATENT & TRADEMARK OFFICE

OIPE IAP100 JUL 07 2006 PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201.DIV	APPLICATION NUMBER: 10/382,577
	APPLICANT: Severinsky et al	
	FILING DATE: 3/7/2003	GROUP ART UNIT: 3616

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JUN 02 2004

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EXAMINER [signature] DATE CONSIDERED 11/24/07

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OIPE JC177 MAY 2 8 2004 PATENT & TRADEMARK OFFICE

OIPE IAP100 JUL 0 7 2006 PATENT & TRADEMARK OFFICE

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OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Published application US 2001/0037905 ~~of~~ Nogi et al, 11/2001

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	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

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DD	Published patent application US 2003/0085577 of Takaoka et al, May 8, 2003

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	APPLICANT: Severinsky et al	
	FILING DATE: 3/7/2003	GROUP ART UNIT: 3616

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EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
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DD	4 2 9 7 3 3 0	10/1992	Japan			"	
DD	51 1 0 3 2 2 0	8/1976	Japan			"	

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DD	Mayrhofer et al "A Hybrid Drive Based on a Structure Variable Arrangement" (1994)

EXAMINER [signature] DATE CONSIDERED 11/29/07

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609: Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

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OIPE IAP100 JUL 0 7 2006 PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION

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APPLICANT	Severinsky et al
FILING DATE	3/7/2003
GROUP ART UNIT	3616

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U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
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DD	5562566	10/1996	Yang			
DD	5212431	5/1993	Origuchi et al			
	~~4165795~~	~~8/1979~~	~~Lynch et al~~			Previously cited
DD	5283470	2/1994	Hadley et al			
DD	5406126	8/1995	Hadley et al			
DD	5669842	9/1997	Schmidt			
DD	5771478	6/1998	Tsukamoto			
DD	5833570	11/1998	Tabata			
DD	5951614	9/1999	Tabata			
DD	5875691	3/1999	Hata			
DD	5931271	8/1999	Haka			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	510582	10/1992	European Patent Office				
DD	136055	3/1985	European Patent Office				
DD	2517110	10/1975	German				
DD	8201170	4/1982	PCT/SE81/00280				
DD	55110328	8/1980	Japan			part	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	"Diesel-Electric VW", *Popular Science*, December 1990, p. 30.
DD	"Electric Vehicles Only", *Popular Science*, May 1991, pp. 76-81 and 110.
DD	"Lightweight, High-Energy Lead/Acid Battery" *NASA Tech Briefs*, 4/91, 22-24.

EXAMINER [signature] DATE CONSIDERED 11/29/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION

DOCKET NUMBER	PAICE201.DIV
APPLICATION NUMBER	10/382,577
APPLICANT	Severinsky et al
FILING DATE	3/7/2003
GROUP ART UNIT	3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5951118	9/1999	Soejima			
DD	5984432	11/1999	Otomo et al			
DD	5979158	11/1999	Kaiser			
DD	5983740	11/1999	Salecker et al			
DD	6006149	12/1999	Salecker et al			
DD	6003626	12/1999	Ibaraki et al			
DD	6009365	12/1999	Takahara et al			
DD	4126200	11/1978	Miller et al			
DD	4090577	5/1978	Moore			
DD	5323688	6/1994	Walker			
DD	5384521	1/1995	Coe			
DD	5623194	4/1997	Boll			

FOREIGN PATENT DOCUMENTS

DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER [signature] DATE CONSIDERED 11/29/04

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION

DOCKET NUMBER	PAICE201.DIV
APPLICATION NUMBER	10/382,577
APPLICANT	Severinsky et al
FILING DATE	3/7/03
GROUP ART UNIT	3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5675203	10/1997	Schulze et al			
DD	5675222	10/1997	Fliege			
DD	5679087	10/1997	Lutz			
DD	5685798	11/1997	Lutz			
DD	5691588	11/1997	Lutz			
DD	5698905	12/1997	Ruthlein et al			
DD	5713427	2/1998	Lutz			
DD	5714851	2/1998	Antony et al			
DD	5856047	1/1999	Venkatesan et al			
DD	5851698	12/1998	Reichmann et al			
DD	4216684	8/1980	Hagin et al			
DD	4331911	5/1982	Park			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER [signature] DATE CONSIDERED 4/29/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/03	GROUP ART UNIT 3616

U. S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	4 4 1 6 3 6 0	11/1983	Fiala			
DD	4 5 9 1 0 1 6	5/1986	Matthews			
DD	4 5 9 2 4 5 4	6/1986	Michel			
DD	4 6 7 4 2 8 0	6/1987	Stuhr			
DD	4 7 5 3 0 7 8	6/1988	Gardner			
DD	5 0 0 0 0 0 3	3/1991	Wicks			
DD	5 1 4 1 1 7 3	8/1992	Lay			
DD	5 2 4 2 3 3 5	9/1993	Kutter			
DD	5 2 6 4 7 6 4	11/1993	Kuang			
DD	5 9 1 5 4 8 8	6/1999	Fliege			
DD	5 9 4 7 8 5 5	9/1999	Weiss			
DD	5 9 7 1 0 8 8	10/1999	Smith			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER	DATE CONSIDERED
[signature]	11/29/04

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/03	GROUP ART UNIT 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5971092	10/1999	Walker			
DD	5755302	5/1998	Lutz			
DD	5678646	10/1997	Fliege			
	~~5833022~~	~~11/1998~~	~~Welke~~			prev cited
DD	5816358	10/1998	Adler et al			
DD	3699351	10/1972	Addie			
DD	3719881	3/1973	Shibata et al			
DD	3753059	8/1973	Berman			
DD	3790816	2/1974	Berman			
DD	4099589	7/1978	Williams			
DD	4233858	11/1980	Rowlett			
DD	4287792	9/1981	Dailey			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER	DATE CONSIDERED
[illegible signature]	11/29/04

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OIPE JC177 MAY 2 8 2004 PATENT & TRADEMARK OFFICE

OIPE IAP100 JUL 0 7 2006 PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION

DOCKET NUMBER: PAICE201.DIV

APPLICATION NUMBER: 10/382,577

APPLICANT: Severinsky et al

FILING DATE: 3/7/03

GROUP ART UNIT: 3616

RECEIVED JUN 0 2 2004 GROUP 3600

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	4411171	10/1983	Fiala			
DD	5403244	4/1995	Tankersley			
	~~5406128~~	~~4/1995~~	~~Hadley et al~~			cited on pg 6
DD	5549524	8/1996	Yang			
DD	5547433	8/1996	Yang			
DD	5570615	11/1996	Westphal et al			
DD	5915489	6/1999	Yamaguchi			
DD	6110066	8/2000	Nedungadi et al			
DD	6135914	10/2000	Yamaguchi et al			
DD	6387007	5/2002	Fini			
DD	6563230	5/2003	Nada			
DD ✓	6592484	7/2003	Tsai			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Yamaguchi et al, "Dual System - Newly Developed Hybrid System" (incomplete)
DD	Takaoka et al "A High-Expansion-Ratio Gasoline Engine for the Toyota Hybrid System", *Toyota Technical Review* ~~47, 2, 1998~~ Vol.47, No. 2, April 1998
DD	Sasaki et al, "Toyota's Newly Developed Electric-Gasoline Hybrid Powertrain System" (publication data not available)

EXAMINER: [signature] DATE CONSIDERED: 11/29/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

OIPE MAY 2 8 2004 PATENT & TRADEMARK OFFICE

OIPE JUL 0 7 2006 IAP100 PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/03	GROUP ART UNIT 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	3904883	9/1975	Horwinski			
DD	6041877	3/2000	Yamada et al			
	~~5887670~~	~~3/1999~~	~~Tabata et al~~			prev. cited
DD	6123163	9/2000	Otsu et al			
DD	6260644	7/2001	Otsu			
DD	6255865	7/2001	Suzuki			
DD	6435296	8/2002	Arai			
DD	5258651	11/1993	Sherman			
DD	5789823	8/1998	Sherman			
DD	6007443	12/1999	Onimaru			

RECEIVED JUN 0 2 2004 GROUP 3600

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	~~50 0 9 9 4 5 6~~	~~1/1977~~	~~Japan~~		NOT SUBMITTED		

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Ehsani et al "Propulsion System Design of Electric and Hybrid Vehicles", *IEEE Trans. Ind. Elec.*, 44 1 (1997)
DD	Ehsani et al, "Parametric Design of the Drive Train of an Electrically Peaking Hybrid (ELPH) Vehicle", SAE paper 970294 (1997)
DD	Yamaguchi et al, "Development of a New Hybrid System - Dual System", SAE papers 960231 (1996)

EXAMINER	DATE CONSIDERED 11/29/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	:	
	:	
Severinsky et al	:	Examiner: N/A
	:	
Serial No.: 11/429,446	:	Group Art Unit: 3616
	:	
Filed: May 8, 2006	:	Att.Dkt:PAICE201.DIV.6
	:	

For: Hybrid Vehicles

Hon. Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Sir:

This application is a divisional of Ser. No. 10/382,577. Incorporated herein by reference are the several Information Disclosure Statements (IDSs) that were filed in Ser. No. 10/382,577, and its predecessor, Ser. No. 09/822,866, now Patent 6,554,088. Copies of the IDSs thus incorporated are attached, together with the corresponding PTO-1449 forms. Where available the PTO-1449s attached are those returned by the Examiner, showing corrections that were noted in prosecution of the earlier applications. Copies of the documents thus cited were supplied in the parent and grandparent applications, or in earlier predecessor applications Ser. Nos. 09/264,817, now patent 6,209,672, and 09/392,743, now patent 6,338,391, and copies are accordingly not now being supplied herewith.

The Examiner is respectfully requested to consider the documents thus made of record, and to initial the PTO-1449 forms, indicating that he has done so.

Should there be any questions, the Examiner is invited to telephone the undersigned at the number given below.

Early and favorable action on the merits is earnestly solicited.

Dated: July 6, 2006

Respectfully submitted,

Michael de Angeli
Reg. No. 27,869
60 Intrepid Lane
Jamestown RI 02835
401-423-3190

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	:
Severinsky et al	: Examiner: David Dunn
Serial No.: 10/382,577	: Group Art Unit: 3616
Filed: March 7, 2003	: Att.Dkt.:PAICE201.DIV
For: Hybrid Vehicles	:

Hon. Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

FOURTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

Applicant submits this Information Disclosure Statement for consideration by the Examiner. The issued patents from which this application claims priority have been asserted against Toyota Motor Corporation, Toyota Motor North America, Inc. and Toyota Motor Sales, USA, Inc. (collectively "Toyota") in civil action 2:04-CV-211 in the United States District Court for the Eastern District of Texas. A jury trial was recently conducted December 6-20, 2005, and a verdict holding the parent patents as valid but not infringed was returned.

Applicants submit herewith materials from this litigation for the purpose of full disclosure. Applicants respectfully request the Examiner to fully review and consider these materials in determining patentability of the present application. The materials submitted include transcripts of the trial and deposition testimony of the witnesses on whom Toyota relied for prior art assertions, with any confidential material redacted therefrom, together with copies of the documentary evidence discussed therein.

The materials also include a copy of the Court's Markman ruling construing the claims of the parent patents.

The Examiner is respectfully requested to consider these materials and indicate that he has done so in the file of this application.

Should the Examiner have any questions concerning the materials submitted, he is invited to telephone the undersigned at the number given below.

A Supplemental Notice of Allowability is earnestly solicited.

Respectfully submitted,

Dated: March 27, 2006

Michael de Angeli
Reg. No. 27,869
60 Intrepid Lane
Jamestown, RI 02835
401-423-3190

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	5371412	12/1994	Iwashita			
	5412251	5/1995	Furutani			
	5993169	11/1999	Adachi et al			
	6007451	12/1999	Matsui et al			
	6032753	3/2000	Yamazaki et al			
	6155364	12/2000	Nagano et al			
	5539318	7/1996	Sasaki			
	5680050	10/1997	Kawai et al			
	5964309	10/1999	Kimura et al			
	5883496	3/1999	Esaki et al			
	5905360	5/1999	Ukita			
	6158541	12/2000	Tabata et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

Trial and deposition transcripts of witnesses relied upon to assert invalidity of parent patents in Civil Docket No. 2:04-CV-211-DF (E.D. Texas)

Claim construction order entered September 28, 2005 in Civil Docket No. 2:04-CV-211-DF (E.D. Texas)

Toyota Hybrid System, Toyota Press Information, Tokyo, 1997

Prius Hybrid EV, Toyota brochure, undated

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	5253929	10/1993	Ohori			
	5326158	7/1994	Ohori			
	5476151	12/1995	Tsuchida et al			
	5569995	10/1996	Kusaka et al			
	5637977	6/1997	Saito et al			
	5789935	8/1998	Suga et al			
	5895100	4/1999	Ito et al			
	5951115	9/1999	Sakai et al			
	5973463	10/1999	Okuda et al			
	6053841	4/2000	Koide et al			
	5929594	7/1999	Nonobe et al			
	5924395	7/1999	Moriya et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	0136055	03.04.85	European Patent Office				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

		Miller et al, "Starter-Alternator for Hybrid Electric Vehicle.." (1996)
		Johnston et al, "The Design and Development of the [UC Davis].." (No date)
		Johnston et al, "The Design and Development of the [UC Davis].." (1997)
		Alexander et al, "A Mid-Sized Sedan Designed for High Fuel..." (No date)
		"PRIUS New Car Features", (Toyota manual) (1998)
		TRW Systems Group, "Analysis and Advanced Design Study..." (1971)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

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Page 1152 of 1654

INFORMATION DISCLOSURE CITATION IN AN APPLICATION		
	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	4646896	3/1987	Hammond et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	0769403	23.4.1997	European Patent Office				
	7172196	29.9.1994	Japan			X	
	9170533	9.5.1996	Japan			abst.	
	5319110	5.19.1992	Japan			abst.	
	3273933	12.5.1991	Japan			abst.	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

		Gelb, "An Electromechanical Transmission for Hybrid Vehicle..." (1971)
		Hirose et al, "The New High Expansion Ratio Engine..." (1997)
		Hong, "Toyota's Hybrid Program", *Road & Track*, August 1997
		Law, "Toyota Tech", *Car & Driver*, August 1997
		"Dual-Engine Fuel Saver", *Popular Mechanics*, July 1997
		"Toyota Launches Break-Through Hybrid EV", *Motor Trend*, September 1997

EXAMINER	DATE CONSIDERED

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201.DIV	APPLICATION NUMBER: 10/382,577
	APPLICANT: Severinsky et al	
	FILING DATE: 3/7/2003	GROUP ART UNIT: 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	7268922	10.17.1995	Japan			abst.	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

	"Toyota touts advances in safety, emissions", *Automotive News*, 4/28/97
	"'96 North Wind Performance", undated
	Wakefield, "History of the Electric Automobile - Hybrid Electric Vehicles" (1998)
	"Escort 92-94", undated
	"Near-Term Hybrid Vehicle Program", General Electric Company (1979)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	913846	3/1909	Pieper			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

"Electric and Hybrid Vehicle Design Studies", SAE SP-1243 (1997)

Gelb, "The case for Constant Speed Accessory Drives", (1975)

Sasaki, "Toyota's Newly Developed Hybrid Powertrain", (1998)

"Near-Term Hybrid Vehicle Program, Phase 1", General Electric Co. (1979)

"Near-Term Hybrid Vehicle Program, Phase 1, App. A.", Gen'l Elec. (1979)

"Joint Feasibility Study of Hybrid Vehicle, Final Report (1982)

EXAMINER	DATE CONSIDERED

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

		North American Technology Seminar plans, April 1997
		Hermance, THS Technical Explanation (undated)
		"Toyota" brochure describing Prius (undated)
		Hermance, "Toyota Hybrid System" (undated)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
	5412293	5/1995	Minesawa et al			
	5883484	3/1999	Akao			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	8214592	8.20.1996	Japan			abst.	
	10663833	3.6.1998	Japan			abst.	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

Cuddy et al, "Analysis of the Fuel Economy Benefit..." SAE 970289 (1997)

"Team Paradigm Shines in FutureCar Competition" (1996)

Takaoka et al, "Study of the Engine Optimized for Hybrid System" (undated)

Gelb et al, "Cost and Emission Studies of a Heat Engine/Battery.." (1972)

Gelb et al, "Design and Performance Characteristics..." SAE 690169 (1969)

"Electric/Hybrid Vehicles: Alternative Powerplants..." SAE SP-1284 (1997)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	:	
	:	
Severinsky et al	:	Examiner: David Dunn
	:	
Serial No.: 10/382,577	:	Group Art Unit: 3616
	:	
Filed: March 7, 2003	:	Att.Dkt.:PAICE201.DIV
	:	
For: Hybrid Vehicles		

Hon. Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Listed on attached PTO-1449 forms are a number of documents that have come to applicants' attention since the filing of the Supplemental Information Disclosure Statement filed in this application on May 28, 2004. Applicants' thus making these documents of record should not be deemed a concession that they are necessarily available as prior art as defined by 35 USC Sect. 102. The Examiner is respectfully requested to consider these newly-cited documents and to indicate that he has done so in the file of this application.

The relevance of the newly-cited documents to the present invention is summarized as follows:

Japanese Patent Application Publication 7-54983 (Nakagawa et al) (provided with noncertified translation) shows controlling the shifting of an automatic transmission. The usual method is described as controlling the ratio based on detected engine load and vehicle speed, following a predetermined shift pattern. Prior art shows detecting increase in loading, e.g., "uphill running", if the speed drops below shift boundary line while the throttle opening is over a predetermined value. This is stated to be workable only under limited circumstances. This invention calculates a "running load coefficient KFUKA" which is then smoothed and used to correct the predtermined shift pattern.

From paragraph 10, "[T]he running load coefficient KFUKA is calculated according to an equation KFUKA=2-(b/a) when the detected vehicle speed 'b' is lower than the standard loaded-vehicle speed 'a', and according to an equation KFUFA=a/c when the detected vehicle speed 'c' is higher than the standard value 'a' ". This is mathematically inconsistent, since both "b" and "c" are the "detected vehicle speed". Further, it is clear that KFUKA is a running load coefficient, that is, a correction factor somehow responsive to variation in running load, not the running load itself.

Japanese Patent Application Publication 4-244568 (Onishi et al) (provided with noncertified translation) - Shifting of an automatic transmission is controlled responsive to a predictive program that calculates the torque to be available after shifting. Running load is employed in this calculation. It is stated to be determined as follows:

"(0022) The running load estimating means 101 now multiplies the torque converter output torque Tt by the gear ratio "r" to calculate the torque Tm generated at the wheels, and calculates the running load T_L based on the relational formula T_L = Tm − M · rw · α from the vehicle mass M, the effective wheel radius rw and the acceleration α. The flow of this calculation shown in FIG. 6.

"(0023) In FIG. 6,

Step 601: Reading of the respective data of vehicle speed V_{SP} and engine rotational speed N, gear ratio "r" an acceleration α is performed.

Step 602: the turbine rotational speed Nt is calculated by the following formula:

$Nt = V_{SP}/120\pi/rw \cdot r \times 1000$

Step 603: Torque converter or rotational ratio "e" is calculated and pump torque coefficient τ and torque ratio "t" are searched.

$e = Nt/N$, $\tau = f_1(e)$, $t = f_2(e)$

Step 604: Pump torque Tp and turbine torque Tt are calculated.

$Tp = \tau \cdot (N/1000)^2$. $Tt = t \cdot Tp$

Step 605: Calculation of torque Tm. $Tm = Tp \cdot r$

Step 606: Calculation of running load T_L. $T_L = Tm - M \cdot r \cdot \alpha$".

This makes no sense. In particular, it is clear that the idea is to correct the torque at the wheels Tm by the factor M · r · α to reach the running load, but calculating M · r · α does not yield a torque in units of kg-m, but a value in kg − m^2/sec^2.

In any event it is clear that neither reference refers remotely to hybrid vehicles, much less controlling operating modes thereof responsive to road load.

US Patent 6,067,801 (Harada) is based on Japanese application 9-329430. The disclosure is directed to reducing driveline shock occasioned upon shutting off the engine in a hybrid by loading it using one of the two motor/generators. Road load per se is not discussed; mode switching is discussed only inferentially, e.g., "..at the time when the engine is not required, for example, during a reduction of the speed or a downslope run, the hybrid vehicle stops operation of the engine 150 and runs only with the motor MG2" (col. 9, lines 40 - 43). Harada states nothing of relevance to operating the engine when loaded to above a setpoint SP.

However, this reference is generally relevant in that it acknowledges that the engine can be loaded by the battery charging load as well as the loading required for vehicle propulsion (col. 1, lines 15 - 17), that the engine can be shut off when not needed (as noted, col. 9, lines 40 - 43) and that it should be operated at an efficient operating point (same). The vehicle's power requirements, including power for acceleration, for charging, and for auxiliaries, is calculated, and a decision made whether the engine is required. Engine activation is based on vehicle speed, or the necessity of battery charging (col. 10, line 41 - col. 11, line 18). The engine is run at low power levels (col. 12, line 49), and idling is permitted (col. 11, line 65). The engine can be motored to warm it up prior to starting (col. 12, line 17). It is noted that for a given output power requirement it is more efficient to run the engine at lower RPM and higher torque than at higher RPM and lower torque output (col. 13, lines 34 - 45). The minimum RPM of the engine in the loaded state is maintained greater than in the non-loaded state, in order to allow gentle variation in torque applied to the motor MG1 during mode changes, avoiding rough operation (col. 16, lines 17 - 38), not so as only to operate the engine when loaded to the point of efficient operation. Most of the topologies shown involve the usual planetary gearset for combining the torque from the engine and two motors, but an embodiment is shown in Fig. 12 which avoids the planetary gearbox and first motor in favor of a "clutch motor MG3" which includes first and second rotors that function as an electromagnetic coupling (col. 18, lines 43 - 56). A series hybrid version, in which the engine never transmits torque directly to the wheels, is shown in Fig. 13.

Japanese Patent Application Publication 11-122712 (Morita et al) (provided with partial noncertified translation) shows a hybrid with a traction motor and engine propelling the vehicle; a second motor drives the ancillaries and starts the engine (there is no suggestion that this second motor is used to charge the battery), so the topology is effectively a single-motor hybrid with a separate starter. The invention is essentially to disengage a clutch connecting the engine and wheels upon braking, so that the engine can be shut off; when braking ends, the starter is used to motor the engine, and when the accelerator is then applied fuel is supplied and the engine started. Mode shifting is thus performed strictly in accordance with the operation of the accelerator and brake pedals.

Japanese Patent Application Publication 11-113956 (Hisamura) (provided with partial noncertified translation) shows a control device for a continuously variable transmission. The slope of the road being driven on is determined by a calculation employing the actual torque being supplied and the vehicle speed and acceleration. The "flatland" required torque is calculated and compared to the actual torque, to determine the slope of the road, and the transmission ratio adjusted accordingly.

Japanese Unexamined Patent Publication 11-82260 (Tsuzuki et al) (supplied without translation) - Topology includes engine, first clutch, motor/generator, second clutch, and automatic transmission, and wheels, in that order. In order to reduce shock upon engine starting, the second clutch is opened and left open until the engine and motor/generator are synchronized. This would be completely useless, since power flow to the wheels would be interrupted, seriously impacting drivability. Moreover, this would occur under acceleration, just when it would be most annoying and possibly even unsafe.

Japanese Unexamined Patent Publication 11-82261 (Tsuzuki et al) (supplied without translation) is closely related to the above Tsuzuki patent application. According to notes provided by our searcher, this simply adds the idea of providing a starter on the engine. This would suffer the same drivability problem.

According to our German searcher, German applications 198 38 853, 102 60 435, and 198 14 402, (all supplied without translations) describe methods for starting the engines of single motor hybrids.

Fiala US patent 4,411,171 shows a single-motor hybrid wherein the engine is connected through a first clutch to one side of a flywheel; a second clutch on the other side of the flywheel allows the flywheel to be locked to the output shaft, for direct drive, or to serve as the sun gear of a planetary gearbox. The planet carrier is connected to the output shaft, and the ring gear to a single motor/generator. The flywheel can also be locked, which provides an electric-car mode. The vehicle must be stopped to allow starting of the engine (col. 3, line 55), so clearly the vehicle must be operated in distinct low speed (electric car) and high-speed hybrid modes. The engine is to be used to start the vehicle from a standing stop by using some of the engine's torque to drive the motor/generator, i.e., the motor/generator acts as a brake (col. 5, lines 1 - 7), with the planetary gearbox thus decoupling the engine from the output shaft.

Maeda U.S. patent 3,620,323 shows a hybrid vehicle in which the engine is intended to be operated at full throttle at all times; see the abstract, col. 1, lines 37 - 38, col. 5, lines 13 - 15.

Tabata et al U. S. Patent 6,317,665 is directed to control of a lock-up clutch in a hybrid vehicle so as to smooth transitions between operation in motor-drive and engine-drive modes. Tabata et al patent 6,183,389 is also directed to control of operation of lock-up clutches. Finally, Tabata patent 5,887,670 is also directed to smoothing transitions.

Hagiwara patent 5,565,711 is the US equivalent to a Japanese patent document cited against a Japanese application claiming priority from the same basic application as the present application. The Hagiwara patent relates to specifics of the connection of the individual batteries in a battery bank. No claims are pending in this application which are drawn to this aspect of the invention.

Again, the Examiner is respectfully requested to consider these documents, and to indicate that he has done so in the file of the application.

Dated: 2/17/05

Respectfully submitted,

Michael de Angeli
Reg. No. 27,869
60 Intrepid Lane
Jamestown, RI 02835
401-423-3190

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201.DIV	APPLICATION NUMBER: 10/382,577
1/2	APPLICANT: Severinsky et al	
	FILING DATE: 3/7/2003	GROUP ART UNIT: 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	6067801	5/2000	Harada et al			
DD	4411171	10/1983	Fiala			
DD	3620323	5/1968	Maeda			
DD	6317665	11/2001	Tabata et al			
DD	6183389	2/2001	Tabata et al			
DD	5565711	10/1996	Hagiwara			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	754983	2/1995	Japan			X	
DD	4244658	9/1992	Japan			X	
DD	11082261	3/1999	Japan				X
DD	11122712	4/1999	Japan			partial	
DD	62113956	5/1987	Japan			partial	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER: DD | DATE CONSIDERED: 3/16/05

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

OIPE JC98 FEB 2 2 2005 PATENT & TRADEMARK OFFICE

CANCELLED

OIPE IAP100 JUL 0 7 2006 PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION 2/2	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	11082260	3/1999	Japan				X
DD	19838853	8/1998	Germany				X
DD	19814402	3/1998	Germany				X

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER [signature] DATE CONSIDERED 3/16/05

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609: Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of :
:
Severinsky et al : Examiner: David Dunn
:
Serial No.: 10/382,577 : Group Art Unit: 3616
:
Filed: March 7, 2003 : Att.Dkt.:PAICE201.DIV
:
For: Hybrid Vehicles

Hon. Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

The issued patents from which this application claims priority are being asserted against an alleged infringer in civil litigation in the United States District Court for the Eastern District of Texas. The defendants in that case have brought a number of new patents and other documents to applicants' attention. New documents have also been cited in a Complete Search Report prepared by the European Patent Office, dated May 5, 2005 (copy enclosed) against a European application claiming priority from the same US applications. These newly-cited patents and other documents thus located are listed on attached PTO-1449 forms, and are discussed below. The Examiner is respectfully requested to consider these new documents and to indicate that he has done so in the file of this application, and to then re-issue the Notice of Allowance mailed April 21, 2005.

Citation of a document herein should not be considered an admission that the disclosure thereof is indeed relevant to the invention defined by the claims, nor that the document thus made of record is indeed effective as prior art under 35 USC 102.

It is respectfully submitted that although this Statement is being filed after issue of a Notice of Allowance, it is timely under 37 CFR 1.97 (e). The fee of $180.00 (per 37 CFR 1.17(p)) is enclosed.

It is respectfully submitted that none of the newly-cited patents or other documents made of record hereby disclose or suggest the invention claimed herein. Early and favorable action on the merits of the application - specifically, issue of the patent, the Issue Fee having been paid concurrently with submission of this Statement - is earnestly solicited.

Respectfully submitted,

Dated: 6/30/05

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1 / 5

CANCELLED

OIPE JC135 ... 2005 PATENT & TRADEMARK OFFICE

OIPE IAP100 JUL 0 7 2006 PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	5844342	12/1998	Miyatani et al			
DD	5804947	9/1998	Nii et al			
DD	5457363	10/1995	Yoshii et al			
DD	5907191	5/1999	Sasaki et al			
DD	5914575	6/1999	Sasaki			
DD	6005297	12/1999	Sasaki et al			
DD	6166499	12/2000	Kanamori et al			
DD	5801497	9/1998	Shamoto et al			
DD	5909720	6/1999	Yamaoka			
DD	5698955	12/1997	Nii			
DD	5428274	6/1995	Furutani et al			
DD	6077186	6/2000	Kojima et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	2419832	3/1978	France			X	
DD	3124201	10/1989	Japan			X	
DD	51 103220	2/1975	Japan			X	
DD	H5 64531	9/1984	Japan			X	
DD	S 48 49115	10/1971	Japan			X	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Winkelman et al, SAE paper 730511, "Computer Simulation...." (1973)
DD	Berman et al, IEEE VT-23, NO. 3, pp. 61-72 "Propulsion Systems...."(1974)
DD	Berman SPC-TUE-2 "Battery Powered Regenerative SCR Drive"(1970)
DD	Gelb et al "Performance Analyses..." ACS pub (1972), pp 977-988
DD	Berman SPC-TUE-1 "Design Considerations...." (1971)
DD	Berman SPC-TUE-2" All Solid State Method....." (1971)

EXAMINER [signature] DATE CONSIDERED 10/12/05

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

CANCELLED

OIPE JC139 JUL 07 2006 PATENT & TRADEMARK OFFICE

OIPE IAP100 JUL 07 2006 PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	5991683	11/1999	Takaoka et al			
DD	5473228	12/1995	Nii			
DD	5927415	7/1999	Ibaraki et al			
DD	5928301	7/1999	Soga et al			
DD	6176807	1/2001	Oba et al			
DD	5904631	5/1999	Morisawa et al			
DD	5789877	8/1998	Yamada et al			
DD	6087734	7/2000	Maeda et al			
DD	5973460	10/1999	Taga et al			
DD	5988307	11/1999	Yamada et al			
DD	5991683	11/1999	Takaoka et al			
DD	5818116	10/1998	Nakae			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	S 50 302 23	7/1973	Japan			X	
DD	WO 82 011 70	4/1982	PCT				
DD	0510582	12/1995	EPO				
DD	4297330	3/1991	Japan				✓

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Minorikawa et al, "Current Status and Future Trends...." (Undated)
DD	Baum et al "Semiconductor Technologies..." (Undated)
DD	Chen "Automotive Electronics in the Year 2000..." (Apparently 1992)
DD	Brusaglino, SAE paper 910244 "Electric Vehicle Development..." (1991)
DD	Anderson et al, SAE paper 910246 "Integrated Electric..." (1991)
DD	Burke, SAE paper 911914 "Battery Availability for Near-Term..." (1991)

EXAMINER [signature] DATE CONSIDERED 10/12/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

CANCELLED

OIPE JC139 JUL 8 2005 PATENT & TRADEMARK OFFICE

OIPE IAP100 JUL 07 2006 PATENT & TRADEMARK OFFICE

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Chang, IEEE AES Magazine (1993) "Recent Developments of Electric ..."
DD	Kamiyama et al, IEEE 0-7803-0582-5 (1992) "Application Trends...."
DD	Sen, IEEE Trans. Ind. Elec. (1990) "Electric Motor Drives..."
DD	Wang et al, PCSC '71 Record, "Analysis of SCR Chopper Drive" (1971)
DD	EPRI Report TR-101264 "Assessment of Electric Motor Technology (1992)
DD	Berman et al, SAE paper 720111 "Electric Car Drives...." (1972)

EXAMINER [signature] DATE CONSIDERED 10/12/05

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

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Page 1172 of 1654

OIPE JC135 CANCELLED JUL 07 2005 PATENT & TRADEMARK OFFICE

OIPE IAP100 JUL 07 2006 PATENT & TRADEMARK OFFICE

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	WO99 2 4 2 8 0	11/1997	PCT			X	
DD	EP07 4 3 2 1 1	5/1996	EP				
DD	EP08 3 9 6 8 3	10/1997	EP				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Gelb et al, "The Application of Solid Electrolyte Batteries..." (Undated)
DD	Miller, "Integrated Power Module Requirements for Automotive..." (Undated)
DD	Vukosavic et al, IEEE Trans. Ind. App. "SRM Inverter Topologies..." (1991)

EXAMINER [signature] DATE CONSIDERED 10/12/05

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of :
Severinsky et al : Examiner: N/A
Serial No.: 09/822,866 : Group Art Unit: 3619
Filed: April 2, 2001 : Att. Dkt.: PAICE201
For: Hybrid Vehicles

Hon. Commissioner of Patents and Trademarks
Washington, DC 20231

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Listed on attached PTO-1449 forms are a number of new patents discovered after filing of the above application. Copies of the listed patents are enclosed. The Examiner is respectfully requested to consider these patents with respect to the claims of this application.

The relevance of the newly-listed patents may be summarized as follows:

US patent 6,307,276 to Bader shows a hybrid drive system comprising an engine, a traction motor coupled to the countershaft of a multispeed transmission, and a controller which determines a running average value for the vehicle's "required driving torque". The engine output power is then varied as the average required power changes. The specification and claims give examples of 15 and 50 seconds as the time period over which the average is calculated, and it is made clear that the engine power is varied accordingly slowly. Where the engine power is insufficient to satisfy the instantaneous torque requirement, the battery is used to supply power to a traction motor; conversely, when the engine is producing more power than is needed, the excess is used to charge the batteries.

Insofar as Fig. 2 of Bader suggests that the "required driving torque" can be negative (for example, a negative torque can be considered to be applied to the motor/generator(s) by the kinetic energy of the vehicle, i.e., under deceleration or descents, for regenerative braking), this parameter might be misunderstood to be generally comparable to the "road load" parameter, which is analyzed by the present system to make its mode switching determinations, as illustrated by Figs. 6, 7, and 9. However, Bader's "drive power P_o can be calculated from the torque M_o and the rotational speed n_o". Col. 4, lines 21-22. Hence the "drive power" is not in fact suggestive of applicants' road load, since the engine output, i.e., "the torque M_o at the gear input" (col. 4, line 18), cannot be negative.

In any event, there is no suggestion in Bader of changing operational modes of a hybrid vehicle responsive to the value of the "drive power P_o", whether or not this is fairly equivalent to the road load. As made explicit by the relevant claims 1 - 9 of this application, according to an important aspect of the invention the vehicle is operated in different modes according to the road load (among other variables), and so that the engine is operated only under sufficient load to make its operation efficient. For example, when the road load is low, e.g., at low speeds, the engine is run only as necessary to charge the batteries. By comparison, in Bader it appears the engine is to be run constantly, and its speed varied slowly in accordance with the then average value of drive power. Bader thus fails to teach an important aspect of the invention.

Nii patent 6,131,680 is directed to a hybrid vehicle wherein an internal combustion engine and first and second motors are all connected to one of the sun gear, the planet carrier, or the ring gear of a planetary gearbox. Nii adjusts the relative gear ratios according to the torque required, which is apparently derived directly from the position of the accelerator pedal - see col. 22, lines 27 - 30. The Nii hybrid is operated in different modes depending on the state of charge of the battery, and the torque required. See Fig. 9. Under certain circumstances the planetary gearbox may be locked-up to avoid inefficiency. See, e.g., col. 9 line 1 - 7, and Fig. 10. However, the modes shown by Nii are not the same as those used by applicants, although there are some similarities. For example, as stated at col. 37, lines 1 - 6, and in Fig. 26, Nii sets his engine speed to idle when the vehicle is being operated in "motor driving" (i.e., electric car) mode; this is highly inefficient, since the engine produces no useful power at idle. By comparison, applicants shut the engine off completely except when it is being operated at high efficiency.

Mikami patent 5,839,533 is discussed in the application as filed, but was apparently not listed on the PTO-1449 forms filed previously; this patent is acordingly listed on the PTO-1449 filed herewith. A copy of this patent is also provided herewith.

Stemler patent 6,300,735 relates to control of planetary gearboxes as might be used in hybrid vehicles to control the torque supplied by the internal combustion engien and electric motors. Such a gearbox is not a feature *per se* of the invention described by the claims of the present application.

Yanase et al patent 6,318,487 shows a scheme for braking a hybrid vehicle when the battery is fully charged, so that regenerative braking would be inappropriate, and whereby friction braking is avoided; specifically, the engine is motored, so that energy is consumed by compressing air in the engine. This is not a feature of the invention defined by the claims of this application.

Deguchi et al patent 6,278,915 shows a control system for a hybrid comprising a continuously-variable transmission, wherein the transmission ratio is set responsive to target values for the driving torque, the generated electrical power, and the engine speed. Such a transmission is not found in the system defined by the claims of this application, and the control scheme described by this patent is irrelevant to the present claims.

Deguchi et al patent 6,190,282 relates to controlling the engine, motor, and clutch of a hybrid so as to avoid shock to the passengers upon clutch engagement. This is not relevant to the claims of the present application. A similar Deguchi et al patent, 5,993,351, was made of record previously.

Obayashi et al patent 6,232,733 appears to be a further development of the invention described in Egami patents 5,789,881 and 6,018,694, previously made of record. All three of these patents relate to operating the electric motors of a hybrid to reduce vibration when the engine is started. This is not a feature of the claims of this application.

Friedmann et al patent 5,788,004 shows a control system for hybrid vehicles wherein the overall system efficiency is continuously optimized by adjustment of the operational parameters of the various system components.

Kashiwase patent 6,146,302 shows a drive system for a hybrid wherein an engine and first motor are connected to the ring gear of a planetary gearbox, a second motor is connected to its planet carrier, a transmission is connected between the planet carrier and the road wheels of the vehicle, and clutches are provided to engage two of the sun gear, planet carrier and ring gear. No such planetary gearbox is required by the system of the invention.

Frank patent 6,116,363 is stated to be a continuation-in-part of patent 5,842,534, already made of record and disucssed in this application as filed. Both of these Frank patents disclose a braking system for a hybrid vehicle wherein the first 30% of pedal travel initiates regenerative braking, while the latter 70% of pedal travel initiates mechanical braking. See also Frank patent 6,054,844, already of record, which limits the braking torque to be provided by regenerative braking as a function of vehicle speed.

Maeda et al patent 6,074,321 shows a transaxle for a hybrid vehicle having a specific construction that is not particularly relevant to any of the claims of this application.

Moroto reissue patent Re. 36,678 is a reissue of patent 5,513,719, already of record.

Finally, Severinsky et al patent 6,338,391 has recently issued on application Serial No. 09/392,743, that is, is one of the parent applications.

An early and favorable action on the merits of the application is earnestly solicited.

Respectfully submitted,

2/8/02
Dated

Michael de Angeli
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Jamestown, RI 02835
401-423-3190

INFORMATION DISCLOSURE CITATION IN AN APPLICATION

DOCKET NUMBER: ~~ANA201~~

APPLICATION NUMBER: ~~09/822,866~~ 10/382,577

APPLICANT: Severinsky et al

FILING DATE: April 2, 2001

GROUP ART UNIT: ~~3619~~ 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	6307276	10/2001	Bader			
	6131680	10/2000	Nii et al			
	5839533	11/1998	Mikami et al			
	6300735	10/2001	Stemler			
	6318487	11/2001	Yanase et al			
	6278915	8/2001	Deguchi et al			
	6190282	2/2001	Deguchi et al			
	6232733	5/2001	Obayashi et al			
	5788004	8/1998	Friedmann et al			
	6146302	11/2000	Kashiwase			
	6116363	9/2000	Frank			
DD	6074321	6/2000	Maeda et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER: [signature]

DATE CONSIDERED: 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER ~~09/822,866~~ 10/382577
	APPLICANT Severinsky et al	
	FILING DATE 4/2/2001	GROUP ART UNIT ~~3619~~

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	Re 36678	5/2000	Moroto et al			
DD	6338391	1/2002	Severinsky et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER DD DATE CONSIDERED 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	
Severinsky et al	Examiner: David Dunn
Serial No.: 09/822,866	Group Art Unit: 3616
Filed: April 2, 2001	Att. Dkt.: PAICE201
For: Hybrid Vehicles	

Hon. Commissioner of Patents and Trademarks
Washington, DC 20231

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Listed on accompanying PTO-1449 form(s) are a number of additional patents that may be considered relevant by the Examiner to the claims of this application. These patents were identified in supplemental searching conducted after the filing of the application. Copies of the newly-cited documents are provided herewith. The examiner is respectfully requested to consider these documents in connection with the patentability of the claims of this application. Citation of these documents should not be construed to admit they are necessarily statutory prior art effective against this application.

The relevance of the documents thus cited is as follows:

Goehring et al patent 6,394,209 discloses a hybrid vehicle in which the internal combustion engine is stated to be operated only at or near full load. To thus operate the engine of the vehicle of the invention is an object of the invention, and a limitation to that effect is present in claim 1 of the application as amended. However, the Goehring reference refers only to a serial hybrid, and therefore does not teach a hybrid vehicle operated in different modes responsive to the road load, as also required by claim 1.

Tabata et al patent 6,081,042, to be candid, is extrememly difficult to comprehend. It does appear that Tabata shows a hybrid vehicle which can be driven by a motor/generator, an engine, or both, the operation mode to be chosen based on "the currently required output Pd" and the battery state of charge. See Fig. 6 and cols. 17 - 20. Insofar as understood, the value Pd is not the same thing as applicants' instantaneous torque requirement or road load RL. Pd is defined as "an output of the hybrid drive system 210 required to drive the vehicle against a running resistance. This currently required output Pd is calculated according to a predetermined data map or equation, on the basis of the operation amount θ_{AC} of the accelerator pedal, a rate of change of this value θ_{AC}, running speed of the vehicle (speed N_o of the output shaft 19) or the currently established operating position of the automatic transmission." Col. 18, lines 34 - 42.

Another Tabata patent, 5982,045, is directed to control of mode shifting in a hybrid such that transmission ratios or torque distribution ratio changes are prevented from occurring concurrently with mode shifting, the goal evidently being to smooth mode shifting. No disclosure of control of mode shifting responsive to a quantity comparable to applicants' road load is apparent.

Lawrie et al patent 5,993,350 discloses an "automated manual transmission clutch controller" which purports to combine the advantages of conventional automatic and manual transmissions. Mode shifting is evidently carried out responsive to any or several of various "information..includ[ing] vehicle speed, RPM or the like..[or] other vehicle condition signals". Col. 8, lines 37 - 49. The disclosures of three further Lawrie and Lawrie et al patents, 6,006,620, 6,019,698, and 5,797,257 appear to be essentially identical.

Nagano et al patent 6,059,064 shows a hybrid vehicle and appears to be directed to improvements in the braking system employed; these include using a prime mover (e.g., an electric motor) on one axle and another, e.g., an IC engine on another axle. Hill-holding is also addressed, as is anti-lock. The improvements in brake "feel" addressed in the present application do not appear to be discussed by Nagano.

The Examiner is respectfully urged to consider these patents in connection with examination of this application, and to indicate that he has done so in the file of the case.

Respectfully submitted,

9/1/02
Dated

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JUL 0 7 2006
OIPE IAP100
PATENT & TRADEMARK OFFICE

U.S. PTO 10/382577 03/07/03

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201	APPLICATION NUMBER: 09/822,866 10/382577
	APPLICANT: Severinsky et al	
	FILING DATE: 4/2/2001	GROUP ART UNIT: 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	6394209	5/2002	Goehring et al			
	6081042	6/2000	Tabata et al			
	5982045	11/1999	Tabata et al			
	5993350	11/1999	Lawrie et al			
	6019698	02/2000	Lawrie et al			
	5979257	11/1999	Lawrie			
	6006620	12/1999	Lawrie et al			
DD	6059064	05/2000	Nagano et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER [signature] DATE CONSIDERED 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

Notice of References Cited	Application/Control No. ~~09/822,866~~	Applicant(s)/Patent Under Reexamination SEVERINSKY ET AL.	
	Examiner David Dunn	Art Unit 3616	Page 1 of 1

JC498 U.S. PTO 10/382577 03/07/03

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
DD	A	US-6,315,068	11-2001	Hoshiya et al.	180/65.2
DD	B	US-6,330,498	12-2001	Tamagawa et al.	701/22
DD	C	US-6,359,404	03-2002	Sugiyama et al.	318/432
DD	D	US-6470983	10-2002	Amano et al.	180/65.2
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	11/19/04

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	:
Severinsky et al	: Examiner: David Dunn
Serial No.: 09/822,866	: Group Art Unit: 3616
Filed: April 2, 2001	: Att. Dkt.: PAICE201
For: Hybrid Vehicles	

Hon. Commissioner of Patents and Trademarks
Washington, DC 20231

THIRD SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Listed on accompanying PTO-1449 form(s) are five Japanese patent publications that may be considered relevant by the Examiner to the claims of this application. These publications were cited by the Japanese Patent Office in an office action dated September 2, 2002 in connection with prosecution of a Japanese patent application corresponding to the parent US applications, Ser. No. 09/264,817, now patent 6,209,672, and Ser. No. 09/392,743, now patent 6,338,391. A copy of a translation of this Japanese office action is attached, and copies of the newly-cited documents are provided herewith marked (1) - (5), in accordance with the Japanese Examiner's usage; copies of uncertified, partial translations of references 1 and 4 are also provided. The Examiner is respectfully requested to consider these documents in connection with the patentability of the claims of this application.

The relevance of the documents thus cited is as follows:

Japanese utility model registration 63-82283, published as "laid-open No. 2-7702", which was referred to in the Japanese office action as Reference 1 (a partial noncertified translation also being supplied), shows a hybrid vehicle comprising an internal combustion engine, an electric "traction" motor for providing additional torque to the wheels of the vehicle, and a second electric motor that can be operated to also supply additional torque to the wheels or operate as a generator to charge the battery during braking or hill descent. Typically, such hybrids are operated in different modes depending on whether the vehicle is sitting at a traffic light, accelerating, cruising on the highway, and so on. The same is true of the vehicle of the present invention.

In order that the hybrid vehicle can be made commercially acceptable, it is important that the "mode switching" decisions be made by a microprocessor or the like instead of the driver. Various references teach making this decision in different ways. Reference 1 does not address this question. Commonly, as in Japanese published application 06-080048, cited by the Japanese patent office as Reference 3 (which corresponds to US patent 5,697,466, already of record), the decision is made based on the degree to which the driver has depressed the accelerator pedal. By comparison, according to the present invention, as discussed extensively in the earlier prosecution of this and the parent applications, the mode switching decision is made based on the vehicle's instantaneous torque requirement or "road load" RL.

As previously, it is important to emphasize exactly what the terms "road load" RL means as used in the present claims, to distinguish over the art. "Road load" is a somewhat subtle concept, since during many phases of vehicle operation the road load quantitatively resembles, for example, the operator's foot pressure on the accelerator pedal, or simply the engine output power. However, the road load as used herein is neither of these. "Road load" as used herein is simply that amount of torque that must be supplied to the vehicle wheels in order to carry out the operator's current command.

Note that "road load" as thus defined can be positive, as during highway cruising, "highly" positive, as during acceleration or hill-climbing, negative, as during hill descent, and "heavily" negative, as during braking. Figs. 7 and 13 show this clearly, and it is explained in the specification of the application as well. The flowchart of Fig. 9 illustrates precisely how the mode switching decisions are made responsive to road load (with an additional variation possible based on the battery state of charge.)

The fact that according to the present invention the mode switching decisions are made responsive to road load, a quantity which can be positive or negative, distinguishes this invention from all prior art of which we are aware. It will be appreciated that making all of the mode switching decisions based essentially on monitoring this single variable (with subsidiary attention to the battery state of charge, as below) greatly simplifies the decision-making process, as compared, for example, to a system in which the operator's foot pressure on the throttle and brake pedals must be continually monitored.

The new references made of record hereby does not show this invention. Reference 1 does show a hybrid vehicle having components arranged comparably to those recited in claim 1, but there is no mention of the manner in which the mode-switching determinations are made. The Japanese Examiner made the comment that "the vehicle is operated in a plurality of operating modes in response to states of operation such as a load of the vehicle and the like", apparently based on the description in reference 1 of vehicle operation in different modes depending on the driving conditions. However, we find nothing in reference 1 that suggests mode switching based on road load as defined above.

None of the other references cited by the Japanese Examiner and made of record hereby (nor any of those previously made of record, of course) supply this deficiency of Reference 1. The Japanese Examiner cited published application 06-144020 (referred to as reference 2) against claim 1, for showing that the first motor also starts the engine, and cited reference 3 against claim 2, for showing that the state of charge of the battery can be considered in mode switching.

More specifically, in his remarks concerning claim 4, the Japanese Examiner asserted that reference 3 describes mode switching responsive to "road load (a press down amount of an accelerator pedal)(see [Fig. 3]) or the like". As above, "road load" as used in this application is something quite different than the degree to which the accelerator pedal is pressed down; for example, the latter cannot be negative, and road load as used herein can decidedly be negative. We have reviewed US patent 5,697,466 (which corresponds to Reference 3) in detail and it shows nothing comparable to mode switching based on road load as used in this application.

Claims 8 and 9 of this application are directed to the "turbocharger-on-demand" concept, which was an important aspect of the invention in parent application Ser. No. 09/392,743, now patent 6,338,391. Claims 15 - 20 of the Japanese application recite this concept, i.e., that of a turbocharger that is operated only when the road load exceeds a predetermined value for more than a minimum period of time. That is, the turbocharger is not operated continually, as in the usual prior art vehicles, but is only operated when needed, i.e., when road load exceeds the engine's normally aspirated torque capabilities (i.e., RL > MTO); moreover, the turbocharger is operated only when RL > MTO for more than some predetermined period of time T. This is an extremely powerful concept, and one which is only applicable to a hybrid vehicle. Providing the turbocharger on demand allows the engine to provide additional torque when needed, but to operate as a smaller, more efficient engine at other times.

More specifically, in a conventional turbocharged vehicle the turbocharger is spinning constantly, so that a turbine driven by the exhaust flow drives a compressor forcing air into the engine. The main problem with turbochargers as thus used is poor throttle response or "turbo lag", that is, a substantial time delay between the driver calling for more power by pressing on the accelerator pedal and the engine's response. While some progress has been made, mostly by use of smaller turbochargers, this problem is inevitable to some degree, since it takes some time for the turbocharger to "spool up" to its full speed.

The Japanese Examiner cited Japanese published application 55-069724 as reference 4; as noted, a partial noncertified translation of this reference is also provided. Reference 4 shows a turbocharger which is operated on demand, in response to a "load detecting means"; this is the first reference we have seen showing this concept. There is no suggestion of use of this turbocharger in a hybrid vehicle. A conventional (i.e., non-hybrid) vehicle fitted with a turbocharger of this type would have extremely poor throttle response if used to provide additional power for passing (i.e., overtaking) or hillclimbing; the "turbo lag" inherent in operation of a turbocharger starting from zero rpm would be on the order of tens of seconds, which would be totally unacceptable for a consumer vehicle. Possibly such a system would be useful in heavy truck operation or the like, where the load will vary significantly depending on whether the truck was loaded or not; in that case, the operator could be the "load detecting means", i.e., could throw a switch when he knew high power would be needed for an extended period of time.

By comparison, a turbocharger can be employed "on demand" in a hybrid vehicle according to the invention without poor throttle response caused by turbo lag, and without requiring any intervention by the operator. This is simply because the traction motor can be used to supply the vehicle's torque requirements in excess of MTO. Thus, when RL > MTO, the traction motor provides the additional torque required. If RL > MTO for longer than T, the turbocharger is activated and begins to spin. When it is up to operating speed, the traction motor can be deactivated. All this is shown clearly by Fig. 13, and would not be possible simply given the turbocharger-on-demand of Reference 4 in a conventional, non-hybrid vehicle. By comparison, in the present vehicle, at no point are the vehicle's torque requirements not met; therefore there is no "turbo lag".

It is apparent that this advantage can only be achieved by use of a turbocharger on demand in a hybrid vehicle. No combination of references can fairly be said to make this obvious. Specifically, the Japanese Examiner's comment as to claim 17, "it is a usual matter to control a turbocharger in response to a road load or the like" is not correct, for several reasons: no reference shows taking any kind of control action in response to road load as claimed; no reference suggests combining the turbocharger on demand of Reference 4 with a hybrid vehicle; and certainly no reference suggests the complete elimination of the turbo lag problem thus achieved, while at the same time the vehicle's useful load range is greatly broadened.

Finally, Japanese published application 04-274926 (Reference 5) was cited for a showing of preheating a catalyst before starting the associated engine, which is not a feature of the present claims.

The Examiner is respectfully urged to consider these patents in connection with examination of this application, and to indicate that he has done so in the file of the case.

Respectfully submitted,

Nov. 28, 2002
Dated

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OIPE JUL 0 7 2006 IAP100 PATENT & TRADEMARK OFFICE

JC498 U.S. PTO 10/382577 03/07/03

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201	APPLICATION NUMBER: ~~09/822,866~~ 10/382577
	APPLICANT: Severinsky et al	
	FILING DATE: 4/2/01	GROUP ART UNIT: 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	63 8 2 2 8 3	6/1988	Japan				
DD	06 1 4 4 0 2 0	11/1992	Japan				
DD	06 0 8 0 0 4 8	11/1992	Japan				
DD	55 0 6 9 7 2 4	11/1978	Japan				
DD	04 2 7 4 9 2 6	2/1991	Japan				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER	DATE CONSIDERED 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

OIPE JUL 0 7 2006 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	
Severinsky et al	Examiner: N/A
Serial No.: N/A	Group Art Unit: N/A
Filed: Herewith	Att. Dkt.: PAICE201.DIV
For: HYBRID VEHICLES	

Hon. Commissioner of Patents and Trademarks
Washington, DC 20231

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

This application is a divisional of Ser. No. 09/822,866. Incorporated herein by this reference are the original and three supplemental Information Disclosure Statements filed in the parent, copies of which are enclosed herewith. These, together with an Examiner's Notice of References Cited, a copy of which is also enclosed, collectively list all of the art deemed relevant to the claims of the application. Copies of the references were provided in the parent or in the applications from which it in turn claimed priority and thus are not being provided herewith. The Examiner is requested to indicate that all of the art thus listed has been considered.

Early and favorable action on the merits is earnestly solicited.

3/5/03
Dated

Respectfully submitted,

Michael de Angeli
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401-423-3190

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of

Severinsky et al

Serial No.: 09/822,866

Filed: April 2, 2001

For: Hybrid Vehicles

Examiner: N/A

Group Art Unit: N/A

Att. Dkt.: PAICE201

Hon. Commissioner of Patents and Trademarks
Washington, DC 20231

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Listed on attached PTO-1449 forms are the issued patents and literature references considered to be most relevant to the patentability of the claims of this application. Copies of the patents listed on page 15 of the PTO-1449 are attached for the convenience of the Examiner, as is a copy of German patent 1,905,641, with uncertified translation. Copies of the other listed references were provided to the Examiner in connection with one or both of patent applications 09/264,817 and 09/392,743, so additional copies are not being submitted herewith.

Comments on the relevance of the new references which are material to the claims of this continuation-in-part *per se* are found in the application as filed, while the comments on these references found in the prosecution files of the two parent applications are also incorporated by reference herein.

Early and favorable action on the merits is earnestly solicited.

5/21/01
Dated

Respectfully submitted,

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201	APPLICATION NUMBER: ~~09/822,866~~ 10/382577
	APPLICANT: Severinsky et al	
	FILING DATE: 04/02/01	GROUP ART UNIT: ~~N/A~~ 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5343970	9/94	Severinsky	180	65.2	
	5492192	2/96	Brooks et al			
	3566717	3/71	Berman et al			
	3732751	5/73 ~~5/93~~	Berman et al			
	4165795	8/79 ~~8/49~~	Lynch et al			
	5117931	6/92	Nishida			
	3923115	12/75	Helling			
	4588040	5/86	Albright, Jr., et al			
	5318142	6/94	Bates et al			
	5120282	6/92	Fjällström			
	4405029	9/83	Hunt			
	4470476	9/84	Hunt			
DD	4305254	12/81	Kawakatsu			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	1905641	6/76	Germany			X	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Simanaitis, "Electric Vehicles", *Road & Track*, May 1992, pp. 126-136
DD	Reynolds, "AC Propulsion CRX", *Road & Track*, Oct. 1992, pp. 126-129
DD	Kalberlah, "Electric Hybrid Drive Systems...", SAE Paper No. 910247, 1991
DD	Bullock, "The Technological Constraints of Mass,Volume, Dynamic Power Range and Energy Capacity..." SAE Paper No. 891659 1989
DD	Electric and Hybrid Vehicle Technology, vol. SP-915, SAE, Feb. 1992

EXAMINER: DD | DATE CONSIDERED: 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201	APPLICATION NUMBER: 09/822,866
	APPLICANT: Severinsky et al	
	FILING DATE: 04/02/01	GROUP ART UNIT: N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	4407132	10/83	Kawakatsu			
	4335429	6/82	Kawakatsu			
	4180138	12/~~19~~ 79	Shea			
	4351405	9/82	Fields et al			
	4438342	3/84	Kenyon			
	4593779	6/86	Krohling			
	4923025	5/90	Ellers			
	3791473	2/74	Rosen			
	4269280	5/81	Rosen			
	4400997	8/83	Fiala			
	4697660	10/87	Wu et al			
	3970163	7/76	Kinoshita			
DD	4095664	6/78	Bray			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Wouk, "Hybrids: Then and Now", IEEE Spectrum, Vol. 32, 7, July 1995
DD	Bates, "Getting a Ford HEV on...", IEEE Spectrum, Vol. 32, 7, July 1995
DD	King et al, "Transit Bus takes...", IEEE Spectrum, Vol. 32, 7, July 1995
DD	Yamaguchi, "Toyota readies gasoline/electric hybrid system", Automotive Engineering, July 1997, pp. 55-58
DD	Wilson, "Not Electric, Not Gasoline..." Autoweek, June 2, 1997, pp. 17-18

EXAMINER	DATE CONSIDERED 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER ~~09/822,866~~ 10/382577
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	4148192	4/79	Cummings			
	4306156	12/81	Monaco et al			
	4313080	11/82	Park			
	4354144	10/82	McCarthy			
	4533011	8/85	Heidemeyer			
	4951769	8/90	Kawamura			
	5053632	10/91	Suzuki et al			
	3525874	8/70	Toy			
	3650345	8/72	Yardney			
	3837419	9/74	Nakamura			
	3874472	4/75	Deane			
	4042056	8/77	Horwinski			
DD	4562894	1/86	Yang			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Bulgin, "The Future Works, Quietly", Autoweek, Feb. 23, 1998 pp. 12-13
DD	"Toyota Electric and Hybrid Vehicles", a Toyota brochure
	Nagasaka et al, "Development of the Hybrid/Battery ECU...", SAE paper 981122, 1998, pp. 19-27

EXAMINER	DATE CONSIDERED
DMD	11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICB201	APPLICATION NUMBER 09/822,866
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	4611466	9/86	Keedy			
	4815334	3/89 ~~8/89~~	Lexen			
	3623568	11/71	Mori			
	3454122	7/69 ~~8/69~~	Grady, Jr.			
	3211249	10/65	Papst			
	2666492	1/54	Nims et al			
	3502165	3/70	Matsukata			
	1824014	9/31	Froelich			
	3888325	6/75 ~~10/75~~	Reinbeck			
	4578955	4/86	Medina			
	4765656	8/88	Weaver			
	4439989	4/84	Yamakawa			
DD	5301764	4/94	Gardner			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER	DATE CONSIDERED 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201	APPLICATION NUMBER: ~~09/822,866~~
	APPLICANT: Severinsky et al	
	FILING DATE: 04/02/01	GROUP ART UNIT: N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5346031	9/94	Gardner			
	5667029	9/97	Urban et al			
	5704440	1/98	Urban et al			
	5495906	3/96	Furutani			
	5842534	12/98	Frank	180	65.2	
	5823280	10/98	Lateur	180	65.2	
	5826671	10/98	Nakae et al			
	5846155	12/98	Taniguchi et al			
	5845731	12/98	Buglione et al	180	65.2	
	5586613	12/96	Ehsani			
	5635805	6/97	Ibaraki et al			
	5249637	10/93	Heidl et al			
DD	5558588	9/96	Schmidt			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER: [signature] DATE CONSIDERED: 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER 09/822,866
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5558595	9/96 ~~10/96~~	Schmidt et al			
	59~~80~~ 08 077	6/99	Moore			
	5722911	3/98	Ibaraki et al			
	5789882	8/98	Ibaraki et al			
	5550445	8/96	Nii			
	5650931	7/97	Nii			
	5865263	2/99	Yamaguchi et al			
	5788006	8/98	Yamaguchi et al			
	5791427	8/98	Yamaguchi et al			
	5799744	9/98	Yamaguchi et al			
	5806617	9/98	Yamaguchi et al			
	5899286	5/99	Yamaguchi et al			
DD	5433282	7/95	Moroto et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER [signature] DATE CONSIDERED 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER ~~09/822,866~~
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5778326	7/98	Moroto et al			
	5775449	7/98	Moroto et al			
	5697466	12/97	Moroto et al	180	65.2	
	5608308	3/97	Kiuchi et al			
	5614809	3/97	Kiuchi et al			
	5621304	4/97	Kiuchi et al			
	5893895	4/99	Ibaraki			
	5656921	8/97	Farrall			
	5773904	6/98	Schiebold et al			
	5515937	5/96	Adler et al			
	5650713	7/97	Takeuchi et al			
	5632352	5/97	~~Jeanneret~~ Jeanneret et al			
DD	5492189	2/96	Kreigler et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER [signature] DATE CONSIDERED 11/19/04

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION

DOCKET NUMBER	PAICE201
APPLICATION NUMBER	~~09/822,866~~
APPLICANT	Severinsky et al
FILING DATE	04/02/01
GROUP ART UNIT	N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	4354144	10/82	McCarthy			
	4697660	10/87	Wu et al			
	5831341	11/98	Selfors et al			
	5495907	3/96	Data			
	5672920	9/97	Donegan et al			
	5826671	10/98	Nakae et al			
	5757151	5/98	Donegan et al			
	6018694	1/00	Egami et al	701	102	
	5993351	11/99	Deguchi et al	477	5	
	5568023	10/96	Grayer et al			
	5890555	4/99	Miller			
	5172784	12/92	Varela, Jr.			
DD	4444285	4/84	Stewart et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER	[illegible signature]
DATE CONSIDERED	1/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER ~~09/822,866~~
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	4562894	1/86	Yang			
	4495451	1/85	Barnard			
	4583505	4/86	Frank et al			
	4597463	7/86	Barnard			
	5789881	8/98	Egami et al			
	5786640	7/98	Sakai et al			
	5176213	1/93	Kawai et al			
	5839530	11/98	Dietzel			
	5898282	4/99	Drozdz et al			
	5327987	7/94	Abdelmalek			
	5415245	5/95	Hammond			
	5705859	1/98	Karg et al			
DD	5713425	2/98	Buschhaus et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201	APPLICATION NUMBER: ~~09/822,866~~
	APPLICANT: Severinsky et al	
	FILING DATE: 04/02/01	GROUP ART UNIT: N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DI	5820172	10/98	Brigham et al			
	5713426	2/98	Okamura			
	5713814	2/98	Hara et al			
	5823281	10/98	Yamaguchi et al			
	5427196	6/95	Yamaguchi et al			
	5839533	11/98	Mikami et al			
	5725064	3/98	Ibaraki et al			
	5755303	5/98	Yamamoto et al			
	5778997	7/98	Setaka et al			
	5785136	7/98	Falkenmayer et al			
	5785137	7/98	Reuyl			
	5785138	7/98	Yoshida			
DI	5566774	10/96	Yoshida			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER ~~09/822,866~~
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5492190	2/96	Yoshida			
	5441122	8/95	Yoshida			
	5558175	9/96	Sherman			
	5558173	9/96	Sherman			
	5788597	8/98	Boll et al			
	5788003	8/98	Spiers			
	5791426	8/98	Yamada			
	5323868	6/94	Kawashima			
	5545928	8/96	Kotani			
	5291960	3/94	Brandenburg et al			
	5255733	10/93	King			
	5664635	9/97	Koga et al			
DD	5463294	10/95	Valdivia			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION

DOCKET NUMBER	PAICE201
APPLICATION NUMBER	~~09/822,866~~
APPLICANT	Severinsky et al
FILING DATE	04/02/01
GROUP ART UNIT	N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5562565	10/96	Moroto et al			
	5513719	5 ~~6~~/96	Moroto et al			
	5513718	5/96	Suzuki et al			
	5833022	11/98	Welke			
	5841201	11/98	Tabata et al			
	5887670	3/99	Tabata et al			
	5862497	1/99	Yano et al			
	5637987	6/ ~~94~~ 97	Fattic et al			
	5643119	7/97 ~~4/94~~	Yamaguchi et al			
	5644200	7/97 ~~4/94~~	Yang			
	5489001	2/96	Yang			
	5653302	8/ ~~94~~ 97	Edye et al			
DD	5350031	9 ~~6~~/94	Sugiyama et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

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DATE CONSIDERED 11/19/04

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER: PAICE201	APPLICATION NUMBER: ~~09/822,866~~
	APPLICANT: Severinsky et al	
	FILING DATE: 04/02/01	GROUP ART UNIT: N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5345761	9 ~~8~~/94	King et al			
	5337848	8/94	Bader			
	5327992	7 ~~8~~/94	Boll			
	5589743	12/96	King			
	5345154	9/94	King			
	4862009	8/89	King			
	5372213	12/94	Hasebe et al			
	5495912	3 ~~5~~/96	Gray, Jr., et al			
	5588498	12/96	Kitada			
	5492189	2/96	Kriegler			
	5193634	3/93	Masut			
	5125469	6/92	Scott			
DD	4511012	4/85	Rauneker			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER	DATE CONSIDERED
[signature]	11/17/04

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER 09/~~822~~,866
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	4631456	12/86	Drescher et al			
	4680986	7/87	Elsner			
	4953646	9/90	Kim			
	5927417	7/99	Brunner et al	180	65.6	
	6048289	4/00	Hattori et al	477	15	
	6026921	2/00	Aoyama et al	180	65.2	
	6053842	4/00	Kitada et al	477	5	
	5767637	6/98	Lansberry			
	5934395	8/99	Koide et al	180	65.2	
	5969624	10/99	Sakai et al	340	636	
	5986376	11/99	Werson			
	6018198	1/00	Tsuzuki et al			
DD	6054844	4/00	Frank	322	16	

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER 09/822,866
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	6059059	5/00 ~~9/94~~	Schmidt-Brucken			
	6098733	8/00	Ibaraki et al			
	6161384	12/00	Reinbold et al			
	5996347	12/99	Nagae et al			
	6109025	8/00	Murata et al			
	6131538	10/00	Kanai			
	4774811	10/88	Kawamura			
DD	5327992	7/94	Boll			
	~~5249637~~	~~10/93~~	~~Heidl et al~~			DUPLICATE
	~~5495906~~	~~3/96~~	~~Furutani~~			"
	~~6018694~~	~~1/00~~	~~Egami et al~~			"
DD	6209672	4/01	Severinsky			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

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NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 07/11/2006

Michael de Angeli
60 Intrepid Lane
Jamestown, RI 02835

EXAMINER	
DUNN, DAVID R	
ART UNIT	PAPER NUMBER
3616	

DATE MAILED: 07/11/2006

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/382,577	03/07/2003	Alex J. Severinsky	PAICE201.DIV	9389

TITLE OF INVENTION: HYBRID VEHICLES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$0	$1400	$1400	10/11/2006

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may [illegible] payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when du

PTOL-85 (Rev. 07/06) Approved for use through 04/30/2007.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 07/11/2006

Michael de Angeli
60 Intrepid Lane
Jamestown, RI 02835

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/382,577	03/07/2003	Alex J. Severinsky	PAICE201.DIV	9389

TITLE OF INVENTION: HYBRID VEHICLES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$0	$1400	$1400	10/11/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
DUNN, DAVID R	3616	180-065100

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 ____________

2 ____________

3 ____________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☐ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number ____________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature ____________ Date ____________

Typed or printed name ____________ Registration No. ____________

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/382,577	03/07/2003	Alex J. Severinsky	PAICE201.DIV	9389

7590 07/11/2006

Michael de Angeli
60 Intrepid Lane
Jamestown, RI 02835

EXAMINER	
DUNN, DAVID R	
ART UNIT	PAPER NUMBER
3616	

DATE MAILED: 07/11/2006

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 263 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 263 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability	Application No.	Applicant(s)	
	10/382,577	SEVERINSKY ET AL.	
	Examiner	Art Unit	
	David Dunn	3616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *RCE filed1/19/2006*.

2. ☒ The allowed claim(s) is/are *82-122*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached

   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.

   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 3/28/06, 1/19/06
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

David Dunn
Primary Examiner
Art Unit: 3616

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~~Page 1214 of 1654~~

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	5371412	12/1994	Iwashita			
DD	5412251	5/1995	Furutani			
DD	5993169	11/1999	Adachi et al			
DD	6007451	12/1999	Matsui et al			
DD	6032753	3/2000	Yamazaki et al			
DD	6155364	12/2000	Nagano et al			
DD	5539318	7/1996	Sasaki			
DD	5680050	10/1997	Kawai et al			
DD	5964309	10/1999	Kimura et al			
DD	5883496	3/1999	Esaki et al			
DD	5905360	5/1999	Ukita			
	~~6158541~~	~~12/2000~~	~~Tabata et al~~			previously cited

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Trial and deposition transcripts of witnesses relied upon to assert invalidity of parent patents in Civil Docket No. 2:04-CV-211-DF (E.D. Texas)
DD	Claim construction order entered September 28, 2005 in Civil Docket No. 2:04-CV-211-DF (E.D. Texas)
DD	Toyota Hybrid System, Toyota Press Information, Tokyo, 1997
DD	Prius Hybrid EV, Toyota brochure, undated

EXAMINER	DATE CONSIDERED
/David Dunn/	07/07/2006

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	5253929	10/1993	Ohori			
DD	5326158	7/1994	Ohori			
DD	5476151	12/1995	Tsuchida et al			
DD	5569995	10/1996	Kusaka et al			
DD	5637977	6/1997	Saito et al			
DD	5789935	8/1998	Suga et al			
DD	5895100	4/1999	Ito et al			
DD	5951115	9/1999	Sakai et al			
DD	5973463	10/1999	Okuda et al			
DD	6053841	4/2000	Koide et al			
DD	5929594	7/1999	Nonobe et al			
DD	5924395	7/1999	Moriya et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	0136055	03.04.85	European Patent Office				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Miller et al, "Starter-Alternator for Hybrid Electric Vehicle.." (1996)
DD	Johnston et al, "The Design and Development of the [UC Davis].." (No date)
DD	Johnston et al, "The Design and Development of the [UC Davis].." (1997)
DD	Alexander et al, "A Mid-Sized Sedan Designed for High Fuel..." (No date)
DD	"PRIUS New Car Features", (Toyota manual) (1998)
DD	TRW Systems Group, "Analysis and Advanced Design Study..." (1971)

EXAMINER	DATE CONSIDERED
/David Dunn/	07/07/2006

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	4646896	3/1987	Hammond et al			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	0769403	23.4.1997	European Patent Office				
DD	7172196	29.9.1994	Japan			x	
DD	9170533	9.5.1996	Japan			abst.	
DD	5319110	5.19.1992	Japan			abst.	
DD	3273933	12.5.1991	Japan			abst.	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Gelb, "An Electromechanical Transmission for Hybrid Vehicle..." (1971)
DD	Hirose et al, "The New High Expansion Ratio Engine..." (1997)
DD	Hong, "Toyota's Hybrid Program", *Road & Track*, August 1997
DD	Law, "Toyota Tech", *Car & Driver*, August 1997
DD	"Dual-Engine Fuel Saver", *Popular Mechanics*, July 1997
DD	"Toyota Launches Break-Through Hybrid EV", *Motor Trend*, September 1997

EXAMINER /David Dunn/ DATE CONSIDERED 07/07/2006

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

OIPE
MAR 2 8 2006
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PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	7268922	10.17.1995	Japan			abst.	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	"Toyota touts advances in safety, emissions", *Automotive News*, 4/28/97
DD	"'96 North Wind Performance", undated
DD	Wakefield, "History of the Electric Automobile - Hybrid Electric Vehicles" (1998)
DD	"Escort 92-94", undated
DD	"Near-Term Hybrid Vehicle Program", General Electric Company (1979)

EXAMINER /David Dunn/	DATE CONSIDERED 07/07/2006

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD		"Guidelines for Electric Vehicle Safety", SAE J2344 (1998)
DD		"Intrepid", (undated)
DD		"COE's Team Paradigm challenged to build FutureCar" (1995)
DD		Butler et al, "A Versatile Computer Simulation Tool.." SAE 970199 (1997)
DD		Crumbley, "Hybrid vehicle designed", (1994)
DD		Brokaw, "Students Pick up the Challenge", (1997)

EXAMINER /David Dunn/	DATE CONSIDERED 07/07/2006

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	5412293	5/1995	Minesawa et al			
DD	5883484	3/1999	Akao			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	8214592	8.20.1996	Japan			abst.	
DD	10663833	3.6.1998	Japan			abst.	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Cuddy et al, "Analysis of the Fuel Economy Benefit..." SAE 970289 (1997)
DD	"Team Paradigm Shines in FutureCar Competition" (1996)
DD	Takaoka et al, "Study of the Engine Optimized for Hybrid System" (undated)
DD	Gelb et al, "Cost and Emission Studies of a Heat Engine/Battery.." (1972)
DD	Gelb et al, "Design and Performance Characteristics..." SAE 690169 (1969)
DD	"Electric/Hybrid Vehicles: Alternative Powerplants..." SAE SP-1284 (1997)

EXAMINER	DATE CONSIDERED
/David Dunn/	07/07/2006

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	913846	3/1909	Pieper			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD		"Electric and Hybrid Vehicle Design Studies", SAE SP-1243 (1997)
DD		Gelb, "The case for Constant Speed Accessory Drives", (1975)
DD		Sasaki, "Toyota's Newly Developed Hybrid Powertrain", (1998)
DD		"Near-Term Hybrid Vehicle Program, Phase 1", General Electric Co. (1979)
DD		"Near-Term Hybrid Vehicle Program, Phase 1, App. A.", Gen'l Elec. (1979)
DD		"Joint Feasibility Study of Hybrid Vehicle, Final Report (1982)

EXAMINER /David Dunn/ DATE CONSIDERED 07/07/2006

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 361

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD		North American Technology Seminar plans, April 1997
DD		Hermance, THS Technical Explanation (undated)
DD		"Toyota" brochure describing Prius (undated)
DD		Hermance, "Toyota Hybrid System" (undated)

EXAMINER /David Dunn/	DATE CONSIDERED 07/07/2006

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

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U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

Trial and deposition transcripts of witnesses relied upon to assert invalidity of parent patents in Civil Docket No. 2:04-CV-211-DF (E.D. Texas), with documentary evidence made of record therein

Claim construction order entered September 28, 2005 in Civil Docket No. 2:04-CV-211-DF (E.D. Texas)

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

Duplicate (see IDS of 3/28/2006)

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/382,577	SEVERINSKY ET AL.	
	Examiner	**Art Unit**	
	David Dunn	3616	

ISSUE CLASSIFICATION

ORIGINAL					CROSS REFERENCE(S)							
CLASS				SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
280				65.2	477	3						
INTERNATIONAL CLASSIFICATION					701	54						
B	6	0	K	6/04								
				/								
				/								
				/								
				/								

(Assistant Examiner) (Date)	7/7/06 David R. Dunn (Primary Examiner) (Date)	**Total Claims Allowed: 41**
7-7-06 (Legal Instruments Examiner) (Date)		O.G. Print Claim(s): 1 — O.G. Print Fig.: 4

☒ **Claims renumbered in the same order as presented by applicant** ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		31		61		91		121		151		181
	2		32		62		92		122		152		182
	3		33		63		93		123		153		183
	4		34		64		94		124		154		184
	5		35		65		95		125		155		185
	6		36		66		96		126		156		186
	7		37		67		97		127		157		187
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	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

Search Notes	Application No.	Applicant(s)
	10/382,577	SEVERINSKY ET AL.
	Examiner	Art Unit
	David Dunn	3616

SEARCHED

Class	Subclass	Date	Examiner
180	65.2 65.3 65.4 65.8 165	11/29/2004	DD
60	706 711 716		
	718		
290	17 40R 40C		
322	16		
477	2 3		
UPDATE	SEARCH	3/16/05	DD
701	54	"	"
updated		10/24/05	DD
Updated		7/7/06	DD

INTERFERENCE SEARCHED

Class	Subclass	Date	Examiner
180	65.2	3/16/05	DD
	65.4		
updated		10/24/05	DD
Updated		7/7/06	DD

SEARCH NOTES (INCLUDING SEARCH STRATEGY)

	DATE	EXMR
EAST text search	11/29/2004	DD
Interference text search; see enclosed	7/7/06	DD

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 07/11/2006

Michael de Angeli
60 Intrepid Lane
Jamestown, RI 02835

07/18/2006 HDEMESS2 00000098 040401 10382577

01 FC:1501 1400.00 DA
02 FC:8001 30.00 DA

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Michael de Angeli (Depositor's name)
[signature] (Signature)
July 18, 2006 (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/382,577	03/07/2003	Alex J. Severinsky	PAICE201.DIV	9389

TITLE OF INVENTION: HYBRID VEHICLES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$0	$1400	$1400	10/11/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
DUNN, DAVID R	3616	180-065100

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Michael de Angeli
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: PAICE LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Boca Raton, Florida

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☒ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☒ Advance Order - # of Copies 10

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 04-0401 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature [signature] Date July 18, 2006

Typed or printed name Michael de Angeli Registration No. 27,869

OIPE IAP8
JUL 18 2006
PATENT & TRADEMARK OFFICE

MICHAEL M. DE ANGELI, P.C.
ATTORNEY AT LAW
60 INTREPID LANE
JAMESTOWN, RHODE ISLAND 02835
(401) 423-3190

REGISTERED PATENT
ATTORNEY

ADMITTED TO BARS
OF PA & MD
NOT ADMITTED IN RI

FAX: (401) 423-3191
E-MAIL: MDEANGE@COX.NET

FACSIMILE TRANSMISSION

To: Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Fax Number: 571-273-2885 Date: July 18, 2006

Re: Ser. No. 10/382,577

Total Pages (including this sheet): 2

Dear Sir:

Attached please find the completed PTOL-85 for this application. As noted thereon, the Issue Fee and related fees were paid previously, by a paper filed July 1, 2005. Any additional fees may be charged to my Deposit Account 04-0401. Please contact me at the number above if there are questions.

Early issue of the patent is respectfully requested.

Very truly yours,

Michael de Angeli

ATTENTION ATTENTION ATTENTION

Method of Refund:

withdrawn from issue

- [ ] ACH/EFT
- [ ] Credit Card
- [X] Deposit Account # 04-0401
- [ ] Treasury Check

Patent/TM/App/Serial # 10,382,577

Program Area Publishing

Date Processed 08-31-06

ATTENTION ATTENTION ATTENTION

MICHAEL M. DE ANGELI, P.C.
ATTORNEY AT LAW
60 INTREPID LANE
JAMESTOWN, RHODE ISLAND 02835
(401) 423-3190

REGISTERED PATENT
ATTORNEY

ADMITTED TO BARS
OF PA & MD
NOT ADMITTED IN RI

FAX: (401) 423-3191
E-MAIL: MDEANGE@COX.NET

FACSIMILE TRANSMISSION

To: Att: Refund Branch
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA. 22313-1450

Fax Number: 571-273-6500 Date: August 18, 2006

Re: Request for Refund to Deposit Account

Total Pages (including this sheet): 9

Dear Sir:

Attached is a copy of the most recent Statement of my Deposit Account no. 04-0401. As indicated, my account was charged $1400 for the issue fee in Ser. No. 10/382,577, as well as $30 for ten copies of the issued patent; a $25 service charge was also assessed as these charges caused my account balance to fall below $1000.

However, the issue and copy fees in Ser. No. 10/382,577 had been paid previously, by a paper filed July 1, 2005. (Copy attached.) The application was subsequently withdrawn from issue, upon petition; in granting the Petition, the Petitions Examiner specifically noted (see enclosed Decision dated January 26, 2006) that the issue fee could not be refunded but could be applied if the application was again allowed, as subsequently occurred.

The new PTOL-85 mailed July 11, 2006 (attached) specifically noted that the issue fee had already been paid, and my cover letter(also attached) resubmitting the new PTOL-85 specifically noted that the issue and related fees had already been paid. I do apologize if my having checked the Issue Fee and Advance Order boxes under section 4a led to confusion.

Adjustment date: 09/05/2006 RCLEMONS
07/18/2006 HDERESS2 00000098 040401 10382577
01 FC:1501 1400.00 CR

02 FC:8001 30.00 CR

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UNITED STATES PATENT AND TRADEMARK OFFICE

United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

MONTHLY STATEMENT OF DEPOSIT ACCOUNT

To replenish your deposit account, detach and return top portion with your check. Make checks payable to "Director of the USPTO."

MICHAEL DE ANGELI, P.C. FINA
MR. MICHAEL DE ANGELI
60 INTREPID LANE
JAMESTOWN RI 02835

Account No.	Date	Page
040401	7-31-06	1

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7	18	06	197	10382577	PAICE201.DIV	8001	30.00	1601.00
7	25	06	79	11404113	RLW-261	2011	150.00	1451.00
7	25	06	80	11404113	RLW-261	2111	250.00	1201.00
7	25	06	81	11404113	RLW-261	2311	100.00	1101.00
7	25	06	82	11404113	RLW-261	2051	65.00	1036.00
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Michael de Angeli

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of	
Severinsky et al	Examiner: David Dunn
Serial No.: 10/382,577	Group Art Unit: 3616
Filed: March 7, 2003	Att. Dkt.: PAICE201.DIV
	Confirmation No. 5936

For: Hybrid Vehicles

Mail Stop ISSUE FEE
Hon. Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF ISSUE FEE

Sir:

Submitted herewith is Issue Fee Transmittal Form PTOL 85. Also enclosed is a check in the amount of $1730.00, including $1400.00 for the Issue Fee, $300.00 for the Publication Fee and $30.00 for 10 soft copies of the patent.

The Commissioner is hereby authorized to charge any underpayment (or to credit overpayment) to PTO Deposit Account No. 04-0401. A duplicate copy of this sheet is attached.

Respectfully submitted,

6/30/05
Dated

Michael de Angeli
Reg. No. 27,869
60 Intrepid Lane
Jamestown, RI 02835
401-423-3190

OIPE JC98 FEB 2 2 2005 PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION 1/2	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLAS	FILING DATE
DD	6067801	5/2000	Harada et al			
DD	4411171	10/1983	Fiala			
DD	3620323	~~5/1968~~ 11/1971	Maeda			
DD	6317665	11/2001	Tabata et al			
DD	6183389	2/2001	Tabata et al			
DD	5565711	10/1996	Hagiwara			

DD 2/18

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	754983	2/1995	Japan			X	
DD	4244658	9/1992	Japan			X	
DD	11082261	3/1999	Japan				X
DD	11122712	4/1999	Japan			partial	
DD	62113956	5/1987	Japan			partial	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER DD DATE CONSIDERED 3/16/05

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER ~~09/822,866~~ 10/382577
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	4148192	4/79	Cummings			
	4306156	12/81	Monaco et al			
	4313080	11/82	Park			
	4354144	10/82	McCarthy			
	4533011	8/85	Heidemeyer			
	4951769	8/90	Kawamura			
	5053632	10/91	Suzuki et al			
	3525874	8/70	Toy			
	3650345	3 8/72	Yardney			
	3837419	9/74	Nakamura			
	3874472	4/75	Deane			
	4042056	8/77	Horwinski			
DD	4562894	1/86	Yang			

DG 2/18

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Bulgin, "The Future Works, Quietly", Autoweek, Feb. 23, 1998 pp. 12-13
DD	"Toyota Electric and Hybrid Vehicles", a Toyota brochure
	Nagasaka et al, "Development of the Hybrid/Battery ECU...", SAE paper 981122, 1998, pp. 19-27

EXAMINER DMD	DATE CONSIDERED 11/19/04

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OIPE JC177 MAY 1 8 2004 TRADEMARK OFFICE

INFORMATION DISCLOSURE CITATION IN AN APPLICATION

DOCKET NUMBER	PAICE201.DIV
APPLICATION NUMBER	10/382,577
APPLICANT	Severinsky et al
FILING DATE	3/7/2003
GROUP ART UNIT	3616

RECEIVED JUN 0 2 2004 GROUP 3600

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	6064161	5/2000	Takahara			
DD	5562566	10/1996	Yang			
DD	5212431	5/1993	Origuchi et al			
	~~4165795~~	~~8/1979~~	~~Lynch et al~~			Previously cited
DD	5283470	2/1994	Hadley et al			
DD	5406126	~~8/1995~~ 4/1995	Hadley et al			
DD	5669842	9/1997	Schmidt			
DD	5771478	6/1998	Tsukamoto			
DD	5833570	11/1998	Tabata			
DD	5951614	9/1999	Tabata			
DD	5875691	3/1999	Hata			
DD	5931271	8/1999	Haka			

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FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	510582	10/1992	European Patent Office				
DD	136055	3/1985	European Patent Office				
DD	2517110	10/1975	German				
DD	8201170	4/1982	PCT/SE81/00280				
DD	55110328	8/1980	Japan			part	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

EXAMINER INITIAL		DOCUMENT
DD		"Diesel-Electric VW", *Popular Science*, December 1990, p. 30.
DD		"Electric Vehicles Only", *Popular Science*, May 1991, pp. 76-81 and 110.
DD		"Lightweight, High-Energy Lead/Acid Battery" *NASA Tech Briefs*, 4/91, 22-24.

EXAMINER [signature] DATE CONSIDERED 11/25/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201	APPLICATION NUMBER ~~09/822,866~~ 10/382577
	APPLICANT Severinsky et al	
	FILING DATE 04/02/01	GROUP ART UNIT N/A

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U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	4148192	4/79	Cummings			
	4306156	12/81	Monaco et al			
	4313080	01 ~~12~~/82	Park			
	4354144	10/82	McCarthy			
	4533011	8/85	Heidemeyer			
	4951769	8/90	Kawamura			
	5053632	10/91	Suzuki et al			
	3525874	8/70	Toy			
	3650345	8/72	Yardney			
	3837419	9/74	Nakamura			
	3874472	4/75	Deane			
	4042056	8/77	Horwinski			
DD	4562894	1/86	Yang			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Bulgin, "The Future Works, Quietly", Autoweek, Feb. 23, 1998 pp. 12-13
DD	"Toyota Electric and Hybrid Vehicles", a Toyota brochure
	Nagasaka et al, "Development of the Hybrid/Battery ECU...", SAE paper 981122, 1998, pp. 19-27

EXAMINER DMD   DATE CONSIDERED 11/19/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP §609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

INFORMATION DISCLOSURE CITATION IN AN APPLICATION	DOCKET NUMBER PAICE201.DIV	APPLICATION NUMBER 10/382,577
	APPLICANT Severinsky et al	
	FILING DATE 3/7/2003	GROUP ART UNIT 3616

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE
DD	5847469	12/1998	Tabata			
DD	6317665	11/2001	Tabata			
DD	6183389	2/2001	Tabata			
DD	5873426	2/1999	Tabata			
DD	5923093	7/1999	Tabata			
DD	6340339	1/2002	Tabata			
DD	5935040	8/1999	Tabata et al			
DD	5415603	5/1995	Tuzuki et al			
DD	6258001	~~6/2001~~ 7/2001	Wakuta			
DD	5904704	4/1999	Woon			
DD	6328122	12/2001	Yamada			
DD	6278195	8/2001	Yamaguchi et al			

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FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DD	4864626	9/1973	Japan			part	
DD	4929642	8/1974	Japan			"	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

DD	Published patent application US 2003/0085577 of Takaoka et al, May 8, 2003

EXAMINER	DATE CONSIDERED
[signature]	11/29/04

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Severinsky et al	: Ser. No. 10/382,577
Patent No.: 7,104,347	: Filed March 7, 2003
Issued: September 12, 2006	: Atty. Dkt.: PAICE-201.DIV

For: Hybrid Vehicles

CHANGE OF CORRESPONDENCE ADDRESS

Hon. Commissioner for Patents
P. O. Box 1450
Alexandria VA 22313-1450

Sir:

Effective November 15, 2011, kindly change the address for correspondence concerning this patent to the following:

Michael de Angeli
34 Court Street
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Tel: 401-423-3190
Fax: 401-423-3191
Email: Mdeangeli20@gmail.com

Thank you for your attention to this matter.

Respectfully submitted,

Michael de Angeli
Reg. No. 27,869
60 Intrepid Lane
Jamestown RI 02835
401-423-3190

Dated: 11/14/11

AO 120 (Rev. 08/10)

TO: **Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE** **FILING OR DETERMINATION OF AN** **ACTION REGARDING A PATENT OR** **TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court for the District of Maryland Baltimore Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:14-cv-00492-WDQ	2/19/2014	for the District of Maryland Baltimore Division

PLAINTIFF	DEFENDANT
Paice LLC and The Abell Foundation, Inc.	Ford Motor Company

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,237,634	7/3/2007	Paice LLC and The Abell Foundation, Inc.
2 7,104,347	9/12/2006	Paice LLC and The Abell Foundation, Inc.
3 7,559,388	7/14/2009	Paice LLC and The Abell Foundation, Inc.
4 8,214,097	7/3/2012	Paice LLC and The Abell Foundation, Inc.
5 7,455,134	11/25/2008	Paice LLC and The Abell Foundation, Inc.

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

Trials@uspto.gov
571-272-7822

Paper 12
Entered: September 30, 2014

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner

v.

PAICE LLC & THE ABELL FOUNDATION, INC.,
Patent Owner

Case IPR2014-00579
Patent 7,104,347 B2

Before SALLY C. MEDLEY, KALYAN K. DESHPANDE, and CARL M. DEFRANCO, *Administrative Patent Judges*.

DEFRANCO, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Ford Motor Company ("Ford") filed a Petition requesting an *inter partes* review of claims 1, 7, 8, 18, 21, 23, and 37 of U.S. Patent No. 7,104,347 B2 ("the '347 patent"). Paper 1 ("Pet."). The owner of the '347 patent, Paice LLC & The Abell Foundation, Inc. ("Paice"), filed a Preliminary Response. Paper 11 ("Prelim. Resp.").[1] We have jurisdiction under 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted "unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." After considering the Petition and the Preliminary Response, we conclude that Ford has demonstrated a reasonable likelihood that it would prevail in showing unpatentability of all the challenged claims. Thus, we authorize institution of an *inter partes* review of claims 1, 7, 8, 18, 21, 23, and 37 of the '347 patent.

II. BACKGROUND

A. *The '347 Patent*[2]

The '347 patent describes a hybrid vehicle with an internal combustion engine, two electric motors (a starter motor and a traction motor), and a battery bank, all controlled by a microprocessor that directs

---

[1] Paice filed both redacted and unredacted versions of its Preliminary Response. Papers 7, 11. Our decision cites to the redacted version, i.e., Paper 11, which is marked "Public."

[2] The '347 patent is also the subject of a co-pending case, *Paice, LLC et al. v. Ford Motor Company*, No. 1-14-cv-00492, filed Feb. 19, 2014, in the U.S. District Court for the District of Maryland. Pet. 1.

torque transfer between the engine, the motors, and the drive wheels of the vehicle. Ex. 1001, 17:5–45, Fig. 4. The hybrid vehicle features a hybrid control strategy that runs the engine only under conditions of high efficiency, typically when the vehicle's instantaneous torque demand (i.e., the amount of torque required to propel the vehicle at a desired speed) is at least equal to 30% of the engine's maximum torque output ("MTO"). *Id.* at 20:52–60, 35:5–14; *see also id.* at 13:47–61 ("the engine is never operated at less than 30% of MTO, and is thus never operated inefficiently").

Running the engine only under efficient operating conditions leads to improved fuel economy and reduced emissions. *Id.* at 13:47–51. To achieve such efficiency, the hybrid vehicle includes different operating modes that depend on the vehicle's instantaneous torque demand, the battery's state of charge, and other operating parameters. *Id.* at 19:53–55. For example, the hybrid vehicle operates in: (1) an all-electric mode, where only the traction motor provides the torque to propel the vehicle, whenever operation of the engine would be inefficient (i.e., stop-and-go city driving); (2) an engine-only mode, where only the engine provides the torque to propel the vehicle, whenever the engine can run at an efficient level (i.e., highway cruising); (3) a hybrid mode, where the traction motor provides additional torque to propel the vehicle beyond that already provided by the engine, whenever the instantaneous torque demand exceeds the maximum torque output of the engine (i.e., while accelerating, passing, and climbing hills); and (4) a battery recharge mode where the engine operates a generator to recharge the battery while the traction motor drives the vehicle. *Id.* at 35:66–36:58; *see also id.* at 37:26–38:55.

B. Challenged Claims

Ford challenges independent claims 1 and 23. It also challenges dependent claims 7, 8, 18, and 21, which depend directly or indirectly from claim 1, and dependent claim 37, which depends from claim 23. Claim 1 is illustrative:

> 1. A hybrid vehicle, comprising:
>
> an internal combustion engine controllably coupled to road wheels of said vehicle;
>
> a first electric motor connected to said engine [a]nd operable to start the engine responsive to a control signal;
>
> a second electric motor connected to road wheels of said vehicle, and operable as a motor, to apply torque to said wheels to propel said vehicle, and as a generator, for accepting torque from at least said wheels for generating current;
>
> a battery, for providing current to said motors and accepting charging current from at least said second motor; and
>
> a controller for controlling the flow of electrical and mechanical power between said engine, first and second motors, and wheels,
>
> wherein said controller starts and operates said engine when torque require[d] to be produced by said engine to propel the vehicle and/or to drive either one or both said electric motor(s) to charge said battery is at least equal to a setpoint (SP) above which said engine torque is efficiently produced, and wherein the torque produced by said engine when operated at said setpoint (SP) is substantially less than the maximum torque output (MTO) of said engine.

Ex. 1001, 58:13–37.

Independent claim 23 is directed to a "method" of controlling a hybrid vehicle. *Id.* at 60:22. Like claim 1, it recites an "internal combustion engine capable of efficiently producing torque at loads between a lower level SP [setpoint] and a maximum torque output MTO." *Id.* at 60:23–25. Unlike claim 1, however, claim 23 does not require *two* motors but simply recites "*one or more* electric motors" for providing output torque and generating electrical current. *Id.* at 60:25–27 (emphasis added).

C. Evidence of Record

As its basis for challenging the claims of the '347 patent, Ford relies upon five publications authored-in-part by J.R. Bumby (collectively, "the Bumby references"). Ford also proffers the Declaration of Dr. Gregory W. Davis (Ex. 1108).

References	Patents/Printed Publications	Date	Exhibit
Bumby I	J.R. Bumby et al., *Computer modelling of the automotive energy requirements for internal combustion engine and battery electric-powered vehicles*, IEE PROC., v. 132, pt. A, no. 5, 265–279	Sep. 1985	1103
Bumby II	J.R. Bumby and I. Forster, *Optimisation and control of a hybrid electric car*, IEE PROC., v. 134, pt. D, no. 6, 373–387	Nov. 1987	1104
Bumby III	I. Forster and J.R. Bumby, *A hybrid internal combustion engine/battery electric passenger car for petroleum displacement*, PROC. INST. MECH. ENGRS., v. 202, no. D1, 51–64	Jan. 1988	1105

References	Patents/Printed Publications	Date	Exhibit
Bumby IV	J.R. Bumby and P.W. Masding, *A Test-Bed Facility for Hybrid IC Engine-Battery Electric Road Vehicle Drive Trains*, TRANS. INST. MEAS. & CONT., v. 10, no. 2, 87–97	Apr. 1988	1106
Bumby V	P.W. Masding and J.R. Bumby, *Integrated microprocessor control of a hybrid i.c. engine/battery-electric automotive power train*, TRANS. INST. MEAS. & CONT., v. 12, no. 3, 128-146	Jan. 1990	1107

D. Asserted Ground of Unpatentability

Ford asserts the following single ground in challenging the patentability of the claims.

Ground	Basis	Challenged Claims
§ 103	Bumby I, II, III, IV, V (collectively, "the Bumby references")	1, 7, 8, 18, 21, 23, 37

III. ANALYSIS

A. Standing

Paice contends that Ford is "barred or estopped" under 37 C.F.R. § 42.104(a) from requesting *inter partes* review of the '347 patent due to an alleged breach of an arbitration agreement between the parties. Prelim. Resp. 5–12. According to Paice, the arbitration agreement includes "unambiguous terms" that purportedly limit Ford's ability to "challeng[e] the patent claims of the '347 patent." *Id.* at 7, 9–10. Postulating that Ford is in breach of those terms, Paice asserts that Ford has failed to demonstrate the requisite standing to file the instant Petition. *Id.* at 11.

The purported "standing" argument raised by Paice, however, relates to a disputed contractual matter that falls outside the purview of our authority under the Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011). Indeed, the question of whether Ford has breached the arbitration agreement by requesting *inter partes* review of the '347 patent is currently the subject of a preliminary injunction motion filed by Paice in the co-pending district court action, *and yet to be decided.* Prelim. Resp. 11 n.4. As such, we reject Paice's attempt to frame this unresolved breach-of-contract issue as a standing issue ripe for our review. Based on the current record, Paice has not demonstrated that Ford is barred or estopped from challenging the '347 patent.

B. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in the context of the patent in which they appear. 37 C.F.R. § 42.100(b). Ford contends that five claim limitations are in need of construction, namely, "road load (RL)," "setpoint (SP)," "low-load mode I," "highway cruising mode IV," and "acceleration mode V." Pet. 12–17. We construe the relevant limitations as follows.

1. "road load (RL)"

The term "road load" or "RL" is found in independent claim 23 and dependent claim 7. The specification defines "road load" as "the vehicle's instantaneous torque demands, i.e., that amount of torque required to propel the vehicle at a desired speed," and further notes that it "can be positive or negative, i.e., when decelerating or descending a hill, in which case the negative road load . . . is usually employed to charge the battery." Ex. 1001, 12:40–57. We see no reason to deviate from the specification's express definition. Thus, consistent with the specification, we construe "road load" as "the amount of instantaneous torque required to propel the vehicle, be it positive or negative."

2. *"setpoint (SP)"*

Independent claims 1 and 23 recite that the internal combustion engine efficiently produces torque at loads between a "setpoint (SP)" and a "maximum torque output (MTO)." Paice seeks to construe the term "setpoint" as "a definite, but potentially variable value at which a transition between operating modes may occur." Prelim. Resp. 13. Ford, on the other hand, asserts that "setpoint" means a "predetermined torque value." Pet. 14, 16.

The specification of the '347 patent states that the value of a setpoint "may vary somewhat" or be "reset" in response to repetitive driving patterns or other monitored variables. Ex. 1001, 40:37–59. But, just because a setpoint *may* change under certain circumstances does not foreclose it from being "set" or "determined" at a prior point in time. Any other construction would defeat the purpose of it being "set," which the '347 patent admits is for comparison sake. For instance, the specification states that "the microprocessor tests sensed and calculated values for system variables [such as road load (RL)] . . . *against setpoints, and uses the results of the comparisons* to control the mode of vehicle operation." Ex. 1001, 40:22–31 (emphasis added). That description makes clear that the microprocessor is comparing a just-derived value against a previously-defined value. As such, we construe the term "setpoint" to at least mean a "predetermined value that may or may not be reset." The inquiry does not end there, however.

Next, Paice takes issue with Ford's construction of "setpoint" as being limited to a "torque value." Prelim. Resp. 13–15. According to Paice, the specification describes setpoint as both a "torque value" and a "battery charge status." *Id.* at 15 (citing Ex. 1115 at 10). We agree that the *specification* provides that either "torque output" or "state of charge of the battery bank" can be compared against setpoints. Ex. 1001, 40:28–31. The *claim language*, however, is not so broad. Although the specification is an important tool in claim construction, it is the claim language itself—and the manner in which a disputed term is used in the context of the claim—which controls the ultimate determination.

Here, contrary to Paice's assertion, the claim language consistently refers to a "setpoint" in terms of a "torque" value. For example, claim 1 recites that the "*torque* require[d] . . . is at least equal to a setpoint (SP) above which said engine *torque* is efficiently produced, and wherein the *torque* produced by said engine when operated at said setpoint (SP) is substantially less than the maximum *torque* output (MTO) of said engine." Nowhere does the claim refer to "setpoint" or "SP" in the context of a battery's "state of charge." Likewise, although claim 23 includes the step of "monitoring the state of charge of said battery," the claim never makes a comparison between the battery's "state of charge" and a "setpoint." Instead, claim 23 consistently references a "setpoint" or "SP" in terms of "torque," e.g., "producing *torque* at loads between a lower level SP and a maximum *torque* output"; "when the *torque* RL required to do so is less than said lower level SP"; "using the *torque* between RL and SP to drive said at least one electric motor"; and "the *torque* produced by said engine when operated at said setpoint (SP) is substantially less than the maximum *torque* output." Ex. 1001, 60:22–54 (emphasis added). Thus, given the claim language's clear correlation of a "setpoint" or "SP" to a torque value, we construe the terms "setpoint" and "SP" to mean "a predetermined torque value."

3. *"low-load mode I," "highway cruising mode IV," and "acceleration mode V"*

Claim 7 expressly defines the terms "low-load mode I," "highway cruising mode IV," and "acceleration mode V," within the body of the claim. Ex. 1001, 58:58–59:8. As such, for purposes of institution, no further construction of these terms is necessary at this time.

C. *Asserted Ground*

1. *Obviousness over Bumby I, II, III, IV, and V*

Ford challenges claims 1, 7, 8, 18, 21, 23, and 37 of the '347 patent on a single ground—that the claimed invention would have been obvious over the collective teachings of the five Bumby references. Pet. 31–59. In support of this ground, Ford provides a detailed claim chart explaining how each claim limitation is met by the Bumby references and why a skilled artisan would have been led to combine their teachings to arrive at the claimed invention. *Id.* at 28–59. Taken together, the five Bumby references disclose a hybrid-vehicle arrangement in which both the internal combustion engine and the electric motor are capable of driving the road wheels directly, with the mix of power between the engine and motor being controlled by a microprocessor. Ex. 1104 at 1, Fig. 2; Ex. 1108 ¶¶ 238-244. In order to maximize engine efficiency, Bumby describes a hybrid control strategy that operates the engine only "when load demand is high," rather than at "low speed, low load situations [where] the ic engine is inefficient compared with the electric traction system." Ex. 1106 at 3–4; Ex. 1108 ¶¶ 251–255, 258. Notably, Bumby defines "maximum engine efficiency" in terms of a "lower torque bound" and an "upper torque bound." Ex. 1104 at 10–11, Fig. 16; Ex. 1105 at 7–8, Fig. 8.

Based on the current record, we find credible the testimony of Ford's declarant, Dr. Davis, who equates Bumby's "lower" and "upper" torque boundaries — for maximizing engine efficiency — to the "setpoint" and "maximum torque output" limitations recited by the challenged claims. Ex. 1108 ¶¶ 277–293. We also are persuaded by Dr. Davis's explanation of how the Bumby references teach the use of a starter motor in the manner required by challenged claim 1. Ex. 1106 at 7 (describing "a conventional starter motor"); Ex. 1108 ¶¶ 248–249. And, in disclosing the claimed "operating modes," Bumby describes a "low-load" all-electric mode, a "long distance, high-speed travel" engine-only mode, a "battery charge" mode, and an "accelerator" mode. Ex. 1107 at 4; *see also* Ex. 1106 at 3; Ex. 1105 at 11–12; Ex. 1104 at 13.

Paice argues that neither the Petition nor Dr. Davis's Declaration articulates sufficient reasoning for combining the five Bumby references. Prelim. Resp. 17–18. We do not find this argument persuasive. Given the related nature of the five Bumby references, including the significant overlap of their disclosures and the cross-citations to preceding Bumby references, we are persuaded that a skilled artisan would have been led to combine the teachings of the five Bumby references in an obvious manner to arrive at the claimed invention. *See* Pet. 28–30 (citing Ex. 1108 ¶¶ 189–194).

Paice next takes issue with Dr. Davis's conclusion that Bumby's disclosure of a "lower torque bound" is equivalent to the claimed "setpoint" of claims 1 and 23. Prelim. Resp. 19–21. According to Paice, Dr. Davis fails to indicate how Bumby's lower torque bound is "potentially variable" or "may be varied in any way." *Id.* at 20–21. Paice's contention, however, is premised on an incorrect construction of "setpoint." As properly construed above, "setpoint" simply requires that the torque value be "predetermined." Although the claim language does not preclude the "setpoint" from being reset (e.g., based on driver tendencies), nothing in the claim language requires that it be "variable," as Paice contends.

Having considered the information presented in the Petition and the Preliminary Response, we are persuaded that Ford has demonstrated a reasonable likelihood of showing that a skilled artisan would have found the subject matter of independent claims 1 and 23 obvious over the combined teachings of the five Bumby references. Also, we have considered Ford's challenge of the dependent claims. Pet. 39–49, 59. Paice does not argue any of the dependent claims separately from the independent claims. *See* Prelim. Resp. 16–22. Regardless, the information presented in the Petition persuades us that the limitations of the challenged dependent claims also would have been obvious over the Bumby references.

IV. CONCLUSION

Based on the arguments and evidence presented in the Petition, we determine that Ford has demonstrated a reasonable likelihood that it would prevail in establishing that the subject matter of claims 1, 7, 8, 18, 21, 23, and 37 would have been obvious under 35 U.S.C. § 103.

V. ORDER

For the foregoing reasons, it is

ORDERED that, pursuant to 35 U.S.C. § 314(a), *inter partes* review of challenged claims 1, 7, 8, 18, 21, 23, and 37 of the '347 patent is instituted on the asserted ground of obviousness over the five Bumby references;

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, *inter partes* review of the '347 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial; and

FURTHER ORDERED that no ground other than that specifically listed above is authorized for *inter partes* review of the '347 patent.

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Paper 12
Entered: September 30, 2014

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner

v.

PAICE LLC & THE ABELL FOUNDATION, INC.,
Patent Owner

Case IPR2014-00571
Patent 7,104,347 B2

Before SALLY C. MEDLEY, KALYAN K. DESHPANDE, and CARL M. DEFRANCO, *Administrative Patent Judges*.

DEFRANCO, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Ford Motor Company ("Ford") filed a Petition requesting an *inter partes* review of claims 1, 6, 7, 9, 15, 21, 23, and 36 of U.S. Patent No. 7,104,347 B2 ("the '347 patent"). Paper 1 ("Pet."). The owner of the '347 patent, Paice LLC & The Abell Foundation, Inc. ("Paice"), filed a Preliminary Response. Paper 11 ("Prelim. Resp.").[1] We have jurisdiction under 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted "unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." After considering the Petition and the Preliminary Response, we conclude that Ford has demonstrated a reasonable likelihood that it would prevail in showing unpatentability of all the challenged claims. Thus, we authorize institution of an *inter partes* review of claims 1, 6, 7, 9, 15, 21, 23, and 36 of the '347 patent.

II. BACKGROUND

A. The '347 Patent[2]

The '347 patent describes a hybrid vehicle with an internal combustion engine, two electric motors (a starter motor and a traction motor), and a battery bank, all controlled by a microprocessor that directs

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[1] Paice filed both redacted and unredacted versions of its Preliminary Response. Papers 7, 11. Our decision cites to the redacted version, i.e., Paper 11, which is marked "Public."

[2] The '347 patent is also the subject of a co-pending case, *Paice, LLC v. Ford Motor Company*, No. 1-14-cv-00492, filed Feb. 19, 2014, in the U.S. District Court for the District of Maryland. Pet. 1.

torque transfer between the engine, the motors, and the drive wheels of the vehicle. Ex. 1001, 17:5–45, Fig. 4. The hybrid vehicle features a hybrid control strategy that runs the engine only under conditions of high efficiency, typically when the vehicle's instantaneous torque demand (i.e., the amount of torque required to propel the vehicle at a desired speed) is at least equal to 30% of the engine's maximum torque output ("MTO") capability. *Id.* at 20:52–60, 35:5–14; *see also id.* at 13:47–61 ("the engine is never operated at less than 30% of MTO, and is thus never operated inefficiently").

Running the engine only under efficient operating conditions leads to improved fuel economy and reduced emissions. *Id.* at 13:47–51. To achieve such efficiency, the hybrid vehicle includes different operating modes that depend on the vehicle's instantaneous torque demand, the battery's state of charge, and other operating parameters. *Id.* at 19:53–55. For example, the hybrid vehicle operates in: (1) an all-electric mode, where only the traction motor provides the torque to propel the vehicle, whenever operation of the engine would be inefficient (i.e., stop-and-go city driving); (2) an engine-only mode, where only the engine provides the torque to propel the vehicle, whenever the engine can run at an efficient level (i.e., highway cruising); (3) a dual-operation mode, where the traction motor provides additional torque to propel the vehicle beyond that already provided by the engine, whenever the instantaneous torque demand exceeds the maximum torque output of the engine (i.e., while accelerating, passing, and climbing hills); and (4) a battery recharge mode where the engine operates a generator to recharge the battery while the traction motor drives the vehicle. *Id.* at 35:66–36:58, 37:26–38:55.

B. Challenged Claims

Ford challenges independent claims 1 and 23. It also challenges dependent claims 6, 7, 9, 15, and 21, which depend directly or indirectly from claim 1, and dependent claim 36, which depends from claim 23. Claim 1 is illustrative:

> 1. A hybrid vehicle, comprising:
>
> an internal combustion engine controllably coupled to road wheels of said vehicle;
>
> a first electric motor connected to said engine [a]nd operable to start the engine responsive to a control signal;
>
> a second electric motor connected to road wheels of said vehicle, and operable as a motor, to apply torque to said wheels to propel said vehicle, and as a generator, for accepting torque from at least said wheels for generating current;
>
> a battery, for providing current to said motors and accepting charging current from at least said second motor; and
>
> a controller for controlling the flow of electrical and mechanical power between said engine, first and second motors, and wheels,
>
> wherein said controller starts and operates said engine when torque require[d] to be produced by said engine to propel the vehicle and/or to drive either one or both said electric motor(s) to charge said battery is at least equal to a setpoint (SP) above which said engine torque is efficiently produced, and wherein the torque produced by said engine when operated at said setpoint (SP) is substantially less than the maximum torque output (MTO) of said engine.

Ex. 1001, 58:13–37.

Independent claim 23 is directed to a "method" of controlling a hybrid vehicle. *Id.* at 60:22. Like claim 1, it requires an "internal combustion engine capable of efficiently producing torque at loads between a lower level [setpoint] SP and a maximum torque output MTO." *Id.* at 60:23–25. Unlike claim 1, however, claim 23 does not require *two* motors. Claim 23 simply requires "*one or more* electric motors" for providing output torque and generating electrical current. *Id.* at 60:25–27 (emphasis added).

C. Evidence of Record

Ford relies upon the following prior art as its basis for challenging the claims of the '347 patent, and it also proffers the Declaration of Dr. Gregory W. Davis (Ex. 1005).

References	Patents/Printed Publications	Date	Exhibit
Severinsky	U.S. Patent No. 5,343,970	Sept. 6, 1994	1003
Ehsani	U.S. Patent No. 5,586,613	Dec. 24, 1996	1004

D. Asserted Grounds of Unpatentability

Ford challenges the patentability of claims 1, 6, 7, 9, 15, 21, 23, and 36 of the '347 patent based on the following specific grounds:

Ground	Basis	Challenged Claims
§ 103	Severinsky	23 and 36
§ 103	Severinsky and Ehsani	1, 6, 7, 9, 15, and 21

III. ANALYSIS

A. Standing

Paice contends that Ford is "barred or estopped" under 37 C.F.R. § 42.104(a) from requesting *inter partes* review of the '347 patent due to an alleged breach of an arbitration agreement between the parties. Prelim. Resp. 5–12. According to Paice, the arbitration agreement includes "unambiguous terms" that purportedly limit Ford's ability to "challeng[e] the patent claims of the '347 patent." *Id.* at 7, 9–10. Postulating that Ford is in breach of those terms, Paice asserts that Ford has failed to demonstrate the requisite standing to file the instant petition. *Id.* at 11.

The purported "standing" argument raised by Paice, however, relates to a disputed contractual matter that falls outside the purview of our authority under the Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011). Indeed, the question of whether Ford has breached the arbitration agreement by requesting *inter partes* review of the '347 patent is currently the subject of a preliminary injunction motion filed by Paice in the co-pending district court action, *and yet to be decided.* Prelim. Resp. 11 n.4. As such, we reject Paice's attempt to frame this unresolved breach-of-contract issue as a standing issue ripe for our review. Based on the current record, Paice has not demonstrated that Ford is barred or estopped from challenging the '347 patent.

B. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in the context of the patent in which they appear. 37 C.F.R. § 42.100(b). Ford contends that five claim limitations are in need of construction, namely, "road load (RL)," "setpoint (SP)," "low-load mode I," "highway cruising mode IV," and "acceleration mode V." Pet. 13–17. We construe the relevant limitations as follows.

1. "road load (RL)"

The term "road load" or "RL" is found in independent claim 23 and dependent claims 7, 9, 15, and 36. The specification defines "road load" as "the vehicle's instantaneous torque demands, i.e., that amount of torque required to propel the vehicle at a desired speed," and further notes that it "can be positive or negative, i.e., when decelerating or descending a hill, in which case the negative road load . . . is usually employed to charge the battery." Ex. 1001, 12:40–57. We see no reason to deviate from the specification's express definition. Thus, consistent with the specification, we construe "road load" as "the amount of instantaneous torque required to propel the vehicle, be it positive or negative."

2. "setpoint (SP)"

Independent claims 1 and 23 recite that the internal combustion engine efficiently produces torque at loads between a "setpoint (SP)" and a "maximum torque output (MTO)." Paice seeks to construe the term "setpoint" as "a definite, but potentially variable value at which a transition between operating modes may occur." Prelim. Resp. 13. Ford, on the other hand, asserts that "setpoint" means a "predetermined torque value." Pet. 16.

The specification of the '347 patent states that the value of a setpoint "may vary somewhat" or be "reset" in response to repetitive driving patterns or other monitored variables. Ex. 1001, 40:37–59. But, just because a setpoint *may* change under certain circumstances does not foreclose it from being "set" or "determined" at a prior point in time. Any other construction would defeat the purpose of it being "set," which the '347 patent admits is for comparison sake. For instance, the specification states that "the microprocessor tests sensed and calculated values for system variables [such as road load (RL)] . . . *against setpoints, and uses the results of the comparisons* to control the mode of vehicle operation." Ex. 1001, 40:22–31 (emphasis added). That description makes clear that the microprocessor is comparing a just-derived value against a previously-defined value. As such, we construe the term "setpoint" to mean at least a "predetermined value that may or may not be reset." The inquiry does not end there, however.

Next, Paice takes issue with Ford's construction of "setpoint" as being limited to a "torque value." Prelim. Resp. 13–15. According to Paice, the specification describes setpoint as both a "torque value" and a "battery charge status." *Id.* at 15 (citing Ex. 1115 at 10). We agree that the *specification* provides that either "torque output" or "state of charge of the battery bank" can be compared against setpoints. Ex. 1001, 40:28–31. The *claim language*, however, is not so broad. Although the specification is an important tool in claim construction, it is the claim language itself—and the manner in which a disputed term is used in the context of the claim—that controls the ultimate determination.

Here, contrary to Paice's assertion, the claim language consistently refers to a "setpoint" in terms of a "torque" value. For example, claim 1 recites that the "*torque* require[d] . . . is at least equal to a setpoint (SP) above which said engine *torque* is efficiently produced, and wherein the *torque* produced by said engine when operated at said setpoint (SP) is substantially less than the maximum *torque* output (MTO) of said engine." Nowhere does the claim refer to "setpoint" or "SP" in the context of a battery's "state of charge." Likewise, although claim 23 includes the step of "monitoring the state of charge of said battery," the claim never makes a comparison between the battery's "state of charge" and a "setpoint." Instead, claim 23 consistently references a "setpoint" or "SP" in terms of "torque," e.g., "producing *torque* at loads between a lower level SP and a maximum *torque* output"; "when the *torque* RL required to do so is less than said lower level SP"; "using the *torque* between RL and SP to drive said at least one electric motor"; and "the *torque* produced by said engine when operated at said setpoint (SP) is substantially less than the maximum *torque* output." Ex. 1001, 60:22–54 (emphasis added). Thus, given the claim language's clear correlation of a "setpoint" or "SP" to a torque value, we construe the terms "setpoint" and "SP" to mean "a predetermined torque value that may or may not be reset."

3. "low-load mode I," "highway cruising mode IV," and "acceleration mode V"

Claim 7 expressly defines the terms "low-load mode I," "highway cruising mode IV," and "acceleration mode V," within the body of the claim. Ex. 1001, 58:58–59:8. As such, for purposes of institution, no further construction of these terms is necessary at this time.

C. Asserted Grounds

1. Claims 23 and 36 – Obviousness over Severinsky

Ford challenges claims 23 and 36 on the ground that the claimed invention would have been obvious over Severinsky. Pet. 17–19. In support of this ground, Ford provides a detailed claim chart explaining how each limitation of claims 23 and 36 is met by Severinsky and why a skilled artisan would have found the claimed invention obvious in view of the teachings of Severinsky and the general knowledge of skilled artisans. *Id.* at 19–32.

Claim 23 recites a method of controlling a hybrid vehicle having an engine "capable of efficiently producing torque at loads between *a lower level SP [i.e., setpoint] and a maximum torque output MTO*." Ex. 1001, 60:22–25 (emphasis added). First, Paice asserts that Severinsky does not teach "efficiently" producing engine torque at "a lower level SP," as required by claim 23. Prelim. Resp. 17. But Severinsky expressly defines the engine's "most efficient operational point" to be in the range of "60–90% of its maximum torque." Ex. 1003, 20:63–67. Crediting the testimony of Ford's declarant, Dr. Davis, we are persuaded that a skilled artisan would have understood the low end of Severinsky's range, i.e., 60%, to be a "lower level setpoint." *See* Pet. 21 (citing Ex. 1005 ¶¶ 201–204).

Although Paice appears not to dispute that the lower end of Severinsky's "60-90%" range is a torque value, it nonetheless takes issue with Severinsky's failure to indicate how such torque value "can be varied" or is "potentially variable." Prelim. Resp. 17–18. Paice's argument, however, is premised on an incorrect construction of "setpoint." As properly construed above, "setpoint" simply requires that the torque value be "predetermined," not that it be variable. Although the claim language does not preclude the "setpoint" from being reset (e.g., based on driver tendencies), nothing in the claim language requires that it be "variable," as Paice contends.

Next, Paice contends that Severinsky fails to disclose that the engine "efficiently" produces torque up to a "maximum torque output." Prelim. Resp. 18. According to Paice, Severinsky's disclosure of maintaining engine efficiency "up to 90% of its maximum torque" does not equate to "the full maximum torque as recited in claim 23." *Id.* at 18–19. Paice mischaracterizes Severinsky, which merely discloses the "*most* efficient" operation to be at 90% of maximum torque. That disclosure of an *ideal* upper limit does not preclude the engine's operation above the 90% limit from still being "efficient," which is all claim 23 requires. Indeed, the '347 patent admits that Severinsky's engine can operate at "100% of its maximum torque output, for efficient charging of the battery bank." Ex. 1001, 11:2–7; *see also* Ex. 1005 ¶ 211. Thus, we are persuaded that Severinsky teaches a hybrid engine that efficiently produces torque "at a maximum torque output."

Paice also disputes Ford's position that Severinsky discloses the battery charge limitation of claim 23, namely,

> employing said engine to propel said vehicle when the torque RL required to do so is less than said lower level SP and using the torque between RL and SP to drive said at least one electric

> motor to charge said battery when the state of charge of said battery indicates the desirability of doing so.

Prelim. Resp. 20–22. As described in Severinsky, the microprocessor monitors vehicle performance to determine if "*excess engine torque* is available . . . [that] can be transformed into electrical energy in motor 20 and stored by battery 22." Ex. 1003, 13:65–14:21 (emphasis added). Severinsky further discloses that "when the vehicle starts down a hill, and the operator lifts his foot from the accelerator pedal, the kinetic energy of the vehicle and the *engine's excess torque may be used* to drive the motor 20 as a generator so as *to charge the batteries*." *Id.* at 10:32–36 (emphasis added). Those disclosures by Severinsky are similar to the specification support for claim 23 that "excess engine torque is used to charge the batteries" when the vehicle's torque requirements "are less than the torque then being produced by the engine, e.g., during coasting, on downhills or during braking." Ex. 1001, 38:22–28. Nonetheless, Paice argues that Severinsky does not use engine torque to propel the vehicle when the battery is being recharged. Prelim. Resp. 21–22. But Ford's declarant, Dr. Davis, points to Figure 9 of Severinsky as illustrating a mode "where the engine provides torque to the wheels to propel the vehicle and motor for battery recharging." Ex. 1005 ¶¶ 301–304. We are persuaded by Dr. Davis's testimony that Severinsky teaches the battery charge limitation of claim 23.

Having considered the information presented in the Petition and the Preliminary Response, we determine that Ford has demonstrated a reasonable likelihood of showing that a skilled artisan would have found the subject matter of claim 23 obvious over Severinsky. Also, we have considered Ford's challenge of dependent claim 36. Pet. 33–34. Paice does not argue this dependent claim separately from independent claim 23. *See* Prelim. Resp. 16–22. Based on our review of the detailed claim chart and reasoning presented in the petition, we are persuaded that Ford has shown sufficiently that the dependent limitation of claim 36 also would have been obvious over Severinsky.

2. *Claims 1, 6, 7, 9, 15, and 21 – Obviousness Over Severinsky and Ehsani*

Ford challenges independent claim 1, as well as dependent claims 6, 7, 9, 15, and 21, on the ground that the claimed invention would have been obvious over the combined teachings of Severinsky and Ehsani. Pet. 34–51. Claim 1 recites a hybrid vehicle having *two* electric motors, one acting as a starter motor for the engine and another acting as a generator for the battery. Ex. 1001, 58:16–22. Acknowledging that Severinsky discloses simply a *single* electric motor having the dual functionality of both a starter motor and a generator, Ford points to the long history of starter motors in the automotive industry (dating back to 1912) as evidence that equipping Severinsky with a separate starter motor would have been nothing more than an obvious design choice in the eyes of skilled artisans at the time of the claimed invention. Pet. 36 (citing Ex. 1005 ¶¶ 329–333). Indeed, Severinsky recognizes as much, explaining that the decision to eliminate a separate starter motor was a function of "convenience" in terms of "cost, weight, and manufacturing." Ex. 1003, 21:39–55; *see also id.* at 6:36–39.

Additionally, Ford points to Ehsani as teaching the use of two electric motors in a hybrid vehicle, namely, starter/generator motor 50 and electric propulsion motor 51. Pet. 37 (citing Ex. 1004, Fig. 5, 3:24–25, 8:32–34). We are persuaded by Dr. Davis's testimony that a skilled artisan would have known (and been able) to modify the "one motor" hybrid vehicle of Severinsky to add a separate starter motor, as taught by Ehsani, so that "noise vibration and harshness (NVH) issues would be greatly minimized." Ex. 1005 ¶¶ 366–68. We do not find credible Paice's argument that "adding back a feature that was intentionally removed" by Severinsky evinces a lack of motivation to combine with Ehsani. *See* Prelim. Resp. 22–24.

Paice also faults the combination of Severinsky and Ehsani as failing to suggest "a setpoint (SP) above which said engine torque is efficiently produced," as recited in claim 1. Prelim. Resp. 25. As discussed above, Severinsky discloses that the engine runs at "its *most efficient* operational point [when] it produces 60-90% of its maximum torque whenever operated." Ex. 1003, 20:63–66 (emphasis added). That disclosure evinces that a skilled artisan would have understood Severinsky's lower limit of 60% to be the "setpoint" for efficient operation. *See* Ex. 1005 ¶¶ 398–402. Again, however, Paice faults Severinsky for failing to indicate how its lower limit of 60% "may be varied in any way." Prelim. Resp. 25. As discussed above, Paice misconstrues "setpoint" to require variation when nothing in the claim language suggests such a construction. Thus, we are persuaded that Severinsky's lower limit of 60% of maximum torque for achieving efficient operation of the engine meets the "setpoint" language of claim 1.

Also, we have considered Ford's challenge of dependent claims 6, 7, 9, 15, and 21. Pet. 44–51. Based on our review of the information presented in the Petition, we are persuaded that Ford has shown sufficiently that these dependent limitations are taught by Severinsky and Ehsani. *See id.* (citing Ex. 1005 ¶¶ 410–506). For instance, Paice argues that the combination of Severinsky and Ehsani fails to suggest the limitation of claim 9, which recites a "low-speed battery charging mode II" in which the engine and a first electric motor are disengaged from the wheels and the vehicle is propelled by a second electric motor. Prelim. Resp. 25–26. Although Severinsky discloses a single motor for charging the battery, Ehsani teaches utilizing two electric motors in which generator 50 (i.e., first electric motor) charges battery 24 while the engine is "disengaged from the drive shaft 21 by clutch 51" and electric motor 51 (i.e., the second motor) is used to propel the vehicle. Ex. 1004, 8:28–34. We are persuaded that it would have been obvious to modify Severinsky's single-motor battery charging mode with Ehsani's dual-motor battery charging mode so that the engine can be operated at its most efficient range while still allowing the second motor to drive the vehicle. *See* Ex. 1003, 2:43–54; Ex. 1005 ¶¶ 486–489.

3. Ford's Purported Additional Ground

Ford further contends that claims 1, 6, 7, 9, 15, and 21 are unpatentable under 35 U.S.C. § 103 as obvious over "Ehsani and Severinsky." Pet. 51–59. As part of this challenge, Ford elaborates on Ehsani's teaching of "alternative control techniques" to assert that a skilled artisan would have been motivated to combine the hybrid control strategies of Ehsani and Severinsky to arrive at a hybrid vehicle that adjusts the output of the engine based on torque requirements.[3] Pet. 53–54. But that additional discussion of Ehsani does not rise to the level of a meaningfully distinct ground. Rather, it simply amounts to additional support for combining the two references. As such, we exercise our discretion under 37 C.F.R. § 42.108 to view Ford's challenge based on "Ehsani and Severinsky" not as a different ground, but simply as additional support for the ground of "Severinsky and Ehsani" on which we institute trial.

IV. CONCLUSION

Based on the arguments and evidence presented in the Petition, we determine that Ford has demonstrated a reasonable likelihood that it would prevail in establishing that the subject matter of claims 1, 6, 7, 9, 15, 21, 23, and 36 would have been obvious under 35 U.S.C. § 103.

V. ORDER

For the foregoing reasons, it is

ORDERED that, pursuant to 35 U.S.C. § 314(a), *inter partes* review of challenged claims 1, 6, 7, 9, 15, 21, 23, and 36 of the '347 patent is instituted on the asserted ground of obviousness over Severinsky and Ehsani;

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, *inter partes* review of the '347 patent shall commence on

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[3] Ford also repeats many of the same points it made with respect to the ground based on "Severinsky and Ehsani." *See, e.g.*, Pet. 56–59.

the entry date of this Order, and notice is hereby given of the institution of a trial; and

FURTHER ORDERED that all other grounds presented in Ford's Petition are *denied*, and no ground other than that specifically listed above is authorized for *inter partes* review of the '347 patent.

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Paper 11
Entered: December 11, 2014

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner,

v.

PAICE LLC & THE ABELL FOUNDATION, INC.,
Patent Owner.

Case IPR2014-00884
Patent 7,104,347 B2

Before SALLY C. MEDLEY, KALYAN K. DESHPANDE, and CARL M. DEFRANCO, *Administrative Patent Judges*.

DEFRANCO, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Ford Motor Company ("Ford") filed a Petition for an *inter partes* review of claims 1, 7, 10, 21, 23, and 24 of U.S. Patent No. 7,104,347 B2 ("the '347 patent"). Paper 1 ("Pet."). The owner of the '347 patent, Paice LLC & The Abell Foundation, Inc. ("Paice"), filed a Preliminary Response. Paper 8 ("Prelim. Resp.").[1] We have jurisdiction under 35 U.S.C. § 314(a). After considering the Petition and the Preliminary Response, we conclude that Ford has demonstrated a reasonable likelihood that it would prevail in showing unpatentability of all of the challenged claims. Thus, we authorize institution of an *inter partes* review of the '347 patent.

II. BACKGROUND

A. The '347 Patent[2]

The '347 patent describes a hybrid vehicle with an internal combustion engine, two electric motors (a starter motor and a traction motor), and a battery bank, all controlled by a microprocessor that directs torque transfer between the engine, the motors, and the drive wheels of the vehicle. Ex. 1201, 17:5–45, Fig. 4. The hybrid vehicle features a hybrid control strategy that operates the engine under conditions in which the torque required to drive the vehicle is at least equal to a setpoint (SP) above which torque is produced efficiently but is still less than the maximum

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[1] Paice filed a redacted and an unredacted version of its Preliminary Response. Papers 7, 8. Our decision cites the redacted version, i.e., Paper 8, which is marked "Public."

[2] The '347 patent is also the subject of a co-pending case, *Paice, LLC v. Ford Motor Co.*, No. 1-14-cv-00492, filed Feb. 19, 2014 (D. Md.). Pet. 1.

torque output (MTO) of the engine. *Id.* at 20:52–60, 35:5–14; *see also id.* at 13:47–61 ("the engine is never operated at less than 30% of MTO, and is thus never operated inefficiently"). Running the engine in this manner increases fuel efficiency and reduces undesirable emissions. *Id.* at 13:47–51.

B. Challenged Claims

Ford challenges independent claims 1 and 23, and dependent claims 7, 10, and 21 (which depend directly or indirectly from claim 1) and dependent claim 24 (which depends directly from claim 23). Claim 1 is illustrative:

> 1. A hybrid vehicle, comprising:
>
> an internal combustion engine controllably coupled to road wheels of said vehicle;
>
> a first electric motor connected to said engine [a]nd operable to start the engine responsive to a control signal;
>
> a second electric motor connected to road wheels of said vehicle, and operable as a motor, to apply torque to said wheels to propel said vehicle, and as a generator, for accepting torque from at least said wheels for generating current;
>
> a battery, for providing current to said motors and accepting charging current from at least said second motor; and
>
> a controller for controlling the flow of electrical and mechanical power between said engine, first and second motors, and wheels,
>
> wherein said controller starts and operates said engine when torque require[d] to be produced by said engine to propel the vehicle and/or to drive either one or both said electric motor(s) to charge said battery is at least equal to a setpoint (SP) above which said engine torque is efficiently produced, and wherein the torque produced by said engine when operated

> at said setpoint (SP) is substantially less than the maximum torque output (MTO) of said engine.

Ex. 1201, 58:13–37.

Independent claim 23 is directed to a "method" of controlling a hybrid vehicle. *Id.* at 60:22. Like claim 1, it requires an "internal combustion engine capable of efficiently producing torque at loads between a lower level [setpoint] SP and a maximum torque output MTO." *Id.* at 60:23–25. Unlike claim 1, however, claim 23 does not require *two* motors. Claim 23 simply requires "*one or more* electric motors" for providing output torque and generating electrical current. *Id.* at 60:25–27 (emphasis added).

C. Evidence of Record

Ford relies upon the following prior art as its basis for challenging the claims of the '347 patent, and it also proffers the Declaration of Dr. Gregory W. Davis (Ex. 1215).

References	Patents/Printed Publications	Date	Exhibit
Caraceni	A. Caraceni et al., *Hybrid Power Unit Development for Fiat Multipla Vehicle*, SAE TECHNICAL PAPER 981124	1998	1203
Tabata '201	U.S. Patent No. 5,841,201	Nov. 24, 1998	1204
Tabata '541	U.S. Patent No. 6,158,541	Dec. 12, 2000	1205

D. Asserted Grounds of Unpatentability

Ford challenges the patentability of claims 1, 7, 10, 21, 23, and 24 of the '347 patent based on the following specific grounds:

Ground	Basis	Challenged Claims
§ 103	Caraceni	1, 7, 10, 21
§ 103	Tabata '201 and Tabata '541[3]	23, 24

III. ANALYSIS

A. Standing

Paice contends that Ford is "barred or estopped" under 37 C.F.R. § 42.104(a) from requesting *inter partes* review of the '347 patent due to an alleged breach of an arbitration agreement between the parties. Prelim. Resp. 5–13. According to Paice, the arbitration agreement includes "unambiguous terms" that purportedly limit Ford's ability to "challeng[e] the patent claims of the '347 patent." *Id.* at 8, 10. Postulating that Ford is in breach of those terms, Paice asserts that Ford has failed to demonstrate the requisite standing to file the instant Petition. *Id.* at 11, 13.

The purported "standing" argument raised by Paice, however, relates to a disputed contractual matter that falls outside the purview of our authority under the Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011). Indeed, the question of whether Ford breached the arbitration agreement by requesting *inter partes* review of the '347 patent

[3] Also referred to collectively as "Tabata '201 and '541."

was the subject of a preliminary injunction motion in the co-pending district court action, which the district court recently denied. Prelim. Resp. 12 n.5; *see also* Paper 10 ("Updated Mandatory Notice" of district court's denial of Paice's motion). As such, we reject Paice's attempt to frame this breach-of-contract issue before the district court as a standing issue ripe for our review. Based on the current record, Paice has not demonstrated that Ford is barred or estopped from challenging the '347 patent.

B. Claim Construction

Ford contends that five claim limitations are in need of construction, namely, "road load (RL)," "setpoint (SP)," "low-load mode I," "highway cruising mode IV," and "acceleration mode V." Pet. 13–18. In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in the context of the patent in which they appear. 37 C.F.R. § 42.100(b). Although Ford argues for construction of specific terms (Pet. 13–18), we determine that only the following claim construction is necessary at this stage.

1. "road load (RL)"

The term "road load" or "RL" is found in challenged claims 7, 21, and 23. The specification defines "road load" as "the vehicle's instantaneous torque demands, i.e., that amount of torque required to propel the vehicle at a desired speed," and further notes that it "can be positive or negative, i.e., when decelerating or descending a hill, in which case the negative road load . . . is usually employed to charge the battery." Ex. 1201, 12:40–57. We see no reason to deviate from the specification's express definition. Thus, consistent with the specification, we construe "road load" as "the amount of instantaneous torque required to propel the vehicle, be it positive or negative."

2. *"setpoint (SP)"*

Independent claims 1 and 23 recite that the internal combustion engine efficiently produces torque at loads between a "setpoint (SP)" and a "maximum torque output (MTO)." Paice seeks to construe the term "setpoint" as "a definite, but potentially variable value at which a transition between operating modes may occur." Prelim. Resp. 14. Ford, on the other hand, asserts that "setpoint" means a "predetermined torque value." Pet. 15.

The specification of the '347 patent states that the value of a setpoint "may vary somewhat" or be "reset" in response to repetitive driving patterns or other monitored variables. Ex. 1201, 40:37–59. But, just because a setpoint *may* change under certain circumstances does not foreclose it from being "set" or "determined" at a prior point in time. Any other construction would defeat the purpose of it being "set," which the '347 patent admits is for comparison sake. For instance, the specification states that "the microprocessor tests sensed and calculated values for system variables [such as road load (RL)] . . . *against setpoints, and uses the results of the comparisons* to control the mode of vehicle operation." *Id.* at 40:22–31 (emphasis added). That description makes clear that the microprocessor is comparing a just-derived value against a previously-defined value. As such, we construe the term "setpoint" to mean at least a "predetermined value that may or may not be reset." The inquiry does not end there, however.

Next, Paice takes issue with Ford's construction of "setpoint" as being limited to a "torque value." Prelim. Resp. 14–17. According to Paice, the specification describes setpoint as both a "torque value" and a "battery charge status." *Id.* at 17 (citing Ex. 1211 at 10). We agree that the *specification* provides that either "torque output" or "state of charge of the battery bank" can be compared against setpoints. Ex. 1201, 40:28–31. The *claim language*, however, is not so broad. Although the specification is an important tool in claim construction, it is the claim language itself—and the manner in which a disputed term is used in the context of the claim—that controls the ultimate determination of the meaning of the term.

Here, contrary to Paice's assertion, the claim language consistently refers to a "setpoint" in terms of a "torque" value. For example, claim 1 recites that the "*torque* require[d] to be produced by said engine . . . is at least equal to a setpoint (SP) above which said engine *torque* is efficiently produced, and wherein the *torque* produced by said engine when operated at said setpoint (SP) is substantially less than the maximum *torque* output (MTO) of said engine." Ex. 1201, 58:30–37 (emphasis added). Nowhere does the claim refer to "setpoint" or "SP" in the context of a battery's "state of charge." Likewise, although claim 23 includes the step of "monitoring the state of charge of said battery," the claim never makes a comparison between the battery's "state of charge" and a "setpoint." Instead, claim 23 consistently references a "setpoint" or "SP" in terms of "torque," e.g., "producing *torque* at loads between a lower level SP and a maximum *torque* output"; "when the *torque* RL required to do so is less than said lower level

SP"; "using the *torque* between RL and SP to drive said at least one electric motor"; and "the *torque* produced by said engine when operated at said setpoint (SP) is substantially less than the maximum *torque* output." *Id.* at 60:22–54 (emphasis added). Thus, given the claim language's clear correlation of a "setpoint" or "SP" to a torque value, we construe the terms "setpoint" and "SP" to mean "a predetermined torque value that may or may not be reset."

3. *"low-load mode I," "highway cruising mode IV," and "acceleration mode V"*

Challenged claim 7 expressly defines the terms "low-load mode I," "highway cruising mode IV," and "acceleration mode V," within the body of the claim. Ex. 1201, 58:58–59:8. As such, for purposes of institution, no further construction of these terms is necessary at this time.

C. Asserted Grounds

1. *Claims 1, 7, 10, and 21 – Obviousness Over Caraceni*

Ford challenges independent claim 1, as well as dependent claims 7, 10, and 21, on the ground that the claimed invention would have been obvious over the teachings of Caraceni. Pet. 18. In support of this ground, Ford provides a detailed analysis of how Caraceni meets each limitation of the challenged claims and why a skilled artisan would have found the claimed invention obvious over Caraceni and the general state of the art. *Id.* at 21–43.

In its Preliminary Response, Paice does not appear to dispute that Caraceni teaches all of the structural components of the claimed invention.

See, e.g., Ex. 1203, Fig. 10 (depicting the components of Caraceni's hybrid vehicle). Instead, Paice faults Caraceni for failing to suggest the "setpoint" limitation of claim 1, namely, that the controller operates the engine when the torque demand is "at least equal to a setpoint (SP) above which said engine torque is efficiently produced." Prelim. Resp. 18–20. We are not persuaded. At this stage, we find credible Ford's declarant, Dr. Davis, who explains how Caraceni's Figure 9 (particularly, "time period 2") illustrates that the engine is not started until the requisite torque "exceeds a predetermined torque value" indicative of low fuel consumption, which he characterizes as a "setpoint." *See* Ex. 1215 ¶¶ 274–279 (discussing Ex. 1203, Fig. 9 (annotated)).

Paice takes issue with Dr. Davis's characterization of Caraceni's setpoint because "nothing in the Petition or in Dr. Davis' declaration [] indicate that such a point in Caraceni *may be varied* in any way." Prelim. Resp. 19 (emphasis added). Paice's contention, however, is premised on an incorrect construction of "setpoint." As properly construed above, "setpoint" simply requires that the torque value be "predetermined." Although the claim language does not preclude the "setpoint" from being variable, nothing in the claim language requires it. As such, Paice misses the mark by contending that Caraceni lacks something that the claim does not even require.

Paice further contends that Caraceni is "silent with regard to an engine that produces torque 'efficiently' or has 'low specific fuel consumption.'" Prelim. Resp. 20–21. We view Caraceni differently. For example, Caraceni expressly states that the engine is utilized under "the most favorable working conditions in terms of efficiency and emissions," including "minimiz[ing] fuel consumption." Ex. 1203 at 3, 6, respectively. Caraceni further recognizes the necessity of modifying the engine's control unit "to optimize fuel economy, emission and driveability for the hybrid application." *Id.* at 4. That clear language in Caraceni weighs against Paice's contention of silence on the issue of operating the engine "efficiently," as called for by claim 1.

Having considered Paice's arguments, we are nonetheless persuaded at this time that Ford has demonstrated a reasonable likelihood that Caraceni teaches the limitation of a "setpoint" for operating the engine "efficiently." *See* Pet. 29–32. We also have considered Ford's analysis of Caraceni as applied to the other limitations of claim 1, as well as the limitations of dependent claims 7, 10, and 21. *See id.* (citing Ex. 1215 ¶¶ 298–350). Based on the current record, we are persuaded that Ford has demonstrated a reasonable likelihood that the subject matter of claims 1, 7, 10, and 21 would have been obvious in view of Caraceni.

2. Claims 23 and 24 – Obviousness over Tabata '201 and '541

Independent claim 23 recites a method of controlling a hybrid vehicle having an engine "capable of efficiently producing torque *at loads between a lower level SP [i.e., setpoint] and a maximum torque output MTO*." Ex. 1201, 60:22–25 (emphasis added). Dependent claim 24 adds the step of monitoring driver patterns over time and varying the setpoint accordingly. *Id.* at 60:55–57. In challenging claims 23 and 24, Ford provides a detailed analysis of how Tabata '201 and '541 teach each of the claimed steps and why a skilled artisan would have found the claimed method obvious. Pet. 43–56.

Paice takes issue with Ford's analysis on three fronts. First, Paice contends that claim 23 requires an engine that "produces torque *up to* a maximum torque output (MTO) of the engine." Prelim. Resp. 23 (emphasis added, original emphasis omitted). According to Paice, Tabata '201 and '541 fail to meet this requirement because Tabata's engine operates within a range that "falls below" the maximum output of the engine, but never reaches "up to" the full extent of the engine's output. *Id.* at 25. Paice's argument is misplaced. Neither the specification nor the claim language supports Paice's attempt to inject the phrase "up to" into the claim. For instance, claim 23 does not require that the engine operate at loads "up to" its maximum output; it only requires that the engine operate at loads "between" the lower level setpoint and the maximum output. Likewise, the specification states that the engine is operational "where the road load is *between about* 30% and 100% of the engine's maximum torque output," thereby confirming that the desired load need only fall somewhere within the range for the engine to operate efficiently, not that it cover the full extent of the range. Ex. 1201, 37:45–47 (emphasis added). As explained by Ford's declarant, Dr. Davis, Figure 7 of Tabata '201 clearly shows that the engine operates in a fuel efficient range, i.e., "sweet spot," falling *between* a predetermined value P1 and a maximum torque output MTO. Pet. 48 (citing Ex. 1215 ¶¶ 371–376). That disclosure, along with Dr. Davis's explanation, persuades us at this stage that the combination of Tabata'201 and Tabata

'541 satisfies the claimed range of producing torque "between a lower level SP and a maximum torque output MTO."

Next, Paice argues that neither Tabata'201 nor '541 teaches an engine that "efficiently" produces torque at "a lower level SP," as required by claim 23. Prelim. Resp. 26. But, as confirmed by Ford's declarant, Dr. Davis, Tabata '201 describes the "hatched area" of Figure 7 as indicating the "lowest value" of fuel consumption efficiency and further explains that engine torque output is "selected within a predetermined range" that has a "predetermined width . . . on the upper and lower sides of the line L" in Figure 7. *See* Ex. 1215 ¶¶ 371–376 (citing Ex. 1204, 13:53–14:4, 21:21–26). That language in Tabata '201, which speaks of fuel efficiency in terms of "lowest value" and "lower side" of a predetermined range, persuades us at this time that a skilled artisan would have understood Tabata'201 as teaching a "lower level setpoint."

Third, Paice contends that, even if Tabata'201 is considered to teach a setpoint, it still fails to teach how the setpoint "can potentially be varied" or is "potentially variable." Prelim. Resp. 26. Paice's argument, however, is premised on an incorrect construction of "setpoint." As discussed above, properly construed, "setpoint" simply requires that the torque value be "predetermined," not that it be variable. Although the claim language does not preclude the "setpoint" from being reset (e.g., based on driver tendencies), nothing in the claim language requires that it be "variable," as Paice contends.[4]

Having considered the information presented in the Petition and the Preliminary Response, we determine that Ford is likely to show that claim 23 would have been obvious over the combined teachings of Tabata '201 and '541. Also, we have considered Ford's challenge of dependent claim 24 (Pet. 55–56), and we are persuaded that Ford also is likely to show that claim 24 would have been obvious over Tabata '201 and '541.

IV. CONCLUSION

Based on the existing record, we determine that Ford has demonstrated a reasonable likelihood of showing unpatentability of claims 1, 7, 10, 21, 23, and 24 under 35 U.S.C. § 103. As such, we authorize institution of an *inter partes* review of the '347 patent.

V. ORDER

For the foregoing reasons, it is

ORDERED that, pursuant to 35 U.S.C. § 314(a), *inter partes* review of claims 1, 7, 10, and 21 of the '347 patent is instituted on the asserted ground of obviousness over Caraceni, and review of claims 23 and 24 is

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[4] Paice further contends that the Tabata-based ground should be denied under 35 U.S.C. § 325(d) because the Office "already considered" Tabata '201 and '541 "during prosecution leading to the '347 patent." Prelim. Resp. 22–23. We disagree. In this instance, the mere citation of the Tabata references in an Information Disclosure Statement does not amount to being "presented to the Office" sufficiently enough to warrant denial under § 325(d).

instituted on the asserted ground of obviousness over Tabata '201 and Tabata '541.

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, *inter partes* review of the '347 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial; and

FURTHER ORDERED that no ground other than that specifically listed above is authorized for *inter partes* review of the '347 patent.

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Paper 12
Entered: November 2, 2015

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner,

v.

PAICE LLC and THE ABELL FOUNDATION, INC.,
Patent Owner.

Case IPR2015-00795
Patent 7,104,347 B2

Before SALLY C. MEDLEY, KALYAN K. DESHPANDE, and CARL M. DEFRANCO, *Administrative Patent Judges.*

DESHPANDE, *Administrative Patent Judge.*

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Ford Motor Company ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–5, 14, 16, 19, 20, and 22 of U.S. Patent No. 7,104,347 B2 (Ex. 1301, "the '347 patent"). Paper 1 ("Pet."). Paice LLC and The Abell Foundation, Inc. (collectively, "Patent Owner") filed a Preliminary Response in both unredacted and redacted forms. Papers 9, 10 ("Prelim. Resp.").[1] Patent Owner also filed a Motion to Seal. Paper 11 ("Motion to Seal"). We have jurisdiction under 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted "unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." After considering the Petition, the Preliminary Response, and associated evidence, we conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing unpatentability of all the challenged claims, except claim 2. Thus, we authorize institution of an *inter partes* review of claims 1, 3–5, 14, 16, 19, 20, and 22 of the '347 patent and we do not institute review of claim 2.

A. Related Proceedings

Petitioner indicates that the '347 patent is the subject of *Paice, LLC and The Abell Foundation, Inc. v. Ford Motor Company*, Case No. 1-14-cv-00492 and *Paice LLC and The Abell Foundation, Inc. v. Hyundai Motor America et. al.*, Case No. 1:2012-cv-00499. Pet. 1; Paper 5, 2. Petitioner also indicates that the '347 patent is the subject of IPR2014-00571, IPR2014-00579, and IPR2014-00884. *Id.*; Paper 5, 3. Petitioner further

[1] Citations are to the redacted version of Patent Owner's Preliminary Response (Paper 10, "Prelim. Resp.").

indicates that patents related to the '347 patent are the subject matter of IPR2014-00570, IPR2014-01415, IPR2014-00568, IPR2014-00852, IPR2014-00875, IPR2014-00904, IPR2014-01416, IPR2015-00606, IPR2015-00767, IPR2015-00722, IPR2015-00758, IPR2015-00784, IPR2015-00785, IPR2015-00791, IPR2015-00787, IPR2015-00790, IPR2015-00794, and IPR2015-00792. *Id.* at 1–2; Paper 5, 3.

B. The '347 Patent (Ex. 1301)

The '347 patent describes a hybrid vehicle with an internal combustion engine, two electric motors (a starter motor and a traction motor), and a battery bank, all controlled by a microprocessor that directs the transfer of torque from the engine and traction motor to the drive wheels of the vehicle. Ex. 1301, 17:5–45, Fig. 4. The microprocessor features a control strategy that runs the engine only under conditions of high efficiency, typically when the vehicle's instantaneous torque requirements (i.e., the amount of torque required to propel the vehicle, or "road load") is at least equal to 30% of the engine's maximum torque output ("MTO") capability. *Id.* at 20:52–60, 35:5–14; *see also id.* at 13:47–61 ("the engine is never operated at less than 30% of MTO, and is thus never operated inefficiently").

Running the engine only when it is efficient to do so leads to improved fuel economy and reduced emissions. *Id.* at 13:47–52. To achieve such efficiency, the hybrid vehicle includes various operating modes that depend on the vehicle's torque requirements, the battery's state of charge, and other operating parameters. *Id.* at 19:53–55. For example, the hybrid vehicle may operate in: (1) an all-electric mode, where only the traction motor provides the torque to propel the vehicle and operation of the engine would be inefficient (i.e., stop-and-go city driving); (2) an engine-only mode, where only the engine provides the torque to propel the vehicle and the engine would run at an efficient level (i.e., highway cruising); (3) a dual-operation mode, where the traction motor provides additional torque to propel the vehicle beyond that already provided by the engine and the torque required to propel the vehicle exceeds the maximum torque output of the engine (i.e., while accelerating, passing, and climbing hills); and (4) a battery recharge mode where the engine operates a generator to recharge the battery while the traction motor drives the vehicle. *Id.* at 35:66–36:58, 37:26–38:55.

C. Illustrative Claim

Petitioner challenges claims 1–5, 14, 16, 19, 20, and 22 of the '347 patent. Pet. 4–60. Claim 1 is illustrative of the claims at issue and is reproduced below:

> 1. A hybrid vehicle, comprising:
>
> an internal combustion engine controllably coupled to road wheels of said vehicle;
>
> a first electric motor connected to said engine nd [sic] operable to start the engine responsive to a control signal;
>
> a second electric motor connected to road wheels of said vehicle, and operable as a motor, to apply torque to said wheels to propel said vehicle, and as a generator, for accepting torque from at least said wheels for generating current;
>
> a battery, for providing current to said motors and accepting charging current from at least said second motor; and
>
> a controller for controlling the flow of electrical and mechanical power between said engine, first and second motors, and wheels, wherein said controller starts and operates said engine when torque require to be produced by said engine to propel the vehicle and/or to drive either one or both said electric motor(s) to charge said battery is at least equal to a setpoint (SP) above which said engine torque is efficiently

> produced, and wherein the torque produced by said engine when operated at said setpoint (SP) is substantially less than the maximum torque output (MTO) of said engine.

Ex. 1301, 58:13–37.

D. The Alleged Grounds of Unpatentability

The information presented in the Petition sets forth proposed grounds of unpatentability of claims 1–5, 14, 16, 19, 20, and 22 of the '347 patent under 35 U.S.C. § 103(a) as follows (*see* Pet. 7–60):[2 3]

References	Claims Challenged
Ibaraki '882[4] and Koide[5]	1, 2, and 5
Ibaraki '882, Koide, and Frank[6]	3 and 4
Ibaraki '882, Koide, and Kawakatsu[7]	16
Ibaraki '882, Koide, and Vittone[8]	20
Ibaraki '882, Koide, and Yamaguchi[9]	19

[2] Petitioner supports its challenge with the Declaration of Dr. Gregory W. Davis. Ex. 1308.
[3] Although Petitioner adds the general knowledge of one with ordinary skill in the art to the express statement of each alleged ground of unpatentability (Pet. 3–4), that is not necessary. Obviousness is determined from the perspective of one with ordinary skill in the art. We leave out the express inclusion of the general knowledge of one with ordinary skill.
[4] U.S. Patent No. 5,789,882, issued Aug. 4, 1998 (Ex. 1303)("Ibaraki '882").
[5] U.S. Patent No. 5,934,395, issued Aug. 10, 1999 (Ex. 1317)("Koide").
[6] U.S. Patent No. 6,116,363, issued Sept. 12, 2000 (Ex. 1318) ("Frank").
[7] U.S. Patent No. 4,335,429, issued June 15, 1982 (Ex. 1305) ("Kawakatsu").
[8] Oreste Vittone, *Fiat Conceptual Approach to Hybrid Cars Design*, 12TH INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM (1994) (Ex. 1320) ("Vittone").

References	Claims Challenged
Ibaraki '882, Koide, and Ibaraki '626[10]	22
Ibaraki '882, Koide, and Lateur[11]	14

II. ANALYSIS

A. Patent Owner's Discretionary Dismissal Arguments

Patent Owner first argues that we should exercise our discretion under 35 U.S.C. § 325(d) and reject the Petition because "it relies on substantially the same arguments that [Petitioner] Ford has already presented to the Board in four separate proceedings." Prelim. Resp. 17–26. We have considered Patent Owner's argument, but exercise our discretion and consider the Petition and institute trial on the grounds summarized below, based in part on Ibaraki '882, a reference not previously relied on. We also have considered Patent Owner's arguments regarding multiple attacks on independent claim 1. *Id.* at 21–23. Where a dependent claim is challenged, we see no reason not to consider a challenge of the independent claim from which it depends over the same prior art, even if the independent claim already has been challenged elsewhere. Whatever renders obvious the dependent claim necessarily renders obvious the independent claim.

We also have considered Patent Owner's argument that multiple challenges should not be allowed because, under 35 U.S.C. § 315(e)(1), once a final written decision is issued in one proceeding with respect to a claim,

[9] U.S. Patent No. 5,865,263, issued Feb. 2, 1999 (Ex. 1321) ("Yamaguchi").
[10] U.S. Patent No. 6,003,626, issued Dec. 21, 1999 (Ex. 1322) ("Ibaraki '626").
[11] U.S. Patent No. 5,823,280, issued Oct. 20, 1998 (Ex. 1307) ("Lateur").

Petitioner would be barred from requesting or maintaining a proceeding on that claim on any ground that the Petitioner raised or could have raised in the proceeding which yielded the final written decision. Prelim. Resp. 26–29. The contention is misplaced, because that provision applies only to the Petitioner, not the Board. *See Progressive Cas. Ins. Co. v. Liberty Mut. Ins. Co.*, Nos. 2014-1586, 2014-1466, 2014-1639, 2014-1538, 2014-1636, 2014-1656, 2014-1549, 2014-1637, 2015 WL 5004949, at *2 (Fed. Cir. Aug. 24, 2015). Even if it applies to the Board, it is not burdensome simply to terminate the second proceeding with respect to certain claims.

B. Claim Construction

The Board interprets claims of an unexpired patent using the broadest reasonable construction in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b); Office Patent Trial Practice Guide, 77 Fed. Reg. 48756, 48766 (Aug. 14, 2012). Under the broadest reasonable construction standard, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech. Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

1. "Road Load" or "RL"

The term "road load" or "RL" is recited in independent claim 1 and dependent claims 2–5, 14, 16, 19, 20, and 22. The Specification of the '347 patent defines "road load" as "the vehicle's instantaneous torque demands, i.e., that amount of torque required to propel the vehicle at a desired speed," and further notes that it "can be positive or negative, i.e., when decelerating or descending a hill, in which case the negative road load . . . is usually employed to charge the battery." Ex. 1301, 12:38–58. Accordingly, we construe "road load" and "RL" as "the amount of instantaneous torque required to propel the vehicle, be it positive or negative."[12]

2. "Set Point" or "SP"

The term "setpoint" or "SP" is recited in independent claim 1 and dependent claims 2–5, 14, 16, 19, 20, and 22. Petitioner proposes that "setpoint" or "SP" be construed, in the context of these claims, as "predetermined torque value." Pet. 6–7. In that regard, Petitioner correctly notes that the claims compare the setpoint either to an engine torque value or a torque based "road load" value. *Id.* Independent claim 1 recites a condition "when [the] torque require[d] to be produced by said engine to propel the vehicle and/or to drive either one or both said electric motor(s) to charge said battery is at least equal to a setpoint (SP)." Ex. 1301, 58:29–31. Independent claim 1 further recites a relationship between the setpoint and the maximum torque output of the engine, by the language "the torque produced by said engine when operated at said setpoint (SP) is substantially less than the maximum torque output (MTO) of said engine." *Id.* at 58:34–37. Although Patent Owner correctly notes that the Specification outside of the claims refers to two items being measurable against respective setpoints, i.e., the vehicle's instantaneous torque requirement and the state of charge of the battery bank (Prelim. Resp. 9–10), the setpoint in these claims relates to torque and not battery charge.

Patent Owner asserts that "setpoint" or "SP" is not simply a numerical value divorced from the context of the rest of the vehicle's control system, and that a "setpoint" serves the crucial function of marking the transition

[12] This construction is the same as that proposed by Petitioner. Pet. 5–6. Patent Owner does not propose a different construction.

from one claimed mode to another, and in particular, the transition from propelling the vehicle with the motor to propelling the vehicle with the engine. Prelim. Resp. 7–9. Citing the Specification, Patent Owner further states that the Specification uses "setpoint" synonymously with "transition point." *Id.* at 9–10. Accordingly, Patent Owner urges that the construction of "setpoint" or "SP" must include an indication that it is a point at which a transition between different operating modes may occur. *Id.* at 9–12.

Patent Owner's arguments are misplaced. The Specification outside of the claims sometimes uses "setpoint" interchangeably with "transition point," because the disclosure describes the particular transitions between operative modes, at the setpoints. If the multiple transitions between modes are not described, it would be without meaning to refer to a "setpoint" as a transition point between modes. A transition does not spring solely from the term "setpoint" or "SP." It would be improper to read into a claim all of the disclosed operational modes and all disclosed transitions between modes simply because the claim recites the "setpoint" or "SP."

Patent Owner does not urge that "setpoint" or "SP" requires any particular transition from mode to mode. Instead, Patent Owner merely desires to add that a "setpoint" is where a transition between operating modes "may occur." *Id.* Nothing of significance is added by that proposed construction. If a transition is specified by other limitations in the claim, at the setpoint, then a transition is required at the setpoint. If no transition is specified by other limitations in the claim, then no transition is required at a setpoint. A transition may or may not occur at a setpoint, depending on what else is recited in the claim. It is not necessary to include such "may occur" language in the construction of "setpoint" and "SP." A multitude of events "may occur" at a setpoint, but they are not necessary for setting forth the meaning of "setpoint" or "SP" in a claim. The rest of the claim sets forth what is required to occur at a setpoint.

Nevertheless, we do regard as meaningful to note that nothing in the Specification precludes a setpoint from being reset, after it has been set. A setpoint for however short a period of time still is a setpoint.

We construe "setpoint" and "SP" as "predetermined torque value that may or may not be reset."

3. "monitor patterns of vehicle operation over time"

Dependent claim 2 recites that the controller "*monitors patterns of vehicle operation over time* and varies said setpoint SP accordingly." Ex. 1301, 58:38–40. Patent Owner argues that we should construe the italicized phrase to mean "track and record the driver's repeated driving operations over time." Prelim. Resp. 12. Petitioner does not provide an explicit construction for the phrase.

Patent Owner argues that the Specification of the '347 patent's description of monitoring patterns of vehicle operation over time refers to how the operator actually drives the car over some period of time, as opposed to monitoring an internal data point of the vehicle. *Id.* at 12–16. In support of its construction, Patent Owner directs attention to the following descriptions in the Specification:

> Examples of this practice—amounting in many circumstances to modifying certain specific values depending on other data items not discussed in detail, *or by monitoring the vehicle's actual usage patterns over time*—are given below.

Prelim. Resp. 13 (citing Ex. 1301, 35:47–58).

> It is also within the scope of the invention for the microprocessor to monitor the vehicle's operation over a period

> of days or weeks and reset this important setpoint *in response to a repetitive driving pattern*. For example, suppose the operator drives the same route from a congested suburban development to a workplace about the same time every morning; typically the road load might remain under 20% of MTO for the first few minutes of each day, then vary between 0 and 50% of MTO for another few minutes as the operator passes through a few traffic lights, and then suddenly increase to 150% of MTO as the operator accelerates onto a highway. *It is within the skill in the art to program a microprocessor to record and analyze such daily patterns, and to adapt the control strategy accordingly.* For example, *in response to recognition of a regular pattern as above, the transition point might be adjusted to 60% of MTO*; this would prevent repetitive engine starts as the road load exceeded 30% of MTO for a few hundred yards at a time, as might often occur in suburban traffic. Similarly, the engine starting routine might be initiated after the same total distance had been covered each day.

Ex. 1301, 40:56–41:9 (emphasis added).

In addition, Patent Owner, directing attention to external evidence, argues that the word "pattern" means a regular and repeated course of conduct or behavior. Prelim. Resp. 15–16; Ex. 1328; Ex. 2303.

Although Petitioner does not provide an explicit construction for the phrase "monitoring patterns of vehicle operation over time," Patent Owner argues that Petitioner implicitly construes the phrase to encompass monitoring the battery state of charge or "regenerative charging amount" and adjusting the alleged "setpoint" based on the stored regenerative charging amount, with respect to dependent claim 2. *Id.* at 13–14 (citing Pet. 25–27).

We agree with Patent Owner that Petitioner's implicit construction is not in light of the written description of the Specification of the '347 patent which describes changing a setpoint in response to monitored vehicle operation *patterns*. In particular, the description in the Specification regarding patterns describes clearly that the patterns are in connection with the driving patterns of the operator of the vehicle. Ex. 1301, 40:56–41:9. The Specification does not describe monitoring "patterns" of a battery state of charge, for example. Moreover, the plain words of the phrase require monitoring patterns over time. It is not enough to monitor a single value of a vehicle component, for instance. Rather the plain meaning of the words require monitoring patterns, where a pattern is defined as a regular or logical form, order, etc. Ex. 2303. Thus, we agree with Patent Owner that a pattern is a regular and repeated course of conduct or behavior and that the phrase "monitoring patterns of vehicle operation over time" requires monitoring a driver's repeated driving operations over time.

Accordingly, for purposes of this decision, we interpret "monitoring patterns of vehicle operation over time" to require monitoring a driver's repeated driving operations over time.

C. Claims 1, 2, and 5 – Obviousness over Ibaraki '882 and Koide

Petitioner contends that claims 1, 2, and 5 are unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882 and Koide. Pet. 8–29.

1. Ibaraki '882 (Ex. 1303)

Ibaraki '882 discloses a drive control apparatus for a "hybrid vehicle" equipped with an electric motor and an internal combustion engine. Ex. 1303, 1:10–15. The electric motor provides electric energy and operates as a first drive power source, and the internal combustion engine combusts fuel to provide a second drive power source. *Id.* at 2:57–64. The drive control apparatus includes (1) an engine drive mode where the vehicle is driven by the engine, (2) a motor drive mode where the vehicle is driven by the electric motor, and (3) an electricity generating mode where an electric generator is operated by the engine to charge an electric energy storage device. *Id.* at 2:64–3:2. Depending on the running condition of the vehicle, the drive control apparatus selects the drive mode. *Id.* at 3:5–14.

2. *Analysis*

a. *Claims 1 and 5*

The evidence set forth by Petitioner indicates there is a reasonable likelihood that Petitioner will prevail in showing that claims 1 and 5 are unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882 and Koide. Pet. 8–29. Petitioner provides a detailed analysis, supported by evidence, demonstrating that there is a reasonable likelihood that claims 1 and 5 are obvious over Ibaraki '882 and Koide. *Id.*

For example, claim 1 recites "a hybrid vehicle," the vehicle comprising "an internal combustion engine controllably coupled to road wheels of said vehicle." Petitioner contends that Ibaraki '882 discloses a hybrid vehicle that is propelled by an internal combustion (IC) engine and an electric motor. Pet. 8 (citing Ex. 1303, 1:9–14; Ex. 1308 ¶ 180). Petitioner specifically argues that Ibaraki '882 discloses that the engine is controllably coupled to road wheels via a clutch. *Id.* at 11 (citing Ex. 1303, 19:50–54, Fig. 8; Ex. 1308 ¶¶ 184–190).

Claim 1 further recites "a first electric motor connected to said engine [a]nd operable to start the engine responsive to a control signal" and "a second electric motor connected to road wheels of said vehicle, and operable as a motor, to apply torque to said wheels to propel said vehicle, and as a generator, for accepting torque from at least said wheels for generating current." Petitioner argues that Ibaraki '882 discloses an electric motor that when the vehicle is in the "drive" state, the electric motor transfers power to the drive wheels. Pet. 16 (citing Ex. 1303, 19:24–28; Ex. 1308 ¶ 213). Petitioner argues that this electric motor meets the claimed "second electric motor" and a person with ordinary skill in the art would have understood that the transferring of power to the drive wheels is the same as applying torque to said wheels. *Id.* (citing Ex. 1308 ¶¶ 214–215). Petitioner contends that Ibaraki '882 discloses a "charge" state where the electric motor serves as an electric generator using regenerative braking. *Id.* at 16–17 (citing Ex. 1303, 19:61–67, 22:19–30). Petitioner further argues that Ibaraki '882 discloses an electric generator in addition to the electric motor and a person with ordinary skill in the art would have understood that the terms "generator" and "electric motor," when discussing hybrid vehicles, "indicate[s] whether the operation of the electric machines is motor or generator-based." *Id.* at 13 (quoting Ex. 1316, 21). Petitioner alternatively argues that Koide discloses an electric generator that may be used as an electric motor. *Id.* (citing Ex. 1317, 1:30–32). Petitioner further argues that Koide discloses a dual electric motor hybrid vehicle, where the first motor is used to start the engine and the second motor is used as a drive power source. *Id.* at 13–15 (citing Ex. 1317, 7:45–64, 8:47–60, 9:9–65; Ex. 1308 ¶¶ 205–206). Petitioner also argues that it would have been obvious to combine the controls of Koide to the existing structure of Ibaraki '882 for starting the engine via Ibaraki's electric generator, and allow the electric motor to propel the vehicle in order to remove the need for an exclusive engine starter, thereby reducing costs by reducing the number of components. *Id.* at 15–16 (citing Ex. 1317, 1:60–64; Ex. 1308 ¶ 179).

Claim 1 also recites "a battery, for providing current to said motors and accepting charging current from at least said second motor." Petitioner contends that Ibaraki '882 discloses an electrical energy storage device in the form of a battery, and the battery is used for providing current during the "drive" state and a person with ordinary skill in the art would have understood that a battery would have been operable to provide or accept current from any connected electric motor-generator. *Id.* at 17–18 (citing Ex. 1303, 11:31–33, 19:55–57; Ex. 1308 ¶¶ 223–228).

Claim 1 additionally recites "a controller for controlling the flow of electrical and mechanical power between said engine, first and second motors, and wheels." Petitioner contends that Ibaraki '882 discloses a controller that includes four modes: (1) MOTOR DRIVE, where the electric motor is selected as the drive power source, (2) ENGINE DRIVE, where the engine is selected as the drive power source, (3) ENGINE-MOTOR DRIVE, where both the engine and electric motor are selected as the drive power sources, and (4) CHARGING, where electrical energy generated during regenerative braking is transferred to the battery. *Id.* at 18–19 (citing Ex. 1303, 20:43–49, Fig. 8; Ex. 1308 ¶¶ 230, 232, 233).

Claim 1 further recites "wherein said controller starts and operates said engine when torque require to be produced by said engine to propel the vehicle and/or to drive either one or both said electric motor(s) to charge said battery is at least equal to a setpoint (SP) above which said engine torque is efficiently produced wherein the torque produced by said engine when operated at said setpoint (SP) is substantially less than the maximum torque output (MTO) of said engine." Petitioner contends that this limitation includes the language "and/or" and, therefore, this limitation is met because

Ibaraki '882 discloses "said controller starts and operates said engine when torque require to be produced by said engine to propel the vehicle . . . is at least equal to a setpoint (SP) above which said engine torque is efficiently produced." *Id.* at 19 (emphasis omitted). Specifically, Petitioner contends that Ibaraki '882 discloses a setpoint of engine speed above which the engine torque is efficiently produced, the 70% relative efficiency. *Id.* at 19–24 (citing Ex. 1303, 25:36–26:8, Fig. 5; Ex. 1308 ¶¶ 237–238, 240).

Accordingly, the present record supports that Petitioner has established a reasonable likelihood it will prevail in demonstrating that claim 1 is obvious over Ibaraki '882 and Koide. We are similarly persuaded that Petitioner has established a reasonable likelihood it will prevail in demonstrating claim 5 is obvious over Ibaraki '882 and Koide. *See* Pet. 27–28.

We have considered Patent Owner's argument that the Petition improperly incorporates arguments and evidence from the Declaration of Dr. Davis into the Petition. Prelim. Resp. 29–34. We agree that, in general, arguments must not be incorporated by reference from one document into another document (37 C.F.R. § 42.6(a)(3)). Here, however, Patent Owner's arguments are unpersuasive. Petitioner relies on Ibaraki and Koide in challenging claims 1 and 5. In doing so, Petitioner relies on Dr. Davis' testimony as evidence of what a POSA would have known at the time of the invention. We have reviewed those portions of Dr. Davis' Declaration, to which we are directed, with respect to the grounds upon which we institute, and, have determined that there is nothing unusual about his declaration or the way in which Petitioner relies on the declaration insofar as improper incorporation is concerned, at least not to the extent that we would disregard the Petition in its entirety. Moreover, we will not disregard the Petition because of an alleged "voluminous record." *Id.* at 33–34.

Patent Owner also argues that Petitioner has failed to identify "what claim elements are missing from Ibaraki '882" and, therefore, Patent Owner argues that Petitioner fails to provide the requisite *Graham v. John Deere* analysis. Prelim. Resp. 35–36. Patent Owner further argues that Petitioner fails to demonstrate clearly how it is applying Ibaraki '882 to the claims. *Id.* at 36–37. We are not persuaded by Patent Owner's argument. Whatever disclosure from each prior art reference, listed in Petitioner's claim charts in a corresponding location opposite a reproduced claim limitation, is a representation that that disclosure meets the associated claim limitation. We have reviewed the proposed ground of obviousness over Ibaraki '882 and Koide against claims 1 and 5, and are persuaded, at this juncture of the proceeding, that Petitioner has established a reasonable likelihood that Petitioner would prevail in its challenge to claims 1 and 5.

Patent Owner also argues that Petitioner relies improperly on two separate embodiments of Ibaraki '882, namely, the disclosures of Figures 5 and 11, and fails to explain why a person of ordinary skill in the art would be motivated to combine these embodiments. *Id.* at 36–37. We disagree with Patent Owner. Petitioner explains that Figures 5 and 11 similarly set forth thresholds based on engine torque and engine speed. *See* Pet. 20–21. Petitioner further sets forth that the thresholds determine the point in which the engine mode will transition. *See id.* Although Patent Owner argues that Figure 5 discloses "thresholds are based on engine efficiency" and Figure 11 discloses "thresholds are based on drive power" (Prelim. Resp. 36–37), we are not persuaded that these are two separate embodiments. Rather, both

Figures 5 and 11 disclose threshold points for transitioning between engine modes. The mere fact that Figure 5 also discloses engine efficiency based on speed and torque does not render it a separate embodiment. Accordingly, we are not persuaded by Patent Owner that Petitioner has failed to provide an articulated reasoning with a rational underpinning in supporting its conclusion of obviousness.

We are not persuaded by Patent Owner's argument that Petitioner's parallel citations to both embodiments fail to adequately identify the basis for its claim challenges. *Id.* We are able to discern from Petitioner's citations what portions of Ibaraki '882 Petitioner relies upon to disclose which limitation. Furthermore, as discussed above, we are not persuaded that Petitioner relies on two separate embodiments of Ibaraki '882.

We also are not persuaded by Patent Owner's argument that Petitioner provides nothing more than a conclusory analysis between power and torque and Petitioner fails to explain adequately why a person of ordinary skill in the art would have known to modify Ibaraki '882's "fuel-efficiency- and drive-power-based thresholds to instead transition between operating modes based on the 'torque require[d] to be produced by said engine,' instead providing conclusory statements." *Id.* at 37–38. First, this argument is misplaced as none of the challenged claims require "transitioning between operating modes" based on torque requirements. Furthermore, the ground asserted is one of obviousness, not anticipation. We credit the testimony of Dr. Davis, who explains that a "person having ordinary skill in the art would have understood that power and torque are related as a function of speed." Ex. 1308 ¶ 214. We are persuaded by Petitioner and Dr. Davis that a person with ordinary skill in the art would have understood the relationship between power and torque based on speed, and that when power is transferred by the torque. *Id.* Accordingly, we also are persuaded, at this juncture in the proceeding, that a person with ordinary skill in the art would have understood the different combinations of engine and electric motor required to produce the required torque efficiently, and we are not persuaded by Patent Owner's argument that Petitioner's analysis is conclusory. *See* Pet. 19–22; Ex. 1308 ¶¶ 214, 237–241.

Patent Owner further argues that Petitioner has added annotations to Ibaraki '882 Figures 5 and 11, adding values and threshold lines that are not in the cited reference. Prelim. Resp. 38–39. Patent Owner specifically argues that Petitioner's "annotations are misleading and should not be confused for the actual disclosures of Ibaraki '882, which does not involve transitioning between operating modes based on the 'torque RL required' to propel the vehicle." *Id.* The argument is misplaced as none of the challenged claims require "transitioning between operating modes based on the instantaneous torque required to propel the vehicle." The argument is based on Patent Owner's proposed construction for setpoint, which we have not adopted for the reasons provided above in the claim construction section. Furthermore, we are not confused by Petitioner's annotations and the differences between the annotations and what Ibaraki '882 discloses.

Patent Owner further argues that Ibaraki '882 fails to disclose using the generator to start the engine, and, therefore, fails to disclose the first motor recited by the claims. *Id.* at 39–40. We are not persuaded by this argument. First, Petitioner has presented a ground under obviousness, not anticipation. We credit the testimony of Dr. Davis, who explains that a person with ordinary skill in the art of hybrid vehicles would have understood that an electric generator and electric motor indicates that the operation is electric motor or generator based. Ex. 1308 ¶ 196. Accordingly, Dr. Davis concludes that Ibaraki '882 discloses a first electric motor operable to start the engine. *Id.* ¶ 201. Second, Petitioner has provided Koide to disclose this limitation. Accordingly, Patent Owner's argument is tantamount to an attack on the cited prior art individually, whereas the asserted ground is based on a combination of the references.

We also are not persuaded by Patent Owner's contention that Petitioner fails to establish why a person of ordinary skill in the art would modify Ibaraki '882 to replace the "generator for generating energy" with Koide's electric motor. Prelim. Resp. 41–42. As discussed above, Petitioner establishes that it would have been obvious to combine the controls of Koide to the existing structure of Ibaraki '882 for starting the engine via Ibaraki's electric generator, and allow the electric motor to propel the vehicle in order to remove the need for an exclusive engine starter, thereby reducing costs by reducing the number of components. Pet. 15–16 (citing Ex. 1317, 1:60–64; Ex. 1308 ¶ 179). We do not agree with Patent Owner that Petitioner's argument is conclusory because Petitioner articulated a reasoning with rationale underpinning, to remove complexity and reduce costs.

Patent Owner argues that Petitioner effectively reads the words "substantially less" out of the phrase "substantially less than the maximum torque output (MTO) of said engine." *Id.* at 42–43. We disagree. Instead, Petitioner explains that, based on a description in related patent 7,237,634 Patent (claim 15), "substantially less than the MTO" includes a SP which is less than approximately 70% of the MTO. *See* Pet. 22. Moreover, we are not persuaded by Patent Owner's arguments that Petitioner improperly combines embodiments of Ibaraki '882 to meet the "substantially less than the MTO" phrase. The ground is one of obviousness, not anticipation. In any event, Petitioner provides an explanation of how a single embodiment of Ibaraki '882 describes the substantially less than the MTO limitation (*id.* at 22–24), as even Patent Owner recognizes. We are not persuaded that Petitioner's explanation with respect to Figure 11 in the Petition is based on conclusory statements, attorney argument, and improperly incorporated declaration testimony as asserted.

b. Claim 2

The evidence set forth by Petitioner does not indicate there is a reasonable likelihood that Petitioner will prevail in showing that claim 2 is unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882. Pet. 25–27. Dependent claim 2, which depends from independent claim 1, recites "said controller monitors patterns of vehicle operation over time and vary said setpoint SP accordingly." Petitioner argues that Ibaraki '882 discloses that the controller stores in memory a regenerative charge amount based on a user's accelerator patterns. Pet. 25–27 (citing Ex. 1303, 22:43–65). As discussed above in our claim construction, we interpret "monitors patterns of vehicle operation over time" to require monitoring a driver's repeated driving operations over time. As also discussed above in our claim construction, we are not persuaded by Petitioner's implicit construction of "monitors patterns of vehicle operation over time" to encompass monitoring the battery state of charge or "regenerative charging amount" and adjusting the alleged "setpoint" based on the stored regenerative charging amount. As such, we are not persuaded that Ibaraki '882's disclosure of storing the regenerative charge amount based on a user's accelerator patterns meet claim 2. Petitioner does not argue that Koide discloses this limitation. Accordingly, we are not persuaded that Petitioner has established it will prevail in demonstrating that claim 2 is obvious over Ibaraki '882 and Koide.

D. Claims 3 and 4 – Obviousness over Ibaraki '882, Koide, and Frank

The evidence set forth by Petitioner indicates there is a reasonable likelihood that Petitioner will prevail in showing that claims 3 and 4 are unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Koide and Frank. Pet. 29–34. Dependent claim 3, which depends from independent claim 1, recites "said controller monitors the road load (RL) on the vehicle over time, and controls transition between propulsion of said vehicle by said motor(s) to propulsion by said engine responsive to RL reaching SP, such that said transition occurs only when RL>SP for at least a predetermined time, or when RL>SP2, wherein SP2>SP." Dependent claim 4, which also depends from dependent claim 3, recites "said controller further controls transition from propulsion of said vehicle by said engine to propulsion by said motor(s) such that said transition occurs only when RL<SP for at least a predetermined time." Petitioner contends that Ibaraki '882 discloses all of these limitations, except for the limitation requiring the transition to occur after at least a predetermined time. Pet. 31–33. Petitioner contends that Frank discloses this limitation. *Id.* Petitioner specifically argues that Frank discloses combining a time delay between cycling between different modes in order to avoid frequent cycling. Pet. 32–33 (citing Ex. 1318, 8:32–37; Ex. 1308 ¶¶ 313–322). Petitioner also articulates reasoning with rational underpinnings on why a person of ordinary skill in the art at the

time of the invention would have combined Ibaraki '882, Koide, and Frank. *Id.* at 29–30.

We reject Patent Owner's general arguments based on improper incorporation by reference, insufficient identification of differences, conclusory arguments, and voluminous record for similar reasons provided above. *See* Prelim. Resp. 45–46. We have reviewed the arguments and evidence presented by Petitioner, and also the opposing contentions of Patent Owner, and we are persuaded, at this juncture of the proceeding, that Petitioner has established a reasonable likelihood that Petitioner would prevail in its challenge to claims 3 and 4.

E. Claim 16 – Obviousness over Ibaraki '882, Koide, and Kawakatsu

The evidence set forth by Petitioner indicates there is a reasonable likelihood that Petitioner will prevail in showing that claim 16 is unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Koide, and Kawakatsu. Pet. 34–37. Dependent claim 16, which depends from independent claim 1, recites "the total torque available at the road wheels from said internal combustion engine is no greater than the total torque available from said first and second electric motors combined." Petitioner argues that Kawakatsu disclose this limitation. *Id.* Petitioner also articulates reasoning with rational underpinnings on why a person of ordinary skill in the art at the time of the invention would have combined Ibaraki '882, Koide, and Kawakatsu. *Id.*

Patent Owner argues that Petitioner ignores its reliance on Koide to disclose the claimed "first motor." Prelim. Resp. 48. We are not persuaded by this argument. Although Petitioner lists only Ibaraki '882 as disclosing the hybrid vehicle of claim 1 (Pet. 35), we understand Petitioner's argument to mean the hybrid vehicle of Ibaraki '882, as modified by Koide. *See* Pet. 12–16.

We further reject Patent Owner's general arguments based on improper incorporation by reference, insufficient identification of differences, conclusory arguments, and voluminous record for similar reasons provided above. *See* Prelim. Resp. 47–49. We have reviewed the arguments and evidence presented by Petitioner, and also the opposing contentions of Patent Owner, and we are persuaded, at this juncture of the proceeding, that Petitioner has established a reasonable likelihood that Petitioner would prevail in its challenge to claim 16.

F. Claim 20 – Obviousness over Ibaraki '882, Koide, and Vittone

The evidence set forth by Petitioner indicates there is a reasonable likelihood that Petitioner will prevail in showing that claim 20 is unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Koide, and Vittone. Pet. 37–43. Dependent claim 20, which depends from independent claim 1, recites "the rate of change of torque produced by said engine is limited, such that combustion of fuel within said engine can be controlled to occur substantially at the stoichiometric ratio, and wherein if said engine is incapable of supplying the instantaneous torque required, the additional torque required is supplied by either or both of said motor(s)." Petitioner argues that Vittone discloses this limitation. *Id.* Petitioner also articulates reasoning with rational underpinnings on why a person of ordinary skill in the art at the time of the invention would have combined Ibaraki '882, Koide, and Vittone. *Id.* at 41–43.

We reject Patent Owner's general arguments based on improper incorporation by reference, insufficient identification of differences, conclusory arguments, and voluminous record for similar reasons provided above. *See* Prelim. Resp. 49–50. We have reviewed the arguments and evidence presented by Petitioner, and also the opposing contentions of Patent Owner, and we are persuaded, at this juncture of the proceeding, that Petitioner has established a reasonable likelihood that Petitioner would prevail in its challenge to claim 20.

G. Claim 19 – Obviousness over Ibaraki '882, Koide, and Yamaguchi

The evidence set forth by Petitioner indicates there is a reasonable likelihood that Petitioner will prevail in showing that claim 19 is unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Koide, and Yamaguchi. Pet. 43–47. Dependent claim 19, which depends from independent claim 1, recites "said engine is rotated before starting such that its cylinders are heated by compression of air therein." Petitioner argues that Yamaguchi discloses this limitation. *Id.* Petitioner also articulates reasoning with rational underpinnings on why a person of ordinary skill in the art at the time of the invention would have combined Ibaraki '882, Koide, and Yamaguchi. *Id.*

We reject Patent Owner's general arguments based on improper incorporation by reference, insufficient identification of differences, conclusory arguments, and voluminous record for similar reasons provided above. *See* Prelim. Resp. 51. We have reviewed the arguments and evidence presented by Petitioner, and also the opposing contentions of Patent Owner, and we are persuaded, at this juncture of the proceeding, that Petitioner has established a reasonable likelihood that Petitioner would prevail in its challenge to claim 19.

H. Claim 22 – Obviousness over Ibaraki '882, Koide, and Ibaraki '626

The evidence set forth by Petitioner indicates there is a reasonable likelihood that Petitioner will prevail in showing that claim 22 is unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Koide and Ibaraki '626. Pet. 47–54. Dependent claim 22, which depends from independent claim 1, recites "said engine can be operated at torque output levels less than SP under abnormal and transient conditions, said conditions comprising starting and stopping of the engine and provision of torque to satisfy drivability or safety considerations." Petitioner argues that Ibaraki '626 discloses this limitation. *Id.* Petitioner also articulates reasoning with rational underpinnings on why a person of ordinary skill in the art at the time of the invention would have combined Ibaraki '882, Koide, and Ibaraki '626. *Id.*

Patent Owner argues that Petitioner merely argues that Ibaraki '882 and Ibaraki '626 can be combined because the two systems are similar and include commonly named inventors. Prelim. Resp. 52. We are not persuaded by this argument. Petitioner explains that both Ibaraki '882 and Ibaraki '626 are in the same field of invention of hybrid vehicles having both a combustion engine and an electric motor as power sources. Pet. 47. Petitioner further explains that both Ibaraki '882 and Ibaraki '626 disclose substantially similar control strategies to determine which mode the vehicle should operate in. *Id.* at 48. Petitioner also asserts that both Ibaraki '882 and Ibaraki '626 include many commonly named inventors. *Id.* at 49. Accordingly, Petitioner has provided an articulated reasoning with a rational underpinning on why a person of ordinary skill in the art at the time of the invention would have combined Ibaraki '882, Koide, and Ibaraki '626.

We further reject Patent Owner's general arguments based on improper incorporation by reference, insufficient identification of differences, conclusory arguments, and voluminous record for similar reasons provided above. *See* Prelim. Resp. 52–53. We have reviewed the arguments and evidence presented by Petitioner, and also the opposing contentions of Patent Owner, and we are persuaded, at this juncture of the proceeding, that Petitioner has established a reasonable likelihood that Petitioner would prevail in its challenge to claim 27.

I. Claim 14 – Obviousness over Ibaraki '882, Koide, and Lateur

The evidence set forth by Petitioner indicates there is a reasonable likelihood that Petitioner will prevail in showing that claim 14 is unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Koide, and Lateur. Pet. 54–58. Claim 14 recites "the controller may accept operator input of a desired cruising speed, and thereafter controls the instantaneous torque output by said internal combustion engine and by either or both motor(s) in accordance with variation in RL so as to maintain vehicle speed substantially constant." Petitioner argues that Lateur discloses this limitation. *Id.* Petitioner also articulates reasoning with rational underpinnings on why a person of ordinary skill in the art at the time of the invention would have combined Ibaraki '882, Koide, and Lateur. *Id.*

We reject Patent Owner's general arguments based on improper incorporation by reference, insufficient identification of differences, conclusory arguments, and voluminous record for similar reasons provided above. *See* Prelim. Resp. 53–54. We have reviewed the arguments and evidence presented by Petitioner, and also the opposing contentions of Patent Owner, and we are persuaded, at this juncture of the proceeding, that

Petitioner has established a reasonable likelihood that Petitioner would prevail in its challenge to claim 14.

III. ORDER

Accordingly, it is

ORDERED that pursuant to 35 U.S.C. § 314, an *inter partes* review hereby is instituted as to the following proposed ground:

1. obviousness of claims 1 and 5 over Ibaraki '882 and Koide;
2. obviousness of claims 3 and 4 over Ibaraki '882, Koide, and Frank;
3. obviousness of claim 16 over Ibaraki '882, Koide, and Kawakatsu;
4. obviousness of claim 20 over Ibaraki '882, Koide, and Vittone;
5. obviousness of claim 19 over Ibaraki '882, Koide, and Yamaguchi;
6. obviousness of claim 22 over Ibaraki '882, Koide, and Ibaraki '626;
7. obviousness of claim 14 over Ibaraki '882, Koide, and Lateur.

FURTHER ORDERED that the trial is limited to the grounds identified above and no other grounds are authorized; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial; the trial commences on the entry date of this Decision.

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner,

v.

PAICE LLC & THE ABELL FOUNDATION, INC.,
Patent Owner.

Case IPR2015-00794
Patent 7,104,347 B2

Before SALLY C. MEDLEY, KALYAN K. DESHPANDE, and CARL M. DeFRANCO, *Administrative Patent Judges*.

DESHPANDE, *Administrative Patent Judge*.

SCHEDULING ORDER

A. DUE DATES

This order sets due dates for the parties to take action after institution of the proceeding. The parties may stipulate to different dates for DUE DATES 1 through 5 (earlier or later, but no later than DUE DATE 6). A notice of the stipulation, specifically identifying the changed due dates, must be promptly filed. The parties may not stipulate to an extension of DUE DATES 6 and 7.

In stipulating to different times, the parties should consider the effect of the stipulation on times to object to evidence (37 C.F.R. § 42.64(b)(1)), to supplement evidence (37 C.F.R. § 42.64(b)(2)), to conduct cross-examination (37 C.F.R. § 42.53(d)(2)), and to draft papers depending on the evidence and cross-examination testimony (*see* section B, below).

The parties are reminded that the Testimony Guidelines appended to the Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,772 (Aug. 14, 2012) (Appendix D), apply to this proceeding. The Board may impose an appropriate sanction for failure to adhere to the Testimony Guidelines. 37 C.F.R. § 42.12. For example, reasonable expenses and attorneys' fees incurred by any party may be levied on a person who impedes, delays, or frustrates the fair examination of a witness.

1. INITIAL CONFERENCE CALL

The parties are directed to contact the Board within a month of this decision if there is a need to discuss proposed changes to this Scheduling Order or proposed motions. To request a conference call, the parties should submit a list of dates and times when they are available for a call. If an initial conference call is requested, the parties should be prepared to discuss any proposed changes to this Scheduling Order and any motions the parties anticipate filing during the trial. The parties are directed to the Office Patent Trial Practice Guide, 77 Fed. Reg. at 48,765–66, for guidance in preparing for the initial conference call.

2. DUE DATE 1

The patent owner may file—

a. A response to the petition (37 C.F.R. § 42.120), and

b. A motion to amend the patent (37 C.F.R. § 42.121).

The patent owner must file any such response or motion to amend by DUE DATE 1. If the patent owner elects not to file anything, the patent owner must arrange a conference call with the parties and the Board. The patent owner is cautioned that any arguments for patentability not raised in the response will be deemed waived.

3. DUE DATE 2

The petitioner must file any reply to the patent owner's response and opposition to the motion to amend by DUE DATE 2.

4. DUE DATE 3

The patent owner must file any reply to the petitioner's opposition to patent owner's motion to amend by DUE DATE 3.

5. DUE DATE 4

a. Each party must file any motion for an observation on the cross-examination testimony of a reply witness (*see* section C, below) by DUE DATE 4.

b. Each party must file any motion to exclude evidence (37 C.F.R § 42.64(c)) and any request for oral argument (37 C.F.R. § 42.70(a)) by DUE DATE 4.

6. DUE DATE 5

a. Each party must file any response to an observation on cross-examination testimony by DUE DATE 5.

b. Each party must file any opposition to a motion to exclude evidence by DUE DATE 5.

7. DUE DATE 6

Each party must file any reply for a motion to exclude evidence by DUE DATE 6.

8. DUE DATE 7

The oral argument (if requested by either party) is set for DUE DATE 7.

B. CROSS-EXAMINATION

Except as the parties might otherwise agree, for each due date—

1. Cross-examination begins after any supplemental evidence is due. 37 C.F.R. § 42.53(d)(2).

2. Cross-examination ends no later than a week before the filing date for any paper in which the cross-examination testimony is expected to be used. *Id.*

C. MOTION FOR OBSERVATION ON CROSS-EXAMINATION

A motion for observation on cross-examination provides the parties with a mechanism to draw the Board's attention to relevant cross-examination testimony of a reply witness because no further substantive paper is permitted after the reply. *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,768 (Aug. 14, 2012). The observation must be a concise statement of the relevance of precisely identified testimony to a precisely identified argument or portion of an exhibit. Each observation should not exceed a single, short paragraph. The opposing party may respond to the observation. Any response must be equally concise and specific.

D. PROTECTIVE ORDER

No protective order has been entered in this proceeding. The parties are reminded of the requirement for a protective order when filing a motion to seal. 37 C.F.R. § 42.54. If the parties have agreed to a proposed protective order, including the Standing Default Protective Order, 77 Fed. Reg. 48,756, App. B (Aug 14, 2012), they should file a signed copy of the proposed protective order with the motion to seal. If the parties choose to propose a protective order other than, or departing from, the default Standing

Protective Order, they must submit a joint, proposed protective order, accompanied by a red-lined version based on the default protective order in Appendix B to the Board's Office Patent Trial Practice Guide.

DUE DATE APPENDIX

INITIAL CONFERENCE CALL .... Upon Request

DUE DATE 1 .... January 15, 2016

Patent owner's response to the petition

Patent owner's motion to amend the patent

DUE DATE 2 .... April 8, 2016

Petitioner's reply to patent owner's response to petition

Petitioner's opposition to motion to amend

DUE DATE 3 .... April 22, 2016

Patent owner's reply to petitioner's opposition to motion to amend

DUE DATE 4 .... May 13, 2016

Motion for observation regarding cross-examination of reply witness

Motion to exclude evidence

Request for oral argument

DUE DATE 5 .... May 27, 2016

Response to observation

Opposition to motion to exclude

DUE DATE 6 .... June 3, 2016

Reply to opposition to motion to exclude

DUE DATE 7 .... June 27–29, 2016[1]

Oral argument (if requested)

[1] This case will be on the same schedule as several other related cases. This order contemplates scheduling the hearing for this case and the hearings for the related cases to occur over no more than a three day time frame from June 27, 2016 to June 29, 2016. The details regarding when the individual hearings will be held for this and the related cases within the three day time frame will be forthcoming upon expiration of DUE DATE 4.

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