NOTATUS MOTOR

High-Efficiency Reciprocating Hydraulic Motor with 91.16% Fluid Recirculation: Prototype Development and Patent Status

Inventor and Patentee: Rafael Serrano

Intellectual Property:

- **PCT International Application:** PCT/ES2025/070599 (Filing date: 10/06/2025). Favorable International Search Report (ISR): certifying worldwide novelty and inventive step.
- **National Patent (Spain): Application** P202690012. The granted patent covers not only the apparatus (Claims 1 to 8), but also the operating method (Claim 10), significantly hindering circumvention of the technology.
- **European Patent Application:** File EP25890397.0

Upcoming Actions:

Extension of patent protection to major global industrial markets prior to the national phase entry deadline in August 2027: United States (USPTO), China (CNIPA), Japan (JPO), India (IPO), and other jurisdictions according to commercial interest.

PROPULSION AND POWER WITHOUT COMBUSTION

A New Paradigm: Closed-Loop, Decarbonized Mechanical Work

Background and the Present Challenge

From ancient watermills to modern nuclear reactors, humankind has sought inexhaustible power sources to supply all the energy it needs—ideally by self-sustaining the systems with the very energy they generate in a continuous cycle, while yielding an excess to exchange for external work. However, it has always been assumed that **this violates the laws of thermodynamics**; therefore, the mere allusion to a perpetual motion machine clashes sharply with the sensibilities of any physicist or engineer.

Nevertheless, throughout history engineering has demonstrated that efficiency challenges are overcome through design. The Notatus Motor introduces a radical optimization: rather than demanding a continuous, massive supply of external fluid, it recirculates and confines the pre-existing fluid within the system, drastically reducing the pumping work required to generate a mechanical stroke.

Unlike internal combustion engines—where gases expand and exhaust irreversibly—hydraulic fluid preserves its volume and incompressibility unaltered cycle after cycle. The system orchestrates injection pressure and variable geometry to mechanically displace the useful load while utilizing only a minimal fraction of the chamber's total volume.

The Wall of Historical Incredulity

Every major technological leap has had to confront the skepticism of its era:

- **Aviation**: In the dawn of aviation, it was widely believed that no heavier-than-air craft could ever fly. The Wright brothers emulated the aerofoil profile of birds' wings and used leading-edge geometry to "awaken" the aerodynamic lift that air, by its very nature, was inherently capable of delivering without violating gravity.
- **The Railway:** In the early 19th century, physicians and scientists seriously warned that the human body would disintegrate or passengers would suffocate if traveling over 30 km/h due to air pressure against the lungs.
- **Radio:** Lord Kelvin, one of history's preeminent physicists, declared in 1897: "Radio has no future," unable to conceive that a signal could curve along the contour of the Earth.
- **Lunar Travel:** In 1920, The New York Times ridiculed Robert Goddard, arguing that a rocket could never function in the vacuum of space because it would have "nothing to push against". The newspaper issued a formal retraction on July 17, 1969, as Apollo 11 was en route to the Moon.

Under this very historical premise, the **Notatus Motor** leverages geometry to optimize torque transfer and, while scrupulously upholding conservation laws, effectively multiplies the practical working capacity of the supplied fluid.

1. Introduction and Technical Problem

Conventional hydraulic systems, despite their high power density, require large volumes of fresh fluid per cycle, leading to oversized pumps, high energy consumption, and significant heat generation. This is particularly critical in mobile machinery, off-highway equipment, stationary power generation, and applications where energy autonomy is paramount.

This reciprocating hydraulic motor design replaces combustion with hydraulic fluid acting as a direct ram to drive a connecting rod and crankshaft. The core innovation is the reuse of over 90% of the driving fluid in each cycle, drastically reducing the demand for fresh fluid and the required pumping power through several concurrent volume-saving methods:

First Method: Conical Cavity Geometry

The system employs a set of concentric, telescopic cylindrical segments that, upon deployment, form an internal conical cavity. Based on pure geometry, a right circular cone confines only one-third (1/3) the volume of a cylinder having the same base and height. By keeping the thrust area across the major base fully intact, the transmitted force ($F = P \cdot A$) remains identical while requiring only one-third of the volumetric capacity of a conventional cylinder.

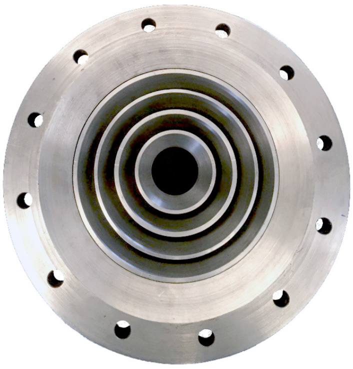


FIG. 2 - Retracted Segments

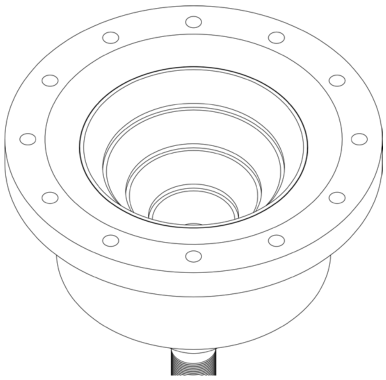


FIG.3 - Deployed Segments

Second Method: Permanent Fluid Retention in Perimeter Voids

When the telescopic segments retract, the design intentionally creates perimeter voids between them. These voids permanently retain a volume of hydraulic fluid that is never evacuated and is reused in each cycle:

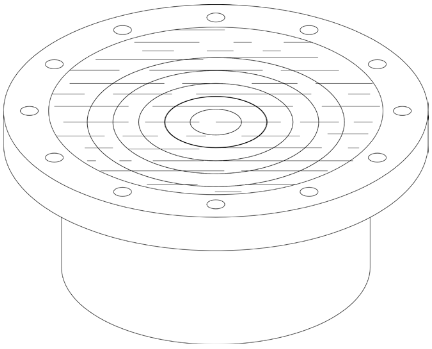


FIG. 4 - Fluid captive within retracted voids

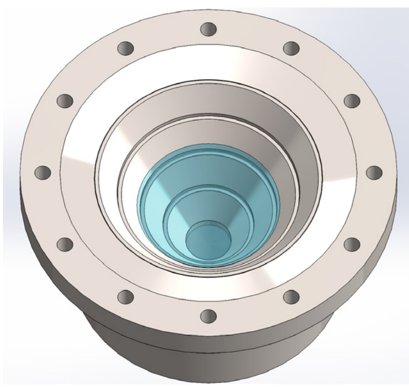
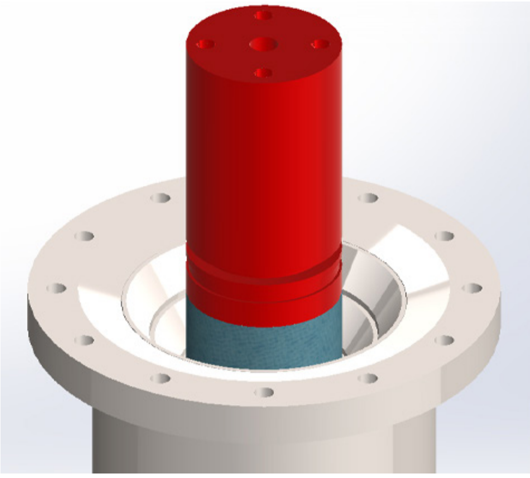


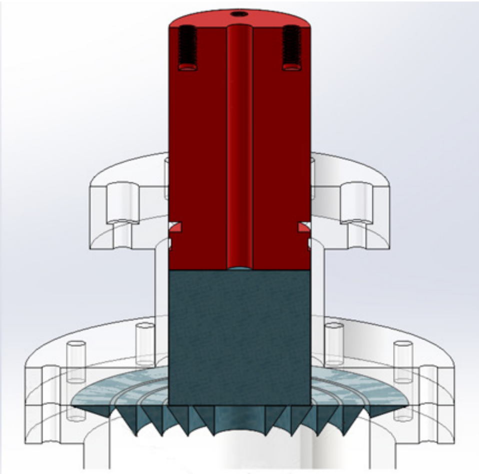
FIG. 5 - Identical fluid and volume as segments deploy

Third Method: Fixed Constant-Volume Occupancy Plunger

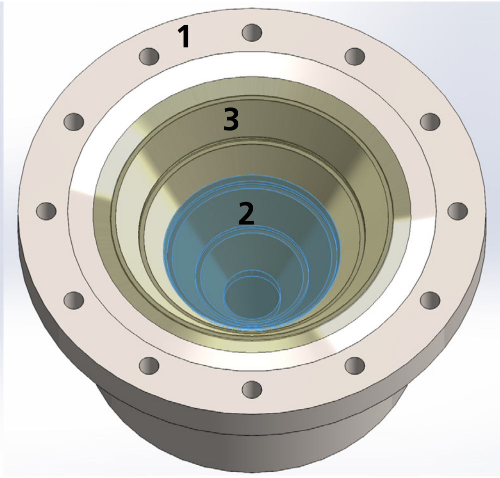
A stationary plunger (in red), rigidly anchored to the upper base (not visible), occupies a constant volume within the system, preventing fresh fluid from filling that space during each cycle. A column of retained fluid associated with the plunger (in green) acts as a "virtual liquid piston" in conjunction with the lower interstitial rings. The plunger houses the injection conduit leading to the core of the system and serves as an active guide to ensure the transmission of force to the crankshaft without the segments bearing any axial load.



Piston and Cavity Assembly
In red, stationary plunger occupying internal volume.
In green, portion of fluid permanently retained within the chamber. FIG. 6



Cross-Section
In red, stationary plunger and fluid feed conduit
In green, sum of fluid volumes permanently retained within the chamber. FIG. 7



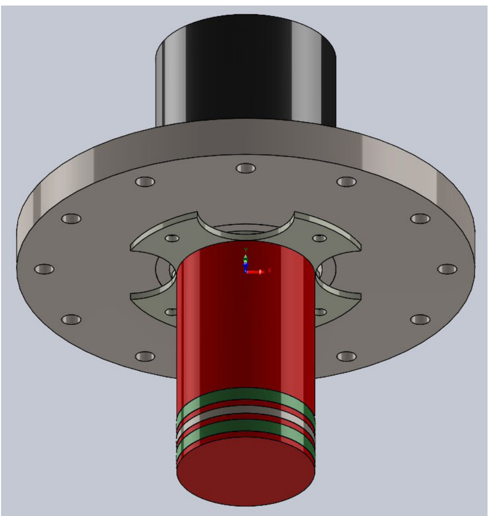
Combined Volume-Saving Methods:
1. Conical cavity: **First saving method**
2. In blue: Volume saved via the **second method**
3. In amber: Volume saved via the **third method**.
FIG. 8

Fourth Method: Emerging Solid Plunger

A solid plunger of defined cross-section penetrates/emerges into the conical chamber as it expands. Being rigidly connected to the moving assembly and displacing alongside it, it dynamically occupies a volumetric space (ΔV_{solids}) that the pump does not need to replenish with fresh fluid. This direct volumetric saving contribution raises the Confinement Coefficient (η) above 0.93, multiplying system gain without requiring additional hydraulic work from the pump.

(See detailed cross-sections in the plates at the end of this document)

Detail of the Emerging Plunger Anchored to the Moving Cylinder Head



Physical-Mathematical Foundation: The Serrano Principle

The operation and drastic reduction in consumption of the **Notatus Motor** are formalized through the **Serrano Principle**, which defines the behavior of hydraulic work in closed, variable-geometry chambers with the intrusion of solid elements:

$$W_{pump} = P \cdot (\Delta V_{chamber} - \Delta V_{solids})$$

Where:

- W_{pump}: Effective work that must be supplied by the external hydraulic pump.
- P: Operating pressure of the hydraulic circuit..
- $\Delta V_{chamber}$: Total volume expansion increment of the cavity.
- ΔV_{solid}: Volume intruded into the chamber by solid elements (plunger and segments) during the stroke.

The **Confinement Coefficient** η and the **Volumetric Amplification** Factor K are defined as:

$$\eta = \frac{\Delta V_{solids}}{\Delta V_{chamber}} \quad \Longrightarrow \quad K = \frac{1}{1 - \eta}$$

Actual Prototype Data

With a measured confinement coefficient of $\eta \approx 0.932$, the system achieves a theoretical K of 14.7. Accounting for fluid compressibility (≈ 0.5%) and mechanical friction losses, the actual amplification factor measured on the prototype is 9.16.

Thermodynamic Aspect

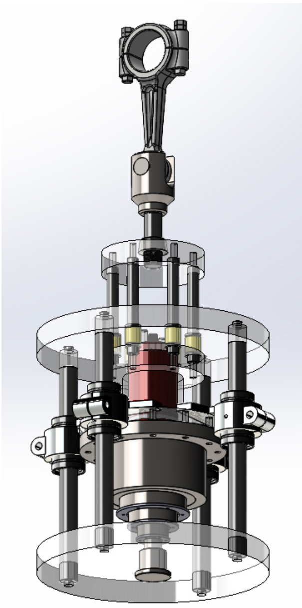
The factor K = 9.16 represents a pumping flow reduction coefficient, not energy creation. The pump only supplies the 8.4% volume differential, while the thrust work on the major base is delivered through the displacement of the captive retained fluid and the kinetic energy of the moving mechanical elements.

Fundamental Efficiency Equation

$$\text{Ratio} = \frac{\text{Volume of the cone}}{(V_{\text{injection}} + V_{\text{compressibility}})} = 9.16$$

- **Ratio (9.16):** Estimated net gain coefficient of the system, calculated after deducting prototype mechanical and friction losses.
- **Volume of the cone:** Total volumetric capacity of the geometric cavity once the sequential deployment of the telescopic segments is complete (100%).
- **V_injection:** Volume of fresh fluid supplied by the pump in each cycle (8.4%).
- **V_compressibility:** Additional volume required to compensate for the natural elasticity of the hydraulic fluid under high pressure (approximately 0.5%).
- **Pure theoretical efficiency** (without compressibility): 1 / 0.084 = 11.9
- **Estimated actual efficiency** (including physical variables): 9.16

A full-scale prototype has been designed, fully manufactured, and is ready for technical validation testing.



3. Prototype Status and Next Steps

- **Component Validation:** All individual components of the Notatus Motor have been manufactured and successfully tested in isolation prior to final assembly, achieving fully satisfactory results.

- **Current Phase:** Final structural assembly. Full performance testing of the high-pressure pressurized system is scheduled to commence immediately.

- **Funding:** The development and construction of the prototype have been entirely funded through the internal equity of the Notatus team. No external funding is required for the completion of the physical model.

4. Strategic Partnership and Collaboration Opportunity

The window of opportunity is tied to the international priority deadline under the PCT system before **August 2027**. Beyond this date, the invention could remain unprotected in markets outside Spain and Europe. Therefore, three collaboration avenues are available:

- **For Industrial Partners and Investors (OEMs, Tier 1):** Early access to a disruptive technology with substantial competitive advantages through technology transfer agreements, exploitation licensing, or co-funding the entry into PCT national phases.

- **For Research Institutions and Universities:** An invitation to validate the full-scale prototype in specialized hydraulic laboratories, co-author high-impact scientific papers, and train the first academic specialists in Notatus technology.

- **For Technology Transfer Offices:** Joint management of a robust intellectual property portfolio featuring a Granted National Patent (P202690012), a European Patent Application in good standing (EP25890397.0), and a favorable Search Report.

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APPENDIX – RESPONSES TO FREQUENT TECHNICAL OBJECTIONS

This technical appendix compiles the detailed physical arguments addressing the most common objections and misconceptions raised by engineers, peer reviewers, and professors of classical mechanics.

First Misconception (Most Common): Confusing it with a Traditional Telescopic Cylinder

- **The Common Error:** Assuming that the concentric segments deploy in stages while bearing the axial load, degrading output force at each successive stage as the cross-sectional area decreases.

- **The Physical Reality:** In the Notatus Motor, the telescopic segments bear no axial load and do not transmit force section by section. Their sole purpose is to serve as an enclosure or variable confinement casing. The entire assembly behaves as a single rigid chamber whose major base delivers constant thrust. The force remains uniform, clean, and continuous from the beginning to the end of the stroke.

Second Misconception: Erroneously Associating Smaller Volume with Lower Force

- **The Common Error:** Arguing that because a cone occupies exactly one-third (1/3) the volume of a cylinder with the same base and height, the force exerted on the piston must likewise be reduced to one-third.

- **The Physical Reality:** This argument confuses chamber volume with linear force—two independent quantities in hydrodynamics. According to fundamental physical law, force depends strictly on fluid pressure and the area of the thrust surface. The total volume of the enclosure plays no role whatsoever in the linear force equation. The Notatus Motor maintains the full area of the major conical base (A_{base}) exposed to pressure, ensuring that the effective output force remains constant. The conical geometry does not multiply force; rather, it optimizes space, eliminating unnecessary volume while achieving the exact same linear displacement.

- **Macroscopic Analogy:** This mirrors the intuitive error of assuming that the depth or total volume of the sea influences a vessel's buoyancy. An ocean liner floats identically in a deep-water basin with mere clearance beneath its keel as it does in the middle of the Atlantic Ocean—because the buoyant force depends solely on the displaced fluid volume and pressure distribution over the hull, not on the vast body of water surrounding it. Similarly, in the Notatus Motor, output force depends entirely on the active thrust area, remaining completely independent of any surplus fluid volume retained at the periphery.

Third Misconception: Conservation of Energy

- **The Common Error:** Dismissing the system as a "perpetual motion machine" based on the spontaneous creation of energy.

- **The Physical Reality:** The system strictly complies with the principle of energy conservation. Net mechanical work output is the direct sum of the pump's mechanical input (which pressurizes and introduces the 8.4% of fresh fluid) and the potential energy state of the retained residual fluid. This 91.6% fluid volume was physically charged into the system during an initial static pre-fill. Being hermetically sealed within a closed loop, it undergoes no thermodynamic expansion (unlike a combusted gas); rather, it operates as an incompressible kinetic transmitter that instantaneously recovers pressure in each cycle when driven by the small injected volume increment. The laws of physics are not violated; they are leveraged to their theoretical maximum through a novel geometric and operational architecture.

Conclusion

The Notatus Motor does not violate thermodynamics. It simply leverages geometry and fluid recycling so that the pump can be nine times smaller. The output work equals the sum of the pump's work plus the energy contribution of the retained fluid, which was already present within the system following the initial fill.

Step-by-Step Operating Principle

- **Initial State:** The conical assembly is fully retracted (FIG. 2). All spaces free of solid components (perimeter recesses and the fixed piston passage) are filled with hydraulic fluid at ambient pressure (FIG. 7). This fluid accounts for 91.6% of the total volume that the conical cavity will reach at full stroke extension.
- **Injection:** The pump begins injecting fresh fluid through an orifice in the fixed piston rod. Because the internal volume is already entirely occupied by liquid, no space is available to accommodate additional fluid. Consequently, the injected fluid must push the base of the cone upward, overcoming the resistance of the crankshaft.
- **Release of Retained Fluid:** As the base ascends, a new volume opens within the conical cavity (FIG. 5). The fluid retained in the perimeter recesses and within the fixed piston passage is released, merging with the injected fluid.
- **Continuous Progression:** This dynamic proceeds millimeter by millimeter. As the base rises, additional retained fluid is continuously discharged and combined with the injected flow (FIG. 8).
- **End of Stroke:** Once the base reaches its top dead center position, the internal geometry forms a complete cone. The final cavity volume is 100% occupied by the combined volume of injected fluid (8.4%) and released retained fluid (91.6%).
- **Energetic Consequence:** The output force driving the piston is strictly defined by pressure multiplied by the area of the major base (Force = P × A_base), remaining constant throughout the stroke. Because the pump supplies merely 8.4% of the total displaced volume, its power requirement is substantially lower than the mechanical power delivered at the output.

On the Conservation of Energy (Response to a Recurring Objection)

Thermodynamics is not violated. The output energy originates from two sources:

- **The energy supplied by the pump** (to inject the 8.4% volume increment).
- **The energy of the retained fluid**, which was introduced into the system during the initial static pre-fill at ambient pressure and remains conserved cycle after cycle because it is never discharged.

When the pump injects fresh fluid under pressure, all the liquid contained within the chamber (both the retained volume and the newly introduced fluid) compresses to that same pressure almost instantaneously (Pascal's Principle). To compensate for volume reduction due to compressibility, the pump must deliver approximately an additional 0.5% of fluid (over the 8.4%). That small fraction is already accounted for within the 9.16 factor.

On the Fixed Piston as a "Through-Rod"

The suggestion to replace the fixed piston with a through-rod is technically intriguing, but the purpose of the fixed piston extends beyond mere volume displacement. Its function is twofold:

- **Occupying** a constant volume that does not require replenishment during each cycle.
- **Housing** the internal conduit through which the pump injects fresh fluid, ensuring injection occurs directly at the core of the system.

Furthermore, as it traverses the interior of the cone, the fixed piston acts as a guide and as an element ensuring force transmission to the crankshaft without requiring the segments to bear any load. It is not merely "dead volume," but an active component within the fluid recycling strategy.

On the Energy of the Retained Fluid (Clarification)

The energy of the retained fluid was introduced into the system during the initial static pre-fill at ambient pressure. Although the discharge valve opens at the end of each cycle and the fluid depressurizes, the fluid has not disappeared: it remains inside the system, occupying volume.

To repressurize it in the subsequent cycle, the pump must inject fresh fluid. First, this fresh fluid compensates for the compressibility of the entire volume contained within the chamber (approximately an additional 0.5%). Only from that point forward does the fresh fluid begin to displace the base of the cone, overcoming the resistance of the crankshaft. As the base ascends, the retained fluid is released from the perimeter recesses and the fixed piston passage, merging with the injected fluid. At the end of the stroke, the pump has supplied 8.4% of the total volume (including the 0.5% compressibility factor).

There is no remote pressurization without displacement. The retained fluid recovers pressure because it is driven by the fresh fluid through the displacement of the base. It is precisely this displacement that enables the release and integration of the retained fluid. The pump supplies merely 8.4% of the total volume, yet owing to the conical geometry and fluid recycling, the output power is 9.16 times that of the pump.

Therefore, the actual sequence is:

- **The pump** injects fresh fluid.
- **Pressure compensation occurs first** (approximately 0.5% for compressibility).
- **From that point onward**, the fresh fluid drives the base.
- **As the base moves**, the retained fluid progressively shifts compartments and merges with the injected fluid.
- **At the end of the stroke**, the 8.4% injection is complete, and the entire retained liquid volume now integrates into the conical geometry alongside the freshly injected fluid.

The retained fluid (91.6% of the total volume) was introduced into the system during the initial manual fill at ambient pressure. Although the discharge valve opens at the end of each cycle and the fluid loses pressure, the fluid has not disappeared: it remains inside the system, occupying volume. To repressurize it in the subsequent cycle, the pump only needs to supply a small additional volume (8.4%), because Pascal's Principle transmits that pressure to the entire body of retained fluid almost instantaneously (at an additional cost of 0.5% to compensate for compressibility).

The energy is not stored within the retained fluid itself. The energy required to pressurize it is supplied by the pump in each cycle. The efficiency gain arises because the pump only has to displace 8.4% of the total volume each cycle—rather than 100%—since the 91.6% is already present within the enclosure. It is akin to having a tank already filled with water: even when the water is stationary and at atmospheric pressure, the fact that it already occupies the reservoir eliminates the work required to refill it from scratch. That reduction in displaced volume is the core operational principle of the system.

Syringe Analogy

Consider a rigid reservoir completely filled with water, hermetically sealed and at ambient pressure. Connected to it is a small syringe, likewise completely filled with water. When force is applied to the syringe plunger, no fluid displacement occurs—there is simply no available volume—yet the applied force creates a hydrostatic pressure that transmits instantaneously throughout the entire fluid volume within the reservoir (Pascal's Principle). The entire enclosure becomes fully pressurized, even though the plunger has barely moved and the displaced volume is practically negligible.

An analogous mechanism governs the Notatus Motor. The retained fluid (accounting for over 91% of the total system volume) is already residing inside the assembly. The pump acts as this high-pressure syringe: it injects a small volume of fresh fluid under high pressure, continuing until the 8.4% delivery is complete. That initial volume increment pressurizes the entirety of the retained fluid. Consequently, the pump only expends energy to displace its own small volumetric fraction and overcome the compressibility of the fluid mass. Displacing 100% of the working volume from an external source each cycle is entirely unnecessary, because the primary fluid volume is already retained internally.

On Fluid Compressibility

Hydraulic fluid, unlike the exhaust gases of an internal combustion engine, undergoes no phase change and can therefore be continuously reused. When the pump injects fresh fluid under pressure, the entire fluid volume contained within the chamber compresses to that same pressure almost instantaneously (Pascal's Principle). To compensate for this volume reduction due to compressibility, the pump must deliver approximately an additional 0.5% of fluid. That small fraction is already integrated into the 9.16 factor.

Fundamental Equation: $W_{out} / W_{pump} = V_{cone} / (V_{inj} + \Delta V_{comp}) \approx 9.16$

Where:

- W_{out} = Mechanical output work
- W_{pump} = Pump input work
- V_{cone} = Total conical cavity volume
- V_{inj} = Injected fresh fluid volume
- ΔV_{comp} = Additional volume compensating for fluid compressibility (≈ 0,5 %)

Theoretical value without compressibility: 1 / 0.084 ≈ 11.9

Estimated value including compressibility and mechanical losses: 9.16

Energy and Volumetric Balance Synthesis

In conclusion, the factor K ≈ 9.16 does not describe a spontaneous creation of energy, but rather a drastic reduction in external pumping work (W_pump).

Since 91.16% of the working volume permanently resides within the sealed enclosure, the external pump does not need to perform kinematic work to refill the cavity on each stroke. Its role is strictly confined to delivering the minimal differential volume (8.4%) and compensating for slight elastic compressibility (0.5%) to transmit hydrostatic pressure to the main thrust base via Pascal's Principle.

The resulting mechanical work is exclusively the product of variable geometric confinement and continuous, closed-loop fluid recirculation.

The Present Challenge and the Notatus Philosophy

Our society has consistently navigated physical constraints, adapting technologies that have driven meaningful progress across modern engineering.

The core objective of this design is to maximize density and efficiency in mechanical power transmission. Just as an airfoil leverages aerodynamic lift from its medium without demanding disproportionate thrust, the Notatus Motor relies on the near-incompressibility of fluid confined within a closed loop to maintain a continuous duty cycle with an exceptionally low external pumping requirement.

This system capitalizes on the bulk modulus and physical properties of hydraulic fluid confined within a custom-geometry, closed-circuit enclosure. Unlike internal combustion engines—where exhaust gases expand and undergo irreversible phase changes—the hydraulic medium preserves its liquid volume and physical integrity cycle after cycle, enabling continuous recirculation within an optimized geometric volume.

And this is no mere rhetoric; it is a principle that **can be rigorously explained, understood, and empirically verified.**

A New Horizon of Applications

- **Global Mobility and Transportation:** Autonomous on-board electrical power generation across land vehicles, aviation, railways, maritime vessels, and submersibles, eliminating the need for fossil fuels and exhaust systems.

- **Heavy and Stationary Industry:** Propulsion for off-highway machinery (mining, construction) as well as continuous baseload generation systems for industrial facilities and isolated off-grid communities.

- **High-Density Vertical Agriculture (Environment-Independent):** Access to continuous, abundant power enables high-yield farming within multi-tier modular enclosures. Each tier integrates specialized artificial lighting arrays to drive continuous photosynthesis for the bed directly beneath it. This decouples crop production from natural sunlight, arable soil, and seasonal fluctuations, allowing any species—regardless of environmental sensitivity—to be grown reliably anywhere on Earth, from polar regions to arid deserts.

- **Desalination and Water Resource Management (Guaranteed Supply):** Access to abundant, high-density mechanical power enables the continuous, decentralized operation of reverse osmosis desalination plants. This eliminates prohibitive operational electricity costs, converting seawater into potable and irrigation water for urban infrastructure or emergency drought relief in arid zones.

- **Deep and Extreme Underground Mining:** In ultra-deep excavation, the costs and operational risks tied to forced-air ventilation for clearing toxic diesel exhaust gases are severe. Operating in a closed circuit without combustion or emissions, this system powers heavy underground machinery safely, drastically cutting forced-ventilation infrastructure requirements and mitigating thermal hazards at the working face.

- **Cold Chain Logistics and Autonomous Data Centers:** The technology delivers uninterrupted thermal and electrical power to critical facilities requiring continuous active cooling. This guarantees total operational autonomy for large-scale data centers and remote hyperscalers, as well as logistics hubs for medical and cold-chain food storage, insulating them against grid failures or external disruption.

- **Autonomous Urban Infrastructure and Residential Well-Being:** Decentralized power generation enables continuous baseload supply for thermal and electrical district networks in urban centers and residential complexes. By securing uninterrupted power for large-scale HVAC systems (heating and air conditioning), municipal water pumping, and domestic distribution, it bypasses vulnerable external grids, lowers baseline living costs, and elevates the global standard of living.

Frequently Asked Questions (FAQ)

- **Is this a perpetual motion machine?**
  No. The system does not create energy out of nothing; it drastically reduces external pumping work because 91.16% of the working fluid already permanently resides within the chamber. The external pump only delivers the minimal volumetric differential required to induce Pascal pressure and execute the displacement stroke.

- **Why does force not degrade across the segments?**
  Because the segments bear no axial load; their role is strictly to confine the fluid. Mechanical force is generated exclusively by hydrostatic pressure acting against the larger base of the cone, which functions as a solid piston.

- **What happens with fluid compressibility?**
  Compressibility is offset by delivering a minor additional volume of fluid (approximately 0.5%) via the pump. That fraction is already accounted for within the 9.16 multiplication factor.

- **What occurs if air is trapped within the system?**
  Entrained air degrades performance due to its high compressibility. For this reason, the system undergoes manual priming prior to initial commissioning and is purged through bleed valves positioned at high points or via low-pressure purge cycles.

- **How are friction losses and ring seal drag managed?**
  This is a central consideration of the mechanical design. Because the segments do not support axial loads, mechanical drag remains minimal. Furthermore, the hydraulic fluid itself provides continuous lubrication along the contact interfaces. Fluid friction losses are mitigated through optimized internal surface finishes and controlled flow velocities, fully accommodated within the operating margin of the near-tenfold multiplication factor.

- **How is high-pressure sealing guaranteed in a conical telescopic geometry?**
  High-integrity seals engineered specifically for heavy-duty hydraulic applications are deployed to withstand substantial dynamic pressures. Because the fluid never exits the assembly and recirculates continuously, seal degradation is significantly reduced compared to open-loop hydraulic architectures exposed to external contamination.

- **What maintenance is required compared to an internal combustion engine?**
  Maintenance demands are dramatically lower. Without combustion, there is no extreme thermal breakdown of the working medium, no soot or carbon buildup, and no exhaust aftertreatment filters to service. Operating as a hermetically sealed circuit where the working fluid is permanently retained, routine maintenance is limited to periodic seal inspections and pump diagnostics.

- **Is this technology scalable for high-power demands, such as maritime propulsion?**
  Completely. The underlying physics scales directly with hydrostatic pressure and cross-sectional area. Increasing net power output requires only proportional scaling of the conical cavity dimensions and the piston base area. Because operation is free from chemical combustion limits, no thermal bottlenecks restrict its scale for marine propulsion, rail traction, or large-scale stationary power generation.

- **Has the system been tested empirically?**
  Individual sub-assemblies have been bench-tested, validating kinematic motion and assembly sealing while yielding experimental measurements on test benches (confirming the net 9.16 factor). The subsequent phase focuses on continuous closed-loop duty-cycle certification at an accredited industrial test facility.

The Notatus Philosophy

The Wright brothers emulated the aerodynamic profile of birds' wings. Unable to replicate complex biological articulation, they devised a propulsion system that allowed the wing's geometry to perform its work efficiently. They did not invent air, nor did they accelerate it externally; they simply propelled their craft through it to activate the necessary pressure differentials. They understood how to use the wing's leading edge to awaken the aerodynamic lift that air, by its very physical nature, was already capable of delivering.

Under this exact premise—just as the Wright brothers leveraged the leading edge of an airfoil—the Notatus Motor harnesses the intrinsic properties of hydraulic fluid. Because the medium undergoes no phase change during operation, its physical integrity remains intact. This fundamental property, combined with the system's geometric architecture, eliminates the need to evacuate the entire working volume on each cycle, as demonstrated below.

The Notatus Motor employs a conical enclosure that inherently reduces the required driving fluid volume to one-third (1/3). Yet this represents only one of four integrated conservation principles. The design departs from brute force to embrace a refined mechanical logic: it does not seek to impose an external force contrary to nature, but rather orchestrates pressure and volumetric flow within an optimized geometry, capitalizing on the incompressibility and volumetric restitution of a confined liquid. In an analogous manner, Notatus does not generate energy out of nothing; it operates as a kinetic transducer that unlocks the intrinsic work potential and incompressibility of the medium within.

Every physical medium can yield mechanical work when engaged by the appropriate technological design. For this reason, the system operates with a fluid confined in a closed circuit under a core operational axiom: what is already present does not need to be replenished. The mere presence of this retained fluid, when acted upon by precise geometric constraints and pressure dynamics, provides an accessible form of energy inherent to its physical nature that can now be harnessed continuously.

The system functions as an optimized kinetic transducer, transforming the near-incompressibility of the liquid into a steady, homogeneous, high-density axial force vector throughout the entire stroke.

On Experimental Validation

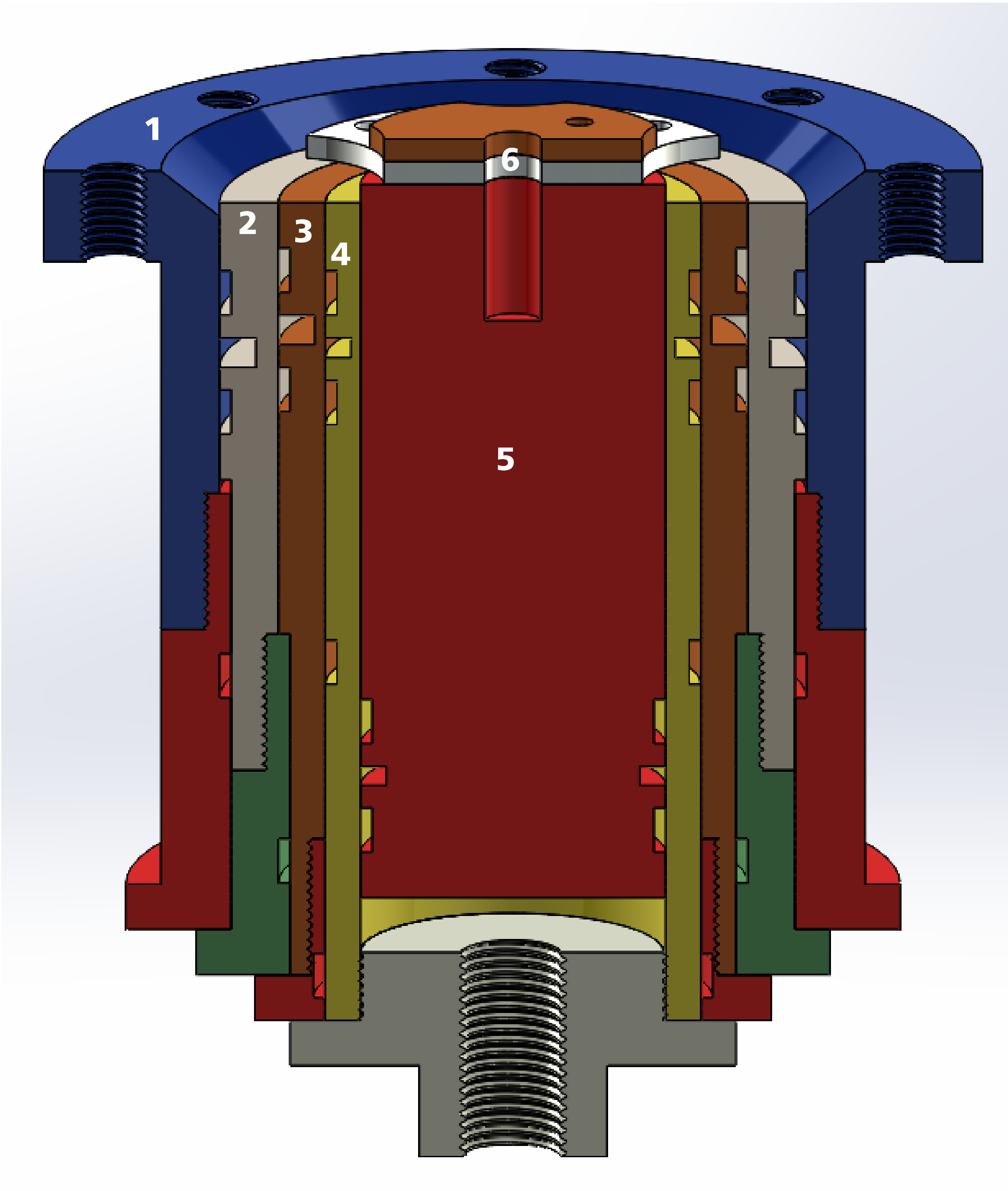
Systematic validation tests on an instrumented test bench will provide the definitive verdict, confirming the empirical values recorded on the prototype. Formal verification in accredited testing laboratories will open clear pathways for industrial collaboration, technological standardization, and joint academic development.

Conclusion of the Annex

In summary, it comes down to capitalizing on the inherent physical properties of hydraulic fluid. There is no violation of thermodynamic principles nor spontaneous creation of energy, but rather continuous, closed-loop fluid recycling: useful mechanical work results from pressurizing the primary thrust base without expending energy to re-pump the pre-existing fluid volume. The governing laws of physics are fully harnessed through an optimized geometric architecture and operational cycle protected by patent.

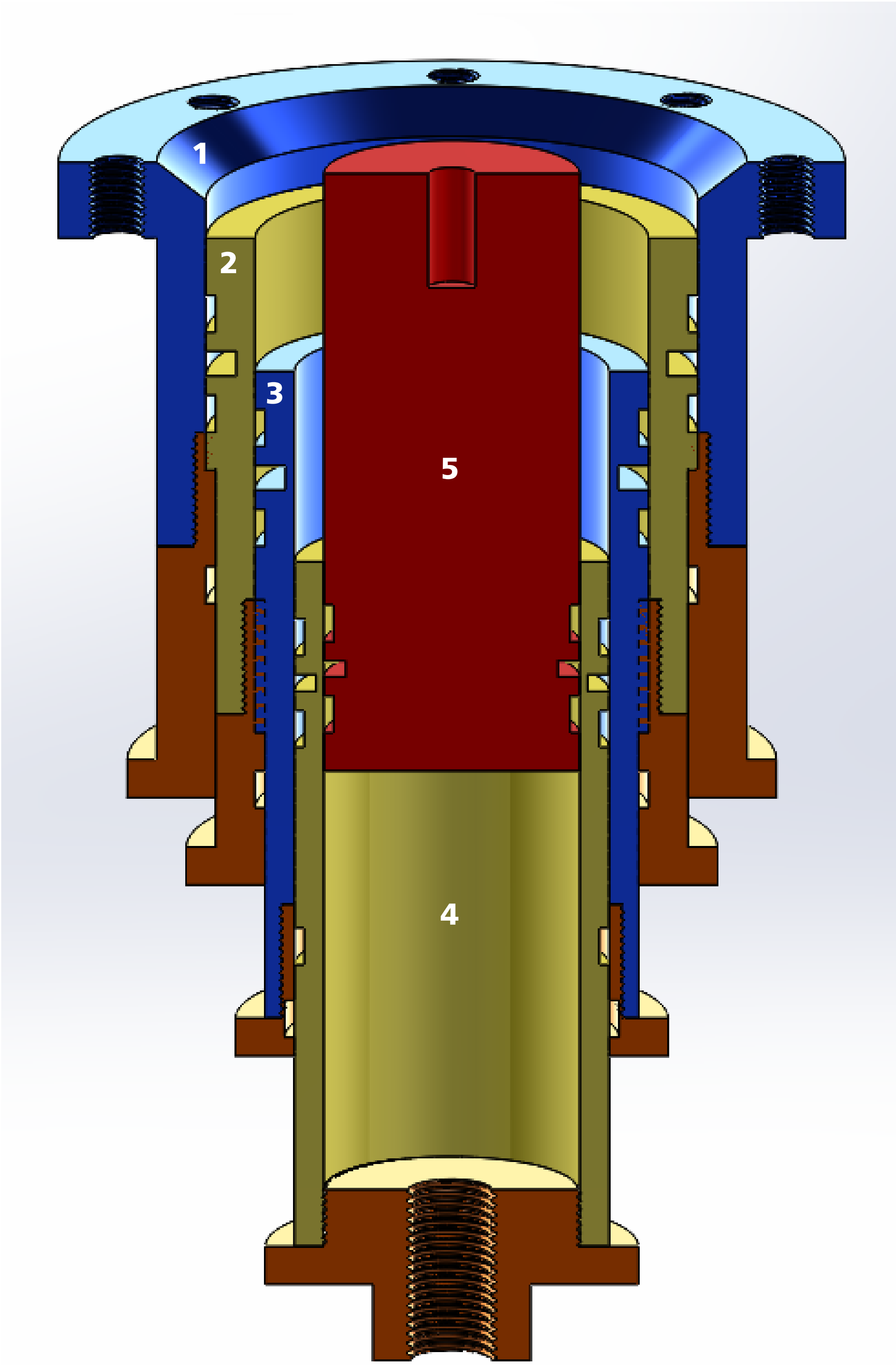
Section: Retracted Stages

1. Stage 1
2. Stage 2
3. Stage 3
4. Emerging Plunger Sleeve/Casing
5. Emerging Plunger
6. Cylinder Head Anchor / Mount



Section: Deployed Stages

1. Stage 1
2. Stage 2
3. Stage 3
4. Emerging Plunger Sleeve/Casing (contains air inlet/outlet)
5. Emerging Plunger (integral with the movable cylinder head)



Section: Thrust Module

1. Stage 1
2. Stage 2
3. Stage 3
4. Emerging Plunger Sleeve/Casing
5. Emerging Plunger
6. Cylinder Head Mount
7. Cylinder Head
8. Fixed Penetrating Plunger
9. Feed Line from Pump