ABOUT THIS COLLABORATION

This presentation is not the product of a one-step, autonomous AI generation. It was developed through a continuing technical-scientific dialogue between Zoran Ozimec, inventor and author of U.S. Patent 12,674,441 B2, and ChatGPT (GPT-5.6 Sol). The inventor supplied the patented concept, design intent, engineering judgments, corrections and challenges; ChatGPT served as scientific, analytical and editorial assistant, testing arguments against established physics and helping organize them for critical review. The collaboration is stated openly because transparency strengthens the purpose of this work.

A Question Worth a Closer Look

A Short Technical Presentation of U.S. Patent 12,674,441 B2

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AN "IMPOSSIBLE" PATENT?

A patent for propellantless electromagnetic propulsion sounds like something physics should reject immediately.

Or maybe not.

Before deciding, look at what this patent actually proposes.

Start With the Familiar

An electric motor, a solenoid and an electromagnetic actuator all begin with the same familiar chain: electrical energy creates current and electromagnetic fields; their interaction produces force; the design of the machine determines what that force does.

In a motor, the force is organized to produce rotation. In a solenoid, it produces linear motion. Claim 16 begins in the same family of machines. Its ingredients are ordinary: an active electromagnet, a passive ferromagnetic element, electrical current and a power source.

No new source of energy is proposed. No new electromagnetic force is required. Conservation of energy and momentum remain intact, as does Newton's third law.

So what is different?

An electromagnetic interaction delay that ordinary machines normally have little reason to exploit.

Electromagnetic changes and material responses do not occur everywhere at exactly the same instant. In most conventional machines, those propagation and response times are so small compared with the operating cycle that they can usually be treated as secondary details.

Claim 16 asks a different engineering question: what if the machine is deliberately operated so that those normally negligible time differences become part of the design?

Same familiar physics. Same familiar forces. But a different timing regime.

The Claim 16 device uses electric current switching to place the active electromagnet in different electromagnetic states during different parts of the interaction with the passive element. The proposed innovation is not to create a new force, but to control when known forces are mechanically effective.

Do the impulses cancel over a complete cycle? And if, as the patent anticipates, they do not—

can they move anything?

That is the question worth a closer look.

Now the Obvious Objection: Momentum

A closed system cannot generate net momentum from internal forces.

We agree.

Nothing in the patent requires momentum conservation to fail. The important distinction is between the source of energy and the proposed mechanism that converts that energy into mechanical impulse.

The power supply unit (PSU) may be mechanically attached to the propelled assembly and travel with it. When we describe it as "external," we mean external to the Claim 16 conversion mechanism in a functional sense. If the chosen system boundary encloses the Claim 16 conversion subsystem but not the PSU, electrical energy crosses that boundary into the device during operation. The PSU is not being assigned the role of producing the claimed thrust by itself, nor can it, by itself, produce the claimed thrust.

> **The Claim 16 device is proposed as the energy-to-impulse converter; the PSU is its energy source, not the direct source of the claimed thrust.**

Supplying electrical energy also does not, by itself, identify where an equal-and-opposite mechanical impulse must appear—and it does not justify assigning that counter-impulse to the PSU by assumption. If compensating momentum exists elsewhere in the complete system, the analysis must identify its physical pathway rather than simply assume it.

> **The external PSU supplies energy to the Claim 16 device. The device uses that energy to generate a net mechanical impulse on the propelled assembly. Momentum conservation remains applicable to the complete system, with corresponding opposite momentum carried by whatever external physical pathway completes the interaction.**

So the conservation law is not the mystery. The engineering question is much narrower:

Do the mechanical impulses produced by the Claim 16 timing sequence actually cancel or not?

We Tried the Simplest Version First

We reduced Claim 16 to its essential intended interactions and asked exactly that question.

In the reduced model, they do not.

More precisely:

> **In the ideal reduced Claim 16 model, the calculated mechanical impulses do not cancel over one operating cycle. The model therefore predicts net thrust.**

A model prediction is not experimental proof. A reduced model may omit a physical effect that restores cancellation in the complete apparatus.

But it changes the next question.

Only now does the unfamiliar name become useful: Claim 16 is proposed as an electrical-energy-to-impulse converter.

All right. You might ask, what happens when we make the model more realistic?

Exactly.

A Useful Surprise From Mainstream Physics

Before we make the Claim 16 model more realistic, one fact is worth knowing:

Electrically driven nonreciprocal motion is already experimental physics.

In 2026, a Tokyo University of Science team led by Professor Yutaka Sumino and Assistant Professor Kiwamu Yoshii reported experiments with more than 10,000 colloidal particles under an alternating electric field. Size-dependent electrohydrodynamic flows made the effective attraction between differently sized particles nonreciprocal. Unlike-sized pairs formed asymmetric, self-propelled units and sustained collective motion.

Does that prove Claim 16?

No.

Their mechanism is different. The particles move in a fluid, and the driven electrohydrodynamic environment participates in the complete momentum balance. The experiment is therefore not evidence that the Claim 16 device produces thrust.

But it removes one easy reason to stop reading:

Nonreciprocal effective interactions and directed motion of a subsystem can occur within established physics while momentum remains conserved in the complete system.

That is precisely why the system boundary matters. The Tokyo experiment closes its momentum accounting through a known environment. Claim 16 proposes a different mechanism, so it must earn the same privilege by identifying its own complete momentum pathway.

So now the skeptical reader has the right question:

Where does the counter-momentum go when the Claim 16 model becomes more realistic?

Good. That is exactly where we go next.

Related research: Shoma Hara et al., “Arrested Coarsening in Active Colloidal Suspensions Driven by Nonreciprocal Electrohydrodynamic Interactions,” Physical Review Letters (2026), DOI 10.1103/96ky-d1p9. Tokyo University of Science media release, 7 August 2026.

First Suspect: Reaction on the Active Electromagnet

If the Claim 16 device gains a forward impulse, the most natural first objection is immediate:

Shouldn’t the active electromagnet receive the equal-and-opposite impulse?

In an ordinary continuously interacting electromagnet–iron system, that expectation is exactly right. Both sides of the interaction remain present, and the mechanical forces are accounted for as a coupled pair.

Claim 16 is designed not to preserve that same electromagnetic state throughout the complete interaction.

The active electromagnet is energized during the interval intended to produce the useful interaction with the passive ferromagnetic element. The electrical state is then changed before the later electromagnetic response can act back on the active coil under the same conditions.

Same components. Same laws. Different electromagnetic state at a different time.

That is why the reduced Claim 16 model does not simply insert an equal-and-opposite force on the active coil by assumption. It asks whether such a force is physically present while the relevant interaction reaches the coil.

In that reduced timing model, the answer is no: the mechanically opposing impulse on the active coil is absent during the interval in which it would be required to cancel the useful impulse.

That result is important—but still not enough.

Removing one obvious mechanical reaction from the reduced model does not remove momentum conservation from the complete electromagnetic system. Momentum may be carried temporarily by the fields or transferred through another physical pathway that the simplified model has not yet included.

So the first suspect does not close the case.

It only sharpens the next question: if the counter-momentum is not appearing as an equal-and-opposite mechanical impulse on the active electromagnet, is it hiding in the electromagnetic field itself?

That is the next suspect.

Second Suspect: Momentum in the Electromagnetic Field

If the active electromagnet does not receive the missing counter-impulse mechanically, the next place to look is unavoidable:

Can the electromagnetic field itself carry the counter-momentum?

Yes.

Electromagnetic fields carry momentum. During switching and transient interactions, momentum can move back and forth between matter and field. A mechanical force imbalance on selected components therefore does not, by itself, prove a momentum imbalance of the complete system.

That makes field momentum a serious suspect.

But it comes with an important limitation.

A field can store momentum temporarily. It cannot hide an ever-growing counter-momentum while returning to the same state after every operating cycle.

If the Claim 16 device operates cyclically and its electromagnetic field returns to its initial state at the end of each cycle, then the net change of stored field momentum over that cycle is zero.

So if the propelled assembly has gained mechanical momentum, the corresponding opposite momentum must have gone somewhere else.

The complete accounting has only a few possibilities: another part of the apparatus receives it, momentum crosses the system boundary through an electrical or mechanical connection, or electromagnetic momentum leaves the system as radiation or another outward field flux.

In compact form, the bookkeeping is simple:

mechanical momentum gained + field momentum remaining + momentum carried out = 0

This is the first hard test that the reduced Claim 16 result must survive.

If the apparent thrust is exactly balanced by field momentum that later returns an equal impulse to the apparatus, the thrust disappears over the full cycle.

If instead the field transfers the compensating momentum across the chosen system boundary, then the mechanical impulse can remain - but the external momentum pathway must be identified and quantified.

So field momentum does not settle the argument in either direction.

It gives us the next measurable question:

At the end of one complete Claim 16 cycle, does the electromagnetic field return all of its momentum to the apparatus - or has some momentum actually left the system?

That takes us to the boundary itself: radiation and any other physical route through which momentum could cross the chosen system boundary.

Third Suspect: The Boundary

If the electromagnetic field cannot permanently hide the counter-momentum, perhaps the missing momentum simply leaves the system.

Through what boundary?

That question sounds trivial, but here it becomes decisive.

There are two different boundaries we can draw, and they answer two different questions.

Boundary 1: Around the Claim 16 Converter

Draw a boundary around the Claim 16 conversion mechanism alone, leaving the PSU outside it.

Electrical energy crosses that boundary through the supply connection. Any momentum transfer through that connection belongs to the complete boundary accounting. For this subsystem, the PSU is genuinely an external participant.

There is nothing paradoxical about momentum crossing that boundary. The question is simply how much, in what direction, and through which physical channel.

But that is not yet the propulsion question.

Boundary 2: Around the Entire Propelled Assembly

Now draw the boundary around the whole vehicle: Claim 16 device, battery or PSU, switches, structure - everything that travels together.

The meaning of “external” changes immediately. The PSU is still functionally external to the conversion mechanism as its energy source, but mechanically it is now inside the propelled system.

Momentum transferred from the Claim 16 device into the onboard PSU or structure does not leave the vehicle. It merely moves from one internal component to another.

For the complete propelled assembly to gain momentum cycle after cycle, corresponding opposite momentum must cross this outer boundary - or remain accumulated in some internal degree of freedom that does not reset.

For a repeating operating cycle in which the internal mechanical and electromagnetic state returns to its starting condition, permanent internal accumulation cannot continue indefinitely.

So the sophisticated model has a very specific job.

Find the outward momentum flux.

It could be electromagnetic radiation. It could be momentum carried through an external electrical or mechanical connection in a bench experiment. It could be coupling to an environment not yet included in the reduced model.

Or the calculation may reveal that no sufficient outward pathway exists, in which case an internal counter-impulse must restore the full-cycle balance.

This does not decide Claim 16 in advance. It tells us exactly where the decisive evidence must appear.

How much momentum actually crosses the outer boundary during one cycle?

That is now the question.

And it gives us our next suspect: radiation.

Fourth Suspect: Radiation

Could the missing counter-momentum simply leave as electromagnetic radiation?

Yes - in principle.

Radiation carries momentum. If the Claim 16 cycle emits more electromagnetic momentum in one direction than the other, that radiation could provide the equal-and-opposite momentum required by conservation.

But radiation has an inconvenient property for anyone hoping to use it as an easy explanation: its momentum is tied directly to its energy.

For perfectly directed electromagnetic radiation, the largest possible momentum flow is:

thrust = radiated power / speed of light

So if radiation alone is to balance a mechanical thrust F, the required directional radiated power is approximately F x c.

That gives us immediate engineering intuition. A radiation recoil of 1 millinewton would require roughly 300 kilowatts of perfectly directed electromagnetic power. One newton would require roughly 300 megawatts.

Real radiation is usually less conveniently directed, so the required total radiated power would be greater, not smaller.

This Suspect Is Measurable

That makes radiation unusually useful to our investigation.

If a physical Claim 16 device produces a measured mechanical impulse, we can ask how much electromagnetic energy leaves the apparatus during the same cycle, in what directions, and with what net momentum.

If the measured outward radiation carries the required opposite momentum, the bookkeeping closes through radiation. The device would then be functioning, in momentum terms, as an electromagnetic photon thruster - whether or not that was the intended mechanism.

If the radiation is far too weak, or sufficiently symmetric that its net momentum is negligible compared with the measured mechanical impulse, then radiation cannot be the missing counter-momentum.

There is no philosophical argument left at that point. It becomes a measurement.

And If Radiation Is Too Small?

Then one major conventional escape route has been eliminated.

The counter-momentum must still exist somewhere in the complete system, but we must look elsewhere for its physical carrier rather than assigning it to radiation by default.

That leaves a more subtle possibility: perhaps momentum is exchanged through the externally driven electrical source and its boundary conditions in a way the reduced model has not yet captured.

Can the PSU and the act of switching complete the momentum balance without simply cancelling the Claim 16 mechanical impulse?

That is our next suspect.

Fifth Suspect: The PSU

Could the PSU be where the missing reaction goes?

The PSU unquestionably supplies the energy. But supplying energy does not automatically identify where reaction momentum must appear.

Energy to Momentum

For this presentation, Claim 16 is described as an energy-to-momentum converter with a precise meaning: the PSU supplies electrical energy to the converter; electromagnetic energy transfer is accompanied by electromagnetic momentum and stress; and the Claim 16 timing mechanism converts part of that driven electromagnetic interaction into directed mechanical impulse.

This does not mean that energy and momentum are the same quantity, or that supplying energy exempts the device from momentum conservation.

Momentum must balance globally. It need not cancel locally inside the converter.

Whether the PSU sits on a laboratory table or travels with the apparatus does not change the local electrodynamics. What changes is the system boundary used for the accounting. If the PSU is outside the propelled assembly, the electrical connection and surrounding fields may carry energy and momentum across that boundary. If the PSU is onboard, that exchange is internal and the outer boundary must include the PSU as part of the complete propelled system.

The Claim 16 calculation therefore does not assign an equal-and-opposite mechanical impulse to the PSU by assumption. It calculates the actual mechanical forces on the active coil and passive core. If their complete-cycle sum is nonzero, the corresponding momentum must be accounted for in the complete electromagnetic/source system through field momentum, electromagnetic stress and/or momentum flux across the chosen boundary.

What the Conservation Statement Means

Conservation of momentum remains applicable to the complete physical system. The patent claim is narrower: the mechanical impulses inside the Claim 16 converter are not required to cancel each other over one operating cycle.

No compensating mechanical force is inserted merely because “there must be one.” If such a force exists, it must emerge from the calculated force history or from the complete boundary accounting.

We therefore use two levels of mathematics. The first is a deliberately reduced retarded model that exposes the timing mechanism with almost no machinery. The second keeps distributed propagation and causal core response so the same question can be asked without treating the coil or core as instantaneous objects.

The question is the same in both:

After one complete modeled cycle, do the mechanical impulses cancel?

Pages 9 and 10 show the derivations.

MATHEMATICAL MODEL I

The Reduced Retarded One-Cycle Model

This first model keeps only the timing structure needed by Claim 16. Let the active one-turn coil carry a prescribed current pulse

$$I(t) = I_0\, g(t), \quad g(t)=1 \text{ for } 0<t<T, \text{ and } 0 \text{ otherwise.}$$

Let the coil-core separation be d and the one-way propagation delay be

$$\tau = d/c.$$

On the coil axis, write the delayed coil field at the passive core as Bc(d,t)=K(d) I(t−τ). In the linear reduced core model, the induced magnetic moment is m(t)=α Bc(d,t). The axial force is

$$\text{Fcore}(t) = m(t)\, \partial z\text{Bc}(d,t) = C\, I^2(t-\tau), \quad C>0,$$

where the positive direction is defined as the desired propulsion direction. The useful core impulse is therefore

$$\mathbf{Jcore = \int Fcore(t)dt = C\, I_0^2 \int g^2(t-\tau)dt = C\, I_0^2\, T > 0.}$$

The core response then propagates back to the coil. In the same reduced model, its returned field has the form Br(t)=Kr I(t−2τ). The corresponding axial force on the active coil is proportional to the overlap of the present coil current with that delayed field:

$$\text{Fcoil}(t) = D\, I(t)\, I(t-2\tau),$$
$$\text{Jcoil} = D\, I_0^2 \int g(t)\, g(t-2\tau)\, dt.$$

Claim 16 chooses the switching interval so that the active coil is already OFF before the returned core interaction reaches it. Mathematically, the two pulse supports do not overlap:

$$\mathbf{supp[g(t)] \cap supp[g(t-2\tau)] = \varnothing \quad \Rightarrow \quad Jcoil = 0.}$$

Therefore, over the complete reduced cycle:

RESULT **The calculated mechanical impulses do not cancel.**

The useful core impulse remains while the delayed coil impulse is removed by the prescribed timing.

$$\mathbf{Jnet = Jcore + Jcoil = C\, I_0^2\, T > 0}$$

Scope: this is an ideal reduced model. It proves neither experimental performance nor the absence of all higher-order effects. It establishes the mathematical consequence of the Claim 16 timing assumption itself.

MATHEMATICAL MODEL II

Distributed Retarded Field + Causal Core Response

The second model removes the "whole coil changes at once" simplification. Let s measure position around the conductor and vp be the propagation velocity of the switching disturbance along it:

$$I(s,t) = I_0\, g(t - s/vp).$$

The field at a core point r is constructed from the distributed source at retarded time. Writing KB for the Biot-Savart/geometry kernel and R=|r−rs|:

$$Bc(r,t) = \int C\ KB(r,s)\ I(s,\ t - R/c)\ ds.$$

The passive core is causal rather than instantaneous. With magnetic response kernel χ(r,u):

$$M(r,t) = \int_0 \infty\ \chi(r,u)\ Hc(r,t-u)\ du.$$

For the axial reduced geometry, the resulting mechanical force on the finite core is obtained by integrating the local magnetic-force density:

$$Fcore(t) = \mu_0 \int Vcore\ M(r,t)\ \partial zHc(r,t)\ dV,$$

$$Jcore = \int cycle\ Fcore(t)\ dt.$$

The magnetized core generates a field that propagates back to every point of the coil. With return-field kernel GB:

$$Br(s,t) = \int Vcore\ GB(s,r)\ M(r,\ t - R/c)\ dV.$$

The coil force is then calculated from the actual local current and the actual returned field - not assigned by symmetry:

$$Fcoil(t) = \int C\ [\ I(s,t)\ d\ell \times Br(s,t)\ ]z,$$

$$Jcoil = \int cycle\ Fcoil(t)\ dt.$$

The complete mechanical result of this model is therefore

$$\mathbf{Jnet = Jcore + Jcoil.}$$

The Claim 16 timing condition is imposed locally: after allowing for propagation around the conductor, the current is zero wherever and whenever the significant returned-core field reaches that conductor. In the strict separated-window limit this makes the overlap integral in Jcoil vanish; with finite edges or a finite material-response tail, the residual overlap is calculated directly rather than assumed.

RESULT **The more complete retarded model preserves the same test.**

Finite source propagation and causal core response change the force waveform and timing, but they do not introduce an equal-and-opposite mechanical impulse by assumption. The net result is whatever the two independently integrated force histories produce.

For the separated Claim 16 timing used in the model: Jnet > 0

This remains a mathematical prediction, not experimental proof. Its significance is that the nonzero-cycle impulse is not an artifact of writing a single instantaneous force equation; it survives when retardation, distributed source timing and causal magnetic response are written explicitly into the model.