OKE PROVISIONAL PATENT COVER LETTER

In this document, we will be discussing the Orbital Kite Engine (OKE), a revolutionary technology with the potential to disrupt the current wind energy industry. The OKE utilizes interlocking winches to mechanically control kite lines, allowing for precise control of the kite's trajectory. This unique system is both efficient and practical, making it a viable option for use in renewable energy applications and wind-powered vehicles. Through the course of this document, we will delve into the technical details of the OKE, including its mechanical components, method of operation, and potential benefits to industry and society. By the end of this document, it will be clear that the OKE is a technology that warrants further investment and development.

Invention Title: Orbital Kite Engine

Inventor(s): Christian Harrell

INVENTION OVERVIEW

Purpose of Invention:

The Orbital Kite Engine, or OKE, is a revolutionary technology that harnesses the power of wind to generate electricity. The OKE uses a modified kite, which is flown in the sky on multiple lines, to convert the kinetic energy of the wind into useful electrical energy or means of propulsion. The OKE may be used for the propulsion of a vehicle, or when fixed to a ground station can be made to produce energy by means of a specific pattern called a kite loop, which allows it to travel at faster speeds and generate more power than traditional wind turbines, or sails on a similarly scaled boat. This technology is a more efficient, cost-effective and eco-friendly way of utilizing wind power, making it a promising solution for renewable energy, wind powered propulsion, and a bevy of other applications.

Description of problem(s) that this Invention solves:

The Effective Square Law (Tether Losses) (Skip this if you want to)

The Effective Square Law per Acre (ESLA) is a metric devised by OKE LLC combining several factors affecting the efficiency of an Airborne Wind Energy System (AWES) in power generated per unit area. A key factor is Tether Induced Velocity Loss (TIVL), occurring due to the weight and drag of the tether and kite controller and/or tether, reducing the available power.

Another factor is the Sag Effect, which occurs due to the weight of the tether and kite controller adding to the "sag" in the kite line, reducing the available power.

One example of an AWES that is affected by TIVL is the "Flygen" system, which employs propellers that require a heavy conductive tether. The added weight and drag of the tether results in a significant reduction in the power generated by the system. This not only reduces the efficiency of the technology, but also increases the cost of energy production. Additionally, the cost of replacing a lost kite or propeller in these systems can be substantial, further adding to the overall cost of the technology.

Scaling

When considering the cost of building and maintaining a wind system, it's important to take into account the radius of the traditional wind turbine, and the radius of the kite trajectory, as well as the materials and labor required to construct and maintain the system. The OKE, or kite engine, has a smaller physical footprint and uses 95% less materials than traditional wind turbines, making it more cost-effective in terms of both initial construction and ongoing maintenance. Additionally, the OKE's ability to be transported to different locations allows for greater flexibility in terms of siting, which can minimize the impact on sensitive ecosystems.

Maintenance

The OKE offers significant advantages in terms of maintenance and longevity when compared to traditional wind turbines. One major issue with wind turbines is the limited lifespan of the blades. Traditional wind turbine blades are made of composite materials and are designed to last for approximately 20-25 years. However, in practice, the blades often need to be replaced much sooner due to erosion, weathering, and other forms of wear and tear. This not only results in added maintenance costs but also generates a significant amount of waste.

The OKE, on the other hand, utilizes replaceable fabric kites that can be easily swapped out as needed. The kites are made of lightweight and durable materials that are designed to withstand the elements. Additionally, the small form factor of the OKE means that it can be easily transported and installed in a variety of locations, further reducing maintenance costs and downtime.

In terms of environmental impact, the OKE's highly portable design allows it to be deployed in areas where traditional wind turbines are not viable, such as in offshore shallow waters and in high altitude locations. Furthermore, the replaceable fabric kites generate significantly less waste compared to traditional wind turbine blades, making the OKE a more sustainable and eco-friendly option for generating clean energy.

Deep water

The OKE, or kite engine, is well-suited for both deep and shallow offshore wind options. One of the main advantages of the OKE in offshore operations is its smaller form factor compared to traditional wind turbines. This smaller size means that the OKE requires less material and is less

expensive to build and maintain, making it more cost-effective in offshore operations. Additionally, the OKE's smaller size also means that it has a smaller environmental impact, which is important in sensitive offshore ecosystems.

Another advantage of the OKE in offshore operations is its ability to access higher wind speeds than traditional wind turbines. The OKE is able to fly higher and access stronger winds than traditional wind turbines, which are limited by the weight of the turbine and blades. This means that the OKE is able to generate more power per unit area than traditional wind turbines, making it more efficient in offshore operations.

The OKE, on the other hand, is much smaller and requires less maintenance, making it more cost-effective and accessible in offshore operations. Additionally, the OKE's ability to be transported to different locations allows for greater flexibility in terms of siting, which can minimize the impact on sensitive offshore ecosystems.

Anti Fouling Technology

The OKE utilizes a unique kite looping trajectory in order to optimize its performance and efficiency. Traditional airbourne wind energy systems often employ a simple figure eight trajectory, which while effective in generating power, can be limited in terms of the speed and power the kite can achieve. The OKE, on the other hand, utilizes a kite looping trajectory which allows the kite to achieve faster speeds and therefore generate more power. This is achieved by interlocking winches that prevent fouling in the kite lines and allow the kite to orbit around the axis of the tether line, avoiding twists in the lines. This unique design mimics the perfect kite trajectory, which is commonly used by kite surfers to perform maneuvers. This allows the OKE to generate more power per unit area than traditional wind turbines. Additionally, the kite looping trajectory also allows the OKE to be more adaptable to different wind conditions, making it more versatile and capable of operating in a wider range of environment

Portability

One of the key benefits of the OKE is its small form factor and high portability. The OKE's compact design and lightweight construction allow it to be easily transported to different locations, making it highly adaptable to different wind patterns and seasonal changes.

The small form factor of the OKE also means that it has a much smaller physical footprint than traditional wind turbines, which require large towers and blades that take up a significant amount of land. This makes the OKE a more suitable option for areas with limited land availability, such as coastal regions or densely populated areas. Additionally, the smaller size and lighter weight of the OKE also means that it has a lower impact on wildlife, as it is less likely to cause harm to birds and bats.

Furthermore, the ability to be transported to different locations allows for greater flexibility in terms of siting, which can minimize the impact on sensitive ecosystems. The OKE's compact size and ability to quickly adapt to changing wind patterns makes it a highly efficient and cost-effective solution for harnessing wind energy, particularly in challenging offshore environments.

In terms of green environmental impact, the OKE has several advantages over traditional wind turbines. The smaller physical footprint and lower impact on wildlife, combined with its highly portable nature, make it a much more sustainable option for harnessing wind energy. Additionally, the OKE's compact design and efficient power generation capabilities mean that it can produce the same amount of energy as a traditional wind turbine while using significantly less materials, which also has a positive impact on the environment.

Sailcraft

The OKE can be used to increase the speed of sailcraft by utilizing the unique kite loop function for direct downwind propulsion. This technology is based on the principle of the "square law" of wind power, which states that the power available in the wind increases as the wind speed increases by the square of the speed. This means that as the wind speed doubles, the power available in the wind quadruples.

In the context of sailcraft, this means that by using the OKE to harness the power of the wind, a sailboat can achieve much higher speeds than if it were relying solely on traditional sails. This is because the OKE is able to take advantage of the high wind speeds that are often found at higher altitudes, where traditional sails cannot reach. Additionally, the unique kite loop function of the OKE allows it to capture more wind energy and convert it into propulsion, which results in even higher speeds.

Furthermore, the OKE is highly portable and can be easily deployed and stowed on a sailboat, making it an ideal technology for this application. Additionally, the replaceable fabric kites used by the OKE can be changed out quickly and easily, reducing the maintenance costs and downtime associated with traditional sails.

Overall, the OKE is an innovative technology that has the potential to revolutionize the way sailcraft is powered, increasing speed and efficiency while reducing costs and maintenance.

Description on how the Invention is an improvement over existing technology:

The OKE is able to access higher wind speeds than traditional wind turbines and produce more power than a similarly scaled Airborne wind energy system especially those that employ flying turbines (like Makani) which actually serve to slow the kite trajectory which is contrary to the square law. The OKE is not limited by the weight of the tether and kite controller, which adds to the "sag effect" and increases unwanted inertia. The added weight and inertia on the kite and kite

line reduce the available power by a factor of 8. This can be mathematically demonstrated by the equation

$$P = T^2/W,$$

where P is the power generated, T is the tension in the tether and W is the weight of the tether.

An example of this in the real world is the SkySails kite system, which showed that increasing the weight of the tether from 10kg to 50kg resulted in a 50% decrease in power generated.

In terms of the OKE being a ground based system and all the control vectors are controlled on the ground, meaning the kite and tethers itself are relatively expendable, differentiating the OKE from other wind based ventures like Makani. This allows for a more cost-effective and less risky system, as the need for expensive and heavy flying turbines is eliminated, and the risk of damage or accidents is greatly reduced.

Individual and business demographics that would use this Invention:
The orbital kite engine is a technology that could be used by a variety of individuals and businesses to generate electricity. Some of the demographics that may be interested in using a kite engine include:

Renewable energy developers: Renewable energy developers are companies or organizations that specialize in developing and implementing clean energy solutions. The orbital kite engine is a renewable energy technology that could be of interest to these organizations.

Utilities: Utilities are companies that generate, transmit, and distribute electricity to consumers. The orbital kite engine is a technology that could be used by utilities to generate electricity in a more efficient and cost-effective way.

Industrial and commercial businesses: Industrial and commercial businesses often have high energy demands, and the orbital kite engine could be a useful tool for these businesses to generate electricity in a more sustainable way.

Governments: Governments at all levels (federal, state, local) have a strong interest in developing clean energy solutions, and the orbital kite engine could be a useful tool for these organizations to meet their energy needs in a more sustainable way.

Individual consumers: Individual consumers who are interested in renewable energy and sustainability may also be interested in using the orbital kite engine to generate electricity for their homes or businesses.

Description of the benefits of this Invention to its users:
The Orbital Kite Engine (OKE) is a system that uses interlocking winches to control kite lines mechanically, making it a promising technology for both the renewable energy field and for powering wind-powered vehicles. One of the key benefits of the OKE is its ability to prevent fouling in the kite lines by using a unique technique where the orbit line rotates around the axis

of the tether line. This allows for a much smoother and efficient operation, reducing the risk of entanglement or other issues that can impede performance.

Another key advantage of the OKE is its small form factor and high portability, which makes it an ideal solution for a wide range of environments and applications. Whether it's for use in remote locations or for quickly adjusting to seasonal changes in wind patterns, the OKE is designed to maximize performance and efficiency while minimizing costs and maintenance. Additionally, the use of replaceable fabric kites means that the system can be easily maintained, increasing the lifespan and performance of the device.

In terms of wind energy production, the OKE is able to overcome the problems of Tether Induced Velocity Loss and Sag Effect, which are the factors that limit the performance of traditional wind turbines. This allows for a much higher power output and efficiency, making it a cost-effective solution for renewable energy production.

Overall, the OKE offers a range of benefits for its prospective users, from its unique anti-fouling technique to its small form factor and high portability, making it a promising technology for a wide range of industries.

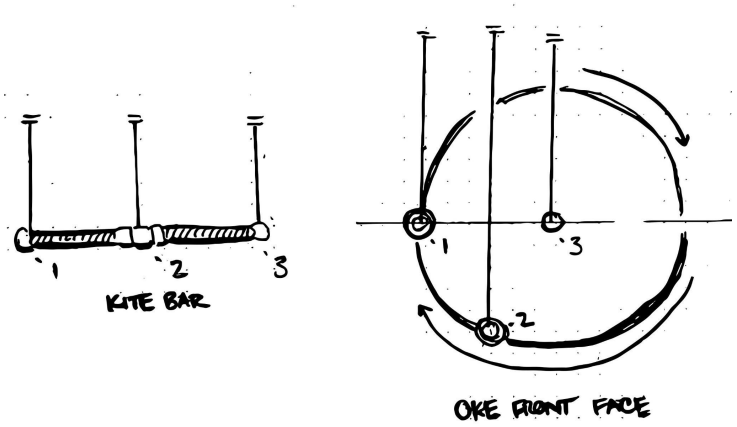
Brief Description of the Invention:

The Orbital Kite Engine (OKE) is a system that uses interlocking winches to control kite lines mechanically, making it a promising technology for both the renewable energy field and for powering wind-powered vehicles. The kite is tethered to the ground station with two or more lines, one of which is the "orbit line" and the other is the "tether line." The orbit line orbits around the axis of the tether line, which is anchored to the ground and supports the tension of the kite. This allows the kite to move in a controlled trajectory, and the interlocking winches prevent the kite lines from fouling. Additionally, a third line, the depower line, may also be used to control the power generated by the kite. The OKE is designed to make everything between the ground station and the kite as light as possible, maximizing the speed and performance of the kite, and making the system highly efficient and practical for use in renewable energy applications and wind-powered vehicles.

DESCRIPTION OF INVENTION DRAWINGS:

Various embodiments of the invention are disclosed in the following detailed description and accompanying drawings.

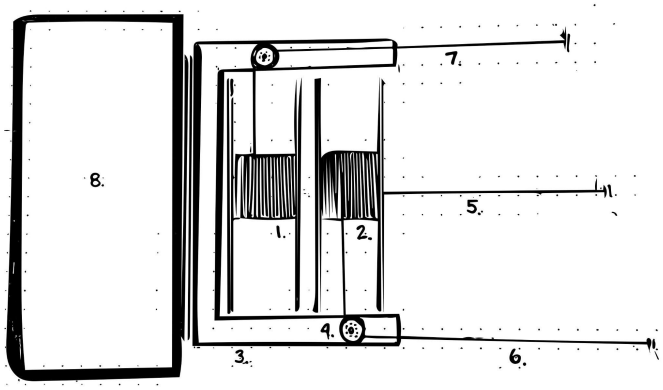
Fig. 1 illustrates a [Front facing view of the Orbital Kite Engine].



1. Left line/ Orbital line
2. Depower line/ Depower line
3. Right line/ Tether line

In the OKE system, the Tether line (3) runs through the center axis of the OKE, while the Orbital line (1) and the DePower line (2) emit from the perimeter on the outer face. All three lines (1, 2, 3) are connected to the kite. When tension is applied to the Tether line (3), a small amount of power is used to rotate the Orbital reel (1) and DePower reel (2) around the Tether line (3) axis, this rotation is solely intended to prevent twisting of lines, which can cause instability. The rotation of the Orbital line (1) and the DePower line (2) do not affect the movement of the kite.

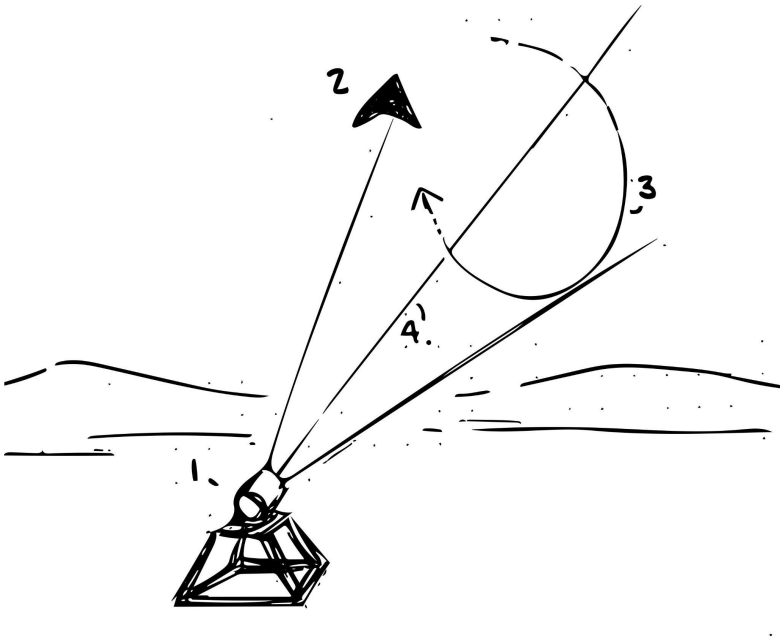
Fig. 2 illustrates a [Side Cross Sectional view].



1. Orbital Reel

2. De Power Reel
3. Rotor Reel
4. Rotor Fairlead 90 degree redirect
5. Tether line
6. De Power line
7. Orbital Line
8. Motors/Transmission

Fig. 3 illustrates a [Three-Quarter image of operation]



1. Orbital Kite Engine Station
2. Kite
3. Orbital Path
4. Axis

INVENTION DETAILED DESCRIPTION

Description of the Parts of the Invention:

The Orbital Kite Engine (OKE) is a mechanical control system that utilizes interlocking winches to control kite lines. The system includes several key components:

Orbital Reel: used to control the Orbital line that rotates around the tether line

De Power Reel: used to control the De Power line and power of the kite

Rotor: When Rotor, Depower, Tether, and Orbital

Rotor Fairlead 90 degree redirect: a mechanism that redirects the Orbital Line and Depower Line 90 degrees to orient the lines in parallel with the tether line.

Tether line: Flows through the center axis of the OKE, the main line connecting the kite to the ground station, which anchors the kite and supports its tension

De Power line: used to adjust the power generated by the kite

Orbital Line: Left control input, able to rotate around the axis of the Tether line.

Motors/Transmission: used to power the interlocking winches

The OKE system is designed to make everything between the ground station and the kite as light as possible, by eliminating heavy tethers and airborne kite controllers. This maximizes the speed and performance of the kite, and makes the system highly efficient and practical for use in renewable energy applications and wind-powered vehicles. The interlocking winches prevent the kite lines from fouling, and allow the OKE to perform unique maneuvers. The combination of Tether line, Orbital Line, and De Power line are used to control the movement and power generated by the kite.

Relationship between the Parts of the Invention:

Details of the Invention Operation/Functions:

The Orbital Kite Engine (OKE) is a system that uses interlocking winches to control kite lines mechanically, making it a promising technology for both the renewable energy field and for powering wind-powered vehicles. The kite is tethered to the ground station with two or more lines, one of which is the "orbit line" and the other is the "tether line." The orbit line is traditionally the left line of the kite and orbits around the axis of the tether line, which is anchored to the ground and supports the weight of the kite. A third line, the depower line, may also be used to control the power of the kite by throttling the amount of power generated.

In generator mode, the OKE works by reeling out the kite lines to generate power. As the kite is propelled by the wind, the tension on the lines is converted into electrical energy which is then sent back to the ground station. The winches then reel in the lines, at a fraction of the energy as when the line is paid out. This process is repeated continuously to generate power.

In "motor mode" the objective is to keep the line as taught as possible, as the tension is translated directly into the power or motion of the vehicle. The OKE uses the wind to propel the kite which in turn pulls on the lines to generate power which is used to power a device or vehicle. The interlocking winches prevent fouling in the kite lines, the lines orbit around the axis of the tether

line and prevent twisting in the lines. This machine was built to mimic the perfect kite trajectory, this allows for greater efficiency and performance compared to other systems.

Unique Features of Invention:

1.The OKE uses interlocking winches to control kite lines mechanically, allowing for precise trajectory control and optimized performance.

2.The OKE uses a lightweight system, with minimal mechanical components, to minimize drag and maximize the speed and performance of the kite.

3.The OKE uses a two-line tether system, with one line orbiting around the axis of the other, to prevent twisting and fouling of the lines.

4The OKE can be operated in both generator and motor mode, allowing for flexible use in a variety of applications.

5The OKE's design allows for easy portability and setup, making it suitable for use in remote or hard-to-reach locations.

6The OKE uses replaceable fabric kites, reducing maintenance costs and increasing the lifespan of the system.

7The OKE's compact size allows for the use in both onshore and offshore environments, including deep-water offshore use.

8 The OKE's kite loop function allows for high-speed operation, making it suitable for wind-powered vehicles and sailcraft.

9
The OKE's efficient design results in lower energy costs and a smaller carbon footprint compared to traditional wind turbines.

10 The OKE's unique design enables it to generate power in low wind conditions, making it more reliable and effective than traditional wind turbines.

Best Manufacturing Method:
the manufacturing method for the ground station of the kite engine, or "ground gen station," would involve the use of durable, high-strength materials such as aluminum or carbon fiber for the frame and interlocking winches. These materials would ensure that the ground gen station is able to withstand the forces exerted on it during operation, while also being lightweight enough to minimize the power required to control the kite.

In addition to the use of high-strength materials, precision manufacturing techniques such as CNC machining or 3D printing may be used to ensure that the ground gen station is built to precise tolerances. This would ensure that the interlocking winches and other mechanical components function smoothly and efficiently, without any wobbling or play in the system.

Finally, the ground gen station would also likely include various electronic and software components, such as control systems and data monitoring equipment. These components would need to be manufactured to the highest standards of quality and reliability, in order to ensure that the kite engine operates smoothly and efficiently over time.

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

In accordance with 37 CFR 1.53(c)

Express Mail Label No. _____

INVENTOR(S) INFORMATION		
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TITLE OF THE INVENTION (MAX OF 500 CHARACTERS)

Orbital Kite Engine

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ENCLOSED APPLICATION PARTS (check only those that apply):

__ Application Information Sheet (Pursuant to 37 CFR 1.76)

__

__ Number of Drawings: _____

__ Invention Description Number of Pages: _____

__ Number of Disks: _____

__ Other Items Included: _____

FILING FEE PAYMENT METHOD & APPLICATION SIZE FEE (check one)

__ Applicant asserts small entity status (*See 37 CFR 1.76*).

__ Applicant certifies micro entity status (*See 37 CFR 1.29 – Applicant must attach form PTO/SB/15A or B or equivalent*).

__ Check or money order made payable to the *Director of the United States Patent and Trademark Office* and is enclosed to cover the filing fee and application size fee (if applicable).

__ Payment by credit card – Requires Form PTO-2038 and must be attached to the application.
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__ The Director is hereby authorized to charge the filing fee and application size fee *(if applicable)* or credit for overpayment to Deposit Account Number: _____.

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This collection of information is required by *37 CFR 1.51*. 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 1.11* and *1.14*. This collection is estimated to take 10 hours 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. Should you require assistance completing this from, call 1-800-786-9199 option 2.

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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government. (Please check one)

__ No

— Yes, the invention was made by an agency of the U.S. Government. The U.S. Government Agency name is:_____.

— Yes, the invention was made under a contract with an agency of the U.S. Government. The name of the U.S. Government Agency and Government contract number are:

— _____

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Docket Number: _____

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4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the *Privacy Act of 1974*, as amended, pursuant to *5 U.S.C. 552a(m)*.
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of *National Security review (35 U.S.C. 181)* and for review pursuant to the *Atomic Energy Act (42 U.S.C. 218(c))*.
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of *44 U.S.C. 2904 and 2906*. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e., GSA or Commerce*) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to *35 U.S.C. 122(b)* or issuance of a patent pursuant to *35 U.S.C. 151*. Further, a record may be disclosed, subject to the limitations of *37 CFR 1.14*, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.

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