What is Drag?

Drag is the physical attraction between the [gaseous] atmospheric atoms and/or molecules, and those in the surface of a body travelling through it, thereby absorbing the body's kinetic energy. Overcoming this resistive force consumes most of the energy required to drive a body or vehicle through a gas. This attraction can only originate from the magnetic force between adjacent atoms. In fact, calculations show this to be the case.

How to Reduce Drag

A significant reduction in atmospheric drag can be achieved simply by increasing inter-atomic distance, which can be achieved by increasing the electrical charge in the body's surface atomic protons (e'), which can be accomplished either through the application of electricity or heat.

Moreover, relative atomic distance reduces magnetic [attractive] force by three orders of magnitude: $F_m = h_p^2.m_a / R^3$ $\{m^4/s^2 . kg / m^3 = kg.m/s^2 = N\}$ more rapidly than the electrical force required to achieve it: $F_e = \underline{T}.K_B.N / R$ $\{K.N.m / K.m = N\}$.

Benefits

This facility improves fuel consumption and stability in moving bodies, but also reduces the destructive forces on stationary bodies in a moving atmosphere; buildings, structures and flagpoles.

Exactly the same forces apply to bodies subjected to relative movement of water, such as ships and submarines, with the obvious benefits in energy consumption and noise reduction.

Title of the Invention:

Anti-Drag.

Abstract:

The present invention relates to a method for reducing or eliminating the frictional drag resistance in a body travelling through a gas, such as an atmosphere.

Cited Patents:

none

References:

1. The Atom; Keith Dixon-Roche; ISBN 978-1-79421-660-0

2. The Mathematical Laws of Natural Science; Keith Dixon-Roche; ISBN 979-8-61029-449-0

3. Webpage; https://www.calqlata.com/Science/Atom.html#Drag

Definitions:

By definition: **light-speed** shall mean the velocity of EME through a medium,
where: for example, the velocity of electro-magnetic energy through a vacuum is approximately 299792459 metres per second.

By definition: **separation radius** shall mean the distance between adjacent atoms in gaseous and viscous matter.

By definition: **neutronic radius** shall mean an electron's orbital radius when it achieves light-speed and immediately before it unites with its proton partner to create a neutron; $\mathbf{R_n}$ = 2.81793795383896E-15 metres

By definition: **proton-electron pair** shall mean a proton partnered with an orbiting electron.

By definition: **hydrogen** (atom) shall mean a proton-electron pair.

By definition: **deuterium** (atom) shall mean a hydrogen atom with a single neutron attached.

By definition: **tritium** (atom) shall mean a hydrogen atom with two neutrons attached.

By definition: **helium** (element) shall mean an element comprising two deuterium atoms.

By definition: **particles** shall mean the electron and the proton that together constitute a proton-electron-pair.

By definition: **shell-1** shall mean the innermost electron shell in any atom, which always contains two electrons (except for the hydrogen, deuterium and tritium atoms).

By definition: **PE** shall mean potential energy.

By definition: **KE** shall mean kinetic energy.

By definition: **magnetic force** shall mean the attractive magnetic force between adjacent atoms (FIG B);

By definition: **electrical force** shall mean the repulsive electrical force between adjacent atoms (FIG B).

By definition: **drag force** shall mean the resistive force induced in a body travelling through a gas.

By definition: **added mass** shall mean the resistive force induced in a body due to the displacement of particles and atoms as it travels through a gas.

By definition: **wind** shall mean the relative movement of a body in a gaseous environment.

By definition: **electrical matrix** shall mean any woven, linked, bound, joined, fused or otherwise connected matrix (or mesh) of wires or cables of any material that can carry an electrical current (FIG B).

By definition: **electrical coating** shall mean any electrically conductive coating or plating.

By definition: **electrically charged layer** shall mean a layer of an electrical matrix or electrical coating.

Description:

Due to recent work on atoms and their inter-atomic forces (reference 2; §7), we now know the cause of drag between our atmosphere and a body passing through it (reference 3); the magnetic force between adjacent atoms.

Unlike magnetic force, electrical force varies with temperature (FIG A). This phenomenon can be seen in matter wherein its density in viscous form (solid and liquid) remains constant irrespective of temperature (apart from changes in crystal structure), whilst the density of unconfined gaseous matter decreases.

All matter is held together by the magnetic force in its atoms, which may be calculated thus:
$F_m = hp^2.m_A / R^3$

And these same atoms are held apart by their electrical force; which may be calculated thus:
$F_e = \underline{T}.K_B.N / R$

In all matter, the separation radius settles when $F_m = F_e$; giving it its density.

Magnetic force is the source of drag resistance between the atoms in a body (e.g. a car) and a gas (e.g. an atmosphere) through which it is travelling.

This invention is based upon reducing the magnetic force in the atmospheric atoms immediately adjacent to the surface of a body passing through it, by increasing their separation radii (R), which may be achieved by increasing the electrical force (F_e) in the body's surface atoms and thereby reducing the magnetic force responsible for the drag.

As shown in the 'Calculations; Example' below, only 1E-09 Joules per square metre of input energy are required to save 196 Joules of energy in transporting a 1m sphere through the nitrogen in our atmosphere at 20 metres per second and at sea-level. Considering that this energy must be supplied by the fuel driving the sphere, it represents a substantial saving in fuel consumption; the calculation example reveals a total reduction of 88%.

This electrical force may be induced by applying and electrically charged layer to the outer surface of the body (FIG C) and inducing in it an electrical charge. As can be seen in the 'Calculations; Example' below, very little energy (1E-09 Joules per square metre) is required to achieve a significant reduction in drag (92.5%).

Even if the design adopted for this invention is less than 1% efficient (i.e. energy input <1E-07 Joules per square metre) it still represents a massive reduction in fuel consumption; 196 Joules.

Calculations:

Magnetic force may be calculated as such:

$F_m = hp^2.m_A / R^3$ # (refer to Example below)

Electrical force may be calculated as such:

$F_e = k.e'^2 / R^2$

Temperature vs Density (in gases):

electron velocity: $v_e = \sqrt{[\ \underline{T}/X\ ]}$
electron kinetic energy: $KE_e = ½.m_e.v_e^2$
potential energy between an electron orbiting in shell-1 and its proton partner: $PE_1 = -2.KE_e$
gas density: $\rho = p.Y.m_M / PE_1$

Drag force may be calculated thus:

separation radius (gaseous): $R_g = \sqrt[3]{[\ Cd.3.m_M / 4\pi.\rho\ ]}$
atomic magnetic force: $F_m = (R_n.c)^2/\xi_m\ .\ m_A/R_g^3$
number of gaseous atoms in contact with the body: $N^o = A / (2\pi.R_g/Cd)^2$
total magnetic force: $F_t = F_m.N^o$
drag force: $F = F_t.v^2 / 1.g$

Activation energy required to reduce drag (E_A):

$F = F_m = F_e$
$F_m = p\ .\ 4\pi R^2$
$F_e = k.e'^2 / R^2$
$e'^2 = p\ .\ 4\pi R^2 / k = (e/v_o)^2\ .\ \underline{T}/X$
$\underline{T} = p/k\ .\ 4\pi R^2\ .\ X.(v_o/e)^2$
$E_A = ½.m_e\ .\ \underline{T}/X$

Morison's Drag and Added mass:

Drag: $Fd = ½.Cd.\rho.A.v^2$
Added mass: $Fa = Cm.\rho.V.g$

Example:

The above formulas show that, in a gas; separation radii (R_g) increase with rising temperature, decreasing its density. And, as the separation radius increases, the magnetic force decreases; rapidly ($F_m \equiv 1/R_g^3$). #

The second atomic layer (to the body surface) in the gas has only $^1/_{27}$th ($1 / 3^3$) the magnetic force in the first (adjacent) layer, and the third layer has only $^1/_{125}$th ($1 / 5^3$) the magnetic force as the adjacent layer, and so forth. I.e. it is only necessary to repel the adjacent layer of gas atoms by a factor of 3 to achieve a drag reduction of 92.5%.

Atmospheric partial pressure of nitrogen: $p = 85203.43175\ N/m^2$ represents a separation radius of;
$R_e = 6.5304E-11$ m (@ 300K)
For a 92.5% reduction in drag; this radius (R_e) must be increased to;
$R_e = 1.95912E-10$ m (@ $\underline{T}$)
The above formulas predict a required energy induction of ≈1E-09 J/m^2 in the atomic layer immediately adjacent to the travelling body.

Whilst it is important to remember that surface drag is only part of the problem, the other being added mass, it usually constitutes the largest proportion of resistance when travelling through an atmosphere. For example:

the total energy consumed by a one metre diameter spherical body (Cd=0.77) traveling for one metre through the nitrogen in our atmosphere @ 20m/s, and @ sea-level is ≈221 J; of which 212 J is needed to overcome drag resistance. Reducing the drag by 92.5% means a total reduction in energy consumed of ≈88% (added mass remains unaltered); which represents an energy saving (in this case) of ≈196 J for an input of $^4/_3\pi \cdot 0.5^3 \cdot 1E-09\ J/m^2 \approx 3E-09$ J.

Where:
A = surface aera
Cd = drag coefficient
v = relative velocity
p = gas pressure
$\underline{T}$ = temperature
Y = temperature coefficient (9.51345439232503)
X = velocity constant (m_e / Y.K_B)
N = number of atoms in the molecule (e.g. O_2; N=2)
e = elementary charge unit
m_A = atomic mass
m_M = molecular mass
m_p = proton mass
m_e = electron mass
PE_1 = PE in proton electron pair in element shell-1
h_p = Newton's constant of motion for a proton: ($h_p = R_n.c / \sqrt{\xi_m}$)
ξ_m = static ratio ($\xi_m = m_p/m_e$ = 1836.15115053207)
R_n = neutronic radius
c = light-speed
k = Coulomb's constant
K_B = Boltzmann's constant

Design Options:

There are a number of ways to incorporate an electrically charged layer in the surface of a body (FIG C):

Option 1; an electrically charged layer embedded in the outer surface material of a body (FIG D);

Option 2; an electrically charged layer bonded to the outer surface material of a body (FIG E);

Option 3; an electrically charged layer plated on the outer surface material of a body (FIG F);

Option 4; an electrically charged layer painted on the outer surface material of a body (FIG F);

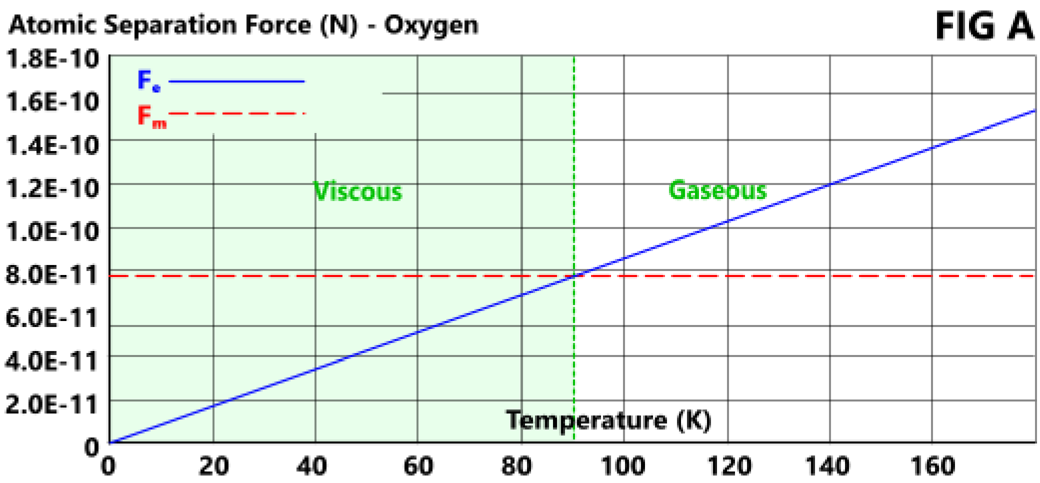
Option 5; an electrically charged layer (options 1 to 4 above) applied only to the area of a body's outer surface that will face oncoming wind (FIG G), leaving the remainder of the body's surface untreated.

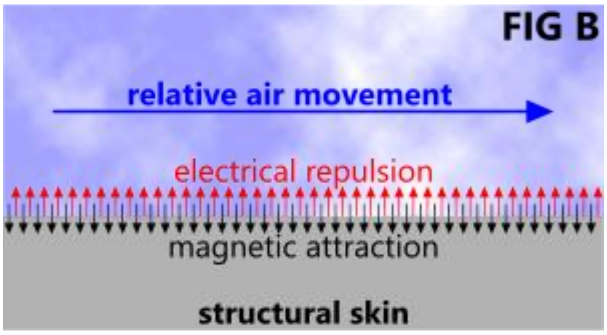
Benefits:

1) A significant reduction in fuel consumption when forcing a body through our atmosphere.
2) A reduction in wind loading on a moving body.
3) A significant reduction in load imposed on structures (e.g. buildings) exposed to high-winds.
4) May be applied to clothing to minimise the impact of wind on individuals.
5) A significant reduction in the excessive drag experienced by vehicles, such as trains, in tight-fitting tunnels.
6) Whilst it would be inadvisable to apply this invention to the wings of an aircraft, application to its fuselage would be advantageous.
7) This same technology may be applied to the surface of a submarine or any other submerged body by vaporising the liquid in contact with the hull's surface.

To summarise; the use of negligible electrical energy (e.g. > 1E-09 J/m^2) will substantially reduce (< 92.5%) drag in a body (e.g. a car) travelling through our atmosphere, and also reduce the wind loading on static structures, such as buildings.

Figures:





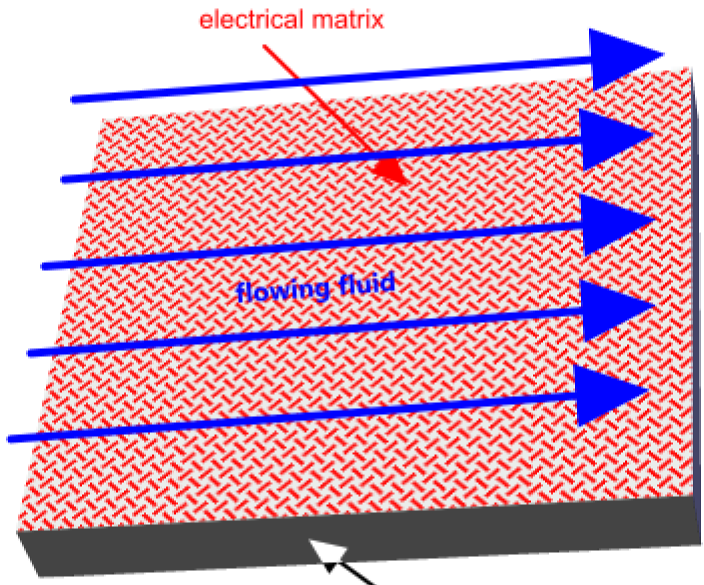


FIG C

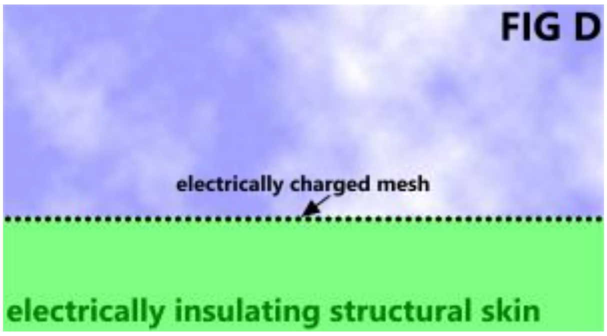


FIG D
electrically charged mesh
electrically insulating structural skin

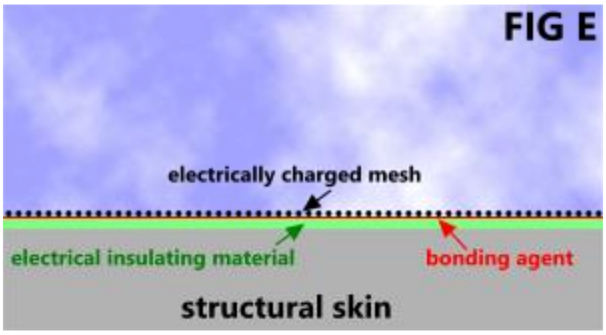


FIG E
electrically charged mesh
electrical insulating material
bonding agent
structural skin

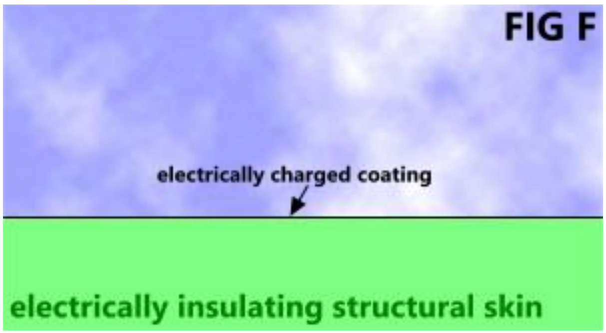


FIG F
electrically charged coating
electrically insulating structural skin

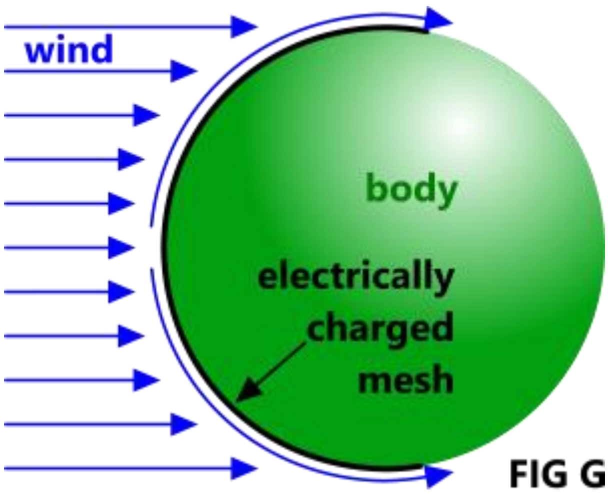

wind
body
electrically charged mesh

FIG G

Claims:

Refer to **Definitions** for a definition of the terms used in these claims.

1. The partial covering of an electrically charged layer on the outer surface of a body the purpose of which is to reduce drag as the body travels through a gas or mixture of gases.

2. The full covering of an electrically charged layer on the outer surface of a body the purpose of which is to reduce drag as the body travels through a gas or mixture of gases.

3. The partial covering of an electrically charged layer on the outer surface of a static structure such as a building to reduce wind loading.

4. The full covering of an electrically charged layer on the outer surface of a static structure such as a building to reduce wind loading.

5. The partial covering of an electrically charged layer on the outer surface of a submerged body such as a submarine reduce drag as the body travels through a liquid.

6. The partial covering of an electrically charged layer on the outer surface of a submerged body such as a submarine reduce drag as the body travels through a liquid.

7. The partial covering of an electrically charged layer on the outer surface of a submerged structure such as an offshore platform to reduce wave and current loading.

8. The full covering of an electrically charged layer on the outer surface of a submerged structure such as an offshore platform to reduce wave and current loading.