A Casimir Effect-Based Propeller.
A Possible Relation with the Cavity Structural Effect.

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The force produced as a result of H. Casimir effect [1] has a quantum-electromagnetic nature and directed normally to the resonator plates.

Its value F_C per a unit of a surface A is

$$\frac{F_C}{A} = -\frac{\eta c \pi^2}{240 a^4} \approx -\frac{1.24 \times 10^{-27}}{a^4}\left(\frac{N}{m^2}\right) \quad (1)$$

It's possible to produce a thrust by means of developing an angle between the plates.

Fig.1 shows a basic concept of this approach.
A local resulting force along Z axis is

$$F_Z = 2F_C \sin(\alpha/2) \quad (2)$$

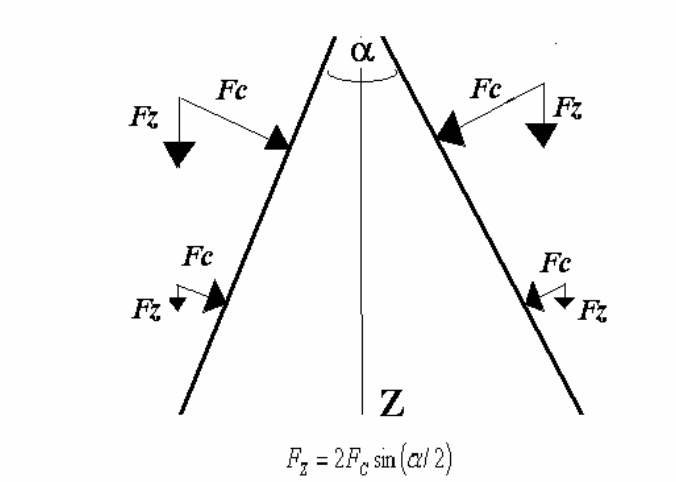

Fig.1. A projection of the force *Fc* onto Z axis develops an elemental thrust

This force experiences a diminishing with a pretty high rate along Z axis as the distance between the plates increases.
A base of this propeller is an element composed of two plates having an angle between them, Fig,2. Moreover, its dimension along Y-axis drastically exceeds that for X and Z axes.

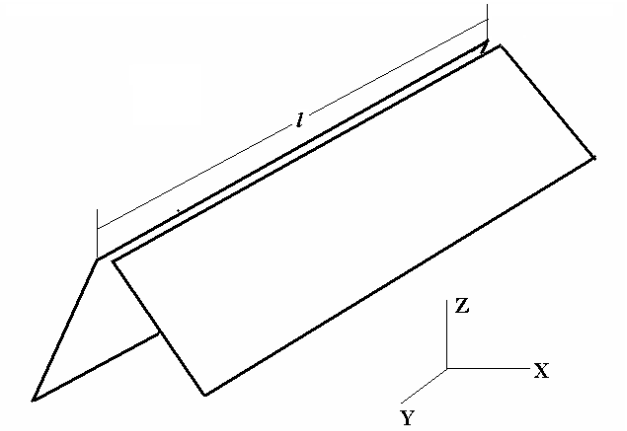

Fig.2. The elemental cell of the Casimir Effect based Propeller. Its length *l* drastically exceeds other dimensions.

Fig.3. supports the following calculation, based on the initial distance a_0 between the plates, the local angle $\alpha/2$ and the height $h= Z_{max}- Z_0$

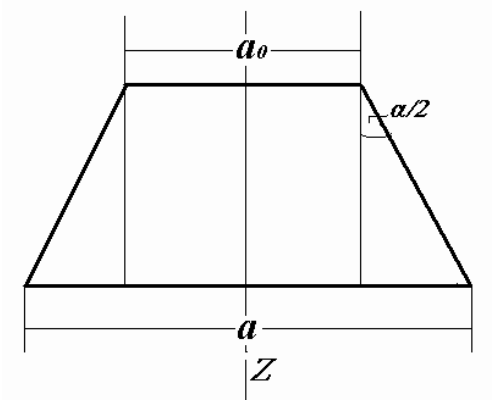

Fig.3. On the calculation of dimension of the elemental cell.

Total force developed by the cells is a sum of the elemental forces dF_z.
The elemental surface is

$$dA=ldz/\cos(\alpha/2) \quad (3)$$

If the initial (atop) distance between the plates is a_0, then, taking into consideration (1), (2) and (3)

$$dF_Z = \frac{1.24\times10^{-27}\cdot l\cdot\tan(\alpha/2)}{8\left(z\cdot\tan(\alpha/2)+a_0/2\right)^4}dz \quad (4)$$

The total force F_Z along Z –axis is

$$F_Z = \frac{1.24\times10^{-27}\cdot l\cdot\tan(\alpha/2)}{8}\int_{z=0}^{z_{max}}\frac{dz}{\left(z\cdot\tan(\alpha/2)+a_0/2\right)^4} \quad (5)$$

Employing the numerical integration [2], estimation of (5) for the cell having its height of 1mm= 1.0E-03 m, (that is z_{max}=0.001), tan(α/2)=0.05, a_0= 1.0e-06 m, l=1m returns the

force F_z *=4.11E-10 N*. This is a force developed by 1.0E-03 m^2 surface. This certain example develops *4.11E-07 N/m^2*. The system of 1.0E+10 such the elements will develop as much as *4 N* thrust. This system can be composed of a matrix of rows and columns, each of them having 1.0E+05 elements, which is compatible with the modern technology. Fig.4 shows a front view concept of such the system. This system forms a cavity structure. Technically, it can be a matrix embedded in a light-weight material like a Styrofoam.

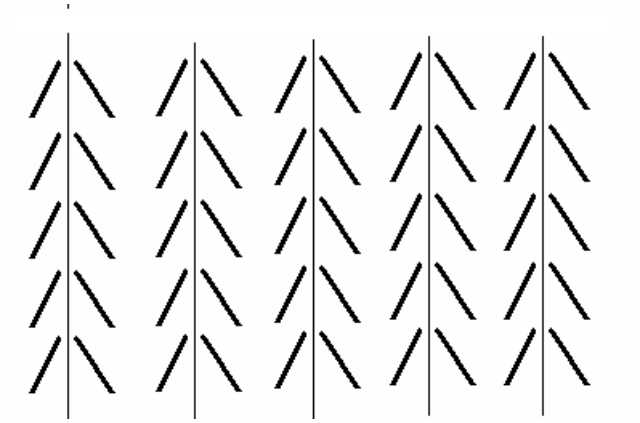

Fig.4. A front view of the Casimir Effect-based Propeller concept.

There are video-demonstrations with developed surface structures developing a force, for instance - [3]. (however, in this certain video, an action of static charges is not excluded).

The cavity structure of the developed matrix enables to admit that the *Cavity Structural Effect* in insects, by Viktor S. Grebennikov, (1927-2001), [4] can be explained on a base of existence of *Casimir Effect* inside wings of the insects, having a developed surface. Grebennikov's works inspired further propulsion proposals [5].

Literature.

1. https://en.wikipedia.org/wiki/Casimir_effect
2. https://www.symbolab.com/solver/definite-integral-calculator/
3. https://www.youtube.com/watch?v=TivfM7N5c0c
4. www.villesresearch.com/cavitystructures.html
5. https://www.youtube.com/watch?v=2M1vNJSxYkU