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ADDITIVELY MANUFACTURED MULTILAYERED ARCHITECTURE WITH NANOMATERIALS FOR ELECTROMAGNETIC RADIATION SHIELDING

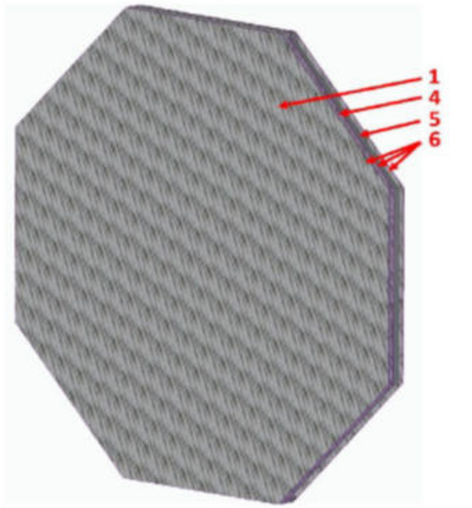
Patent A/00391

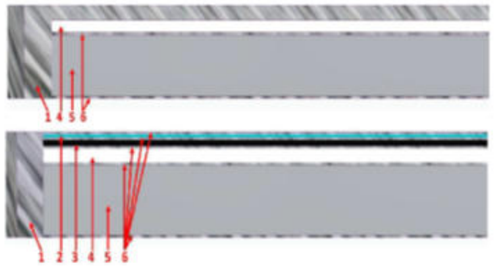
Authors: Alexa-Andreea CRISAN[1], Teodor-Adrian BADEA[1], Raluca MAIER[1]

A multilayered architecture incorporating nanomaterials for electromagnetic radiation shielding, fabricated through additive manufacturing in the form of an octagonal structure (1) with four integrated compartments. Two of these compartments are closed, containing respectively iron sulfate powder (2) and graphene sheets (3), both integrated through overprinting. The other two compartments are provided with access slots for the insertion of a calcium carbonate plate (4) and, respectively, an aluminum sheet (5). The compartments are separated by thin walls (6), which act as energy dissipation elements.

Advantages

- Attenuation of electromagnetic waves through multiple mechanisms (magnetic shielding, reflection, scattering, dielectric losses, and absorption), ensuring superior protection;
- The system's modular design facilitates maintenance and replacement of individual components by providing easy access to each material layer (aluminum, calcium carbonate) while ensuring the secure sealing of the iron sulfate powder and graphene sheets;
- Reduction of manufacturing costs through the use of additive manufacturing technology, which simplifies the process and eliminates the need for complex processing and joining techniques, as well as through the use of synthetic materials and modular structures;
- Extension of the system's service life by enabling the replacement of affected modules without dismantling the entire assembly;
- Resolution of dispersion and stability issues by integrating the iron sulfate powder and graphene sheets directly into the thermoplastic structure through overprinting, ensuring high reliability and consistent performance;
- Optimization of weight and mechanical strength through the use of a modular structure made of lightweight materials, which maintains a robust octagonal shape and ensures long-term stability.





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LIGHTWEIGHT ADDITIVE MANUFACTURING ABLATIVE HEAT SHIELD WITH AIR/VACUUM BUFFER FOR SPACE APPLICATIONS

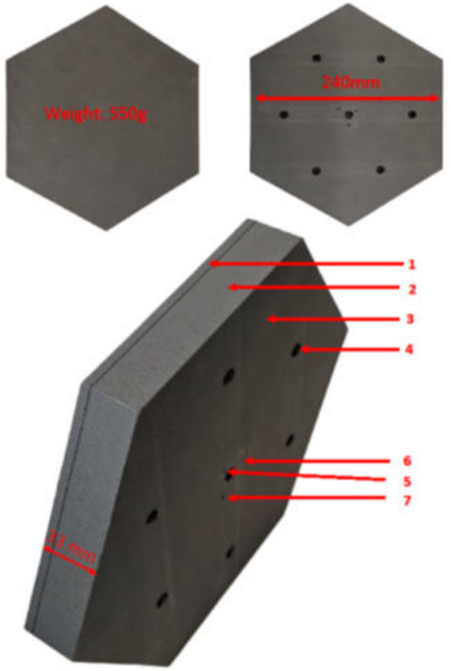
Patent 0139020A0

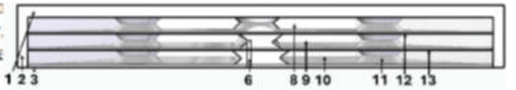
Authors: Teodor-Adrian BADEA[1], Alexa CRISAN[1], Raluca MAIER[1]

A lightweight aditivelly manufactured ablative heat shield with air/vacuum buffers and a hexagonal shape (I) obtained by additive manufacturing with a multilayered inner structure of fire-retardant synthetic materials, consisting of rigid walls: a front wall (1), six side walls (2), a rear wall (3) and respectively in the form of several enclosures called air/vacuum buffers (8, 9, 10) separated by two walls (12, 13) and seven walls (11) corresponding to the grip holes (4). The system integrates seven clamping holes (4) and one communication channel to the external environment for each air/vacuum cushion (5, 6, and 7).

Advantages

- Constructive simplification of existing ablative heat shield systems by integrating the structural concept with air/vacuum buffers;
- Achieving a lightweight and low thermal conductivity heat shield by integrating air/vacuum buffers;
- Possibility to realize the heat shield using different specific additive manufacturing methods, on Earth or even in-situ in space;
- Versatility provided by the heat shield system concept in terms of shape, internal structure (types of fire retardant materials, wall thickness, number of air/vacuum buffers) depending on the specifications, or the targeted application;
- Reduced manufacturing time, costs through the use of additive manufacturing and constructive simplification;
- The heat shield integrates a mechanical attachment system adaptable to the spacecraft interface;
- The heat shield through the mechanical integration system leads to an increase in the lifetime of the whole system, as each hexagonal component can be treated as an individual part, and replaced when necessary, without requiring general maintenance of the whole assembly.





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MODULAR MULTILAYER ADDITIVELY MANUFACTURED BALLISTIC ARMOR WITH AIR BUFFERS

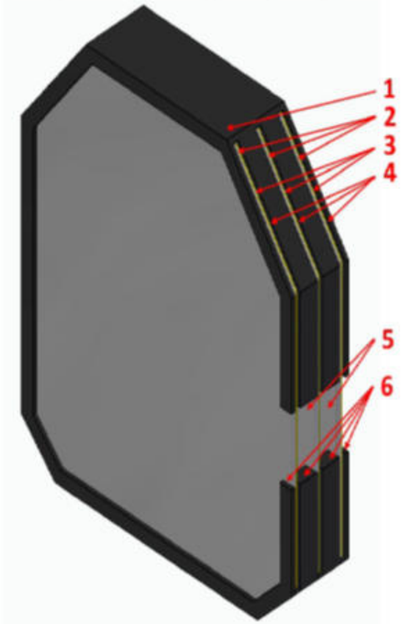
Patent A/00390

Authors: Teodor-Adrian BADEA[1], Alexa CRISAN[1], Raluca MAIER[1]

The invention introduces a modular protective system featuring a multilayered architecture with octagonal geometry, fabricated through advanced additive manufacturing technologies. The system is constructed from lightweight synthetic materials and incorporates three compartments for ceramic plates supported by Kevlar backings. These compartments are separated by two air buffers that serve to dissipate impact energy and mitigate the stresses transmitted to the adjacent layers. The overall design comprises an octagonal external shell (1) equipped with access slots (6) leading to the internal structure, which consists of three compartments (4) for ceramic plates (2) with Kevlar support layers (3), and two air cushions (5).

Advantages

- Attenuation of shock waves and limitation of kinetic energy transfer through integrated air buffers;
- Ease of maintenance and replacement of individual components owing to the modular system architecture;
- Reduction of manufacturing costs achieved by employing additive manufacturing technologies and constructive simplification;
- Extension of the armor's service life by enabling the replacement of damaged modules without dismantling the entire assembly;
- Provision of effective impact protection and improved thermal comfort, ensured by the integration of air cushions and the modular design of the armor.



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Salonul Internațional al Cercetării Științifice, Inovării și Inventicii PRO INVENT

LEVER SYSTEM FOR REDUCING THE RELATIVE MEASUREMENT ERROR OF A TRACTION SENSOR

A 2025 00402

Authors: Valeriu Alexandru Vilag, Jeni Alina Vilag, Iulian Vlăducă, Theodor Mihnea Sîrbu, Răzvan Edmond Nicoară, Alexandru Hank, Bogdan Năvligu, Roxana Nicolae

Romanian Research & Development Institute for Gas Turbines COMOTI

Description

The invention relates to a lever system for reducing the relative measurement error of a traction sensor, intended for small and medium-sized satellite thruster testing laboratories with a propulsion force of up to 1 (one) N (Newton) consisting of four subassemblies (A), (B), (C) and (D) and related components, most of the components being located in a vacuum environment (v), for the accurate determination of the traction (t), produced by the operation of the thruster system (B), the traction (t) being a consequence of the reaction of the gas jet (j), in which the main role is played by the mechanical lever system (A), which increases the force of 1N given by the thruster system (B) which is detected by the 25N force sensor system (C), thus making it possible to amplify the force of 1N given by the thruster system (B), with a multiplication factor (x) = 2.5...5, the 25N force sensor system (C) being calibrated using a weight calibration system (D) and the thruster system (B) is mounted on an L3 profile (12) by means of screws (32) which also support the slat (1), on which a cutout (d) is made, on which the spherical head screw (9) slides, attached to the slat (1) with two screws (10) and two washers (11), the spherical head screw (9) which has the role of pressing pointwise on the slat (2), which will press by a second-degree lever effect in the ratio (x) = 2.5...5, the finer adjustments of the position of the slat (2) vertically, namely of the size (g), being made at the level of the hinge (8) fastening to the L1 profile (3) and the L1 profile (3) to the L2 profile (4), by means of the holes elongated (e) and (f), and the thruster system (B), together with the L3 profile (12), moves vertically through the miniature linear ball guide (14), the calibration system with weights (D) being connected to the L3 profile (12) by means of screws (13), and after calibration, the vacuum zone (v) is isolated from the external environment by means of the non-metallic ferrule connector (31), the lever system being characterized by the fact that by increasing the lever ratio (x) the relative error (ε_r) of the measurement performed will decrease proportionally, in the current invention, this being (ε_r) = 5...10% compared to 25% as it was initially.

Pictures & graphics

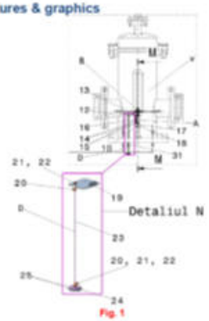


Fig. 1

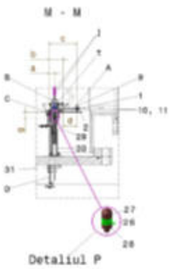


Fig. 2

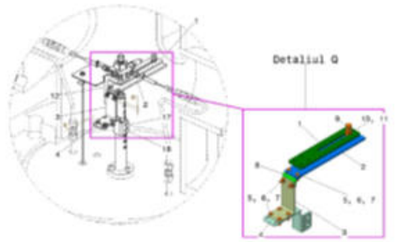
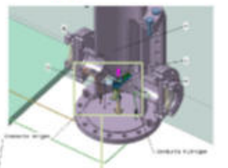


Fig. 3



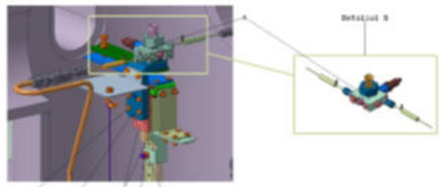


Fig. 5

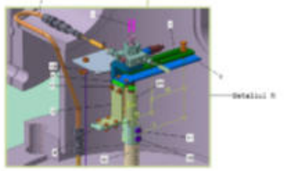


Fig. 4

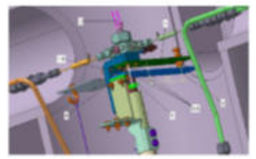


Fig. 6

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International Exhibition of Research, Innovations and Inventions

PRO INVENT the 22th edition

Cluj Napoca, Romania, 15 - 17 Oct 2025

Title: Universal Test Bench For Gas Turbine Engines

Patent Application: **RO 137713 A0**

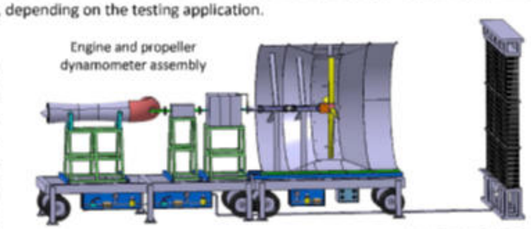
Code No: **A**

Author/s: Catană Răzvan Marius, Dediu Gabriel, Șerbescu Horațiu Mihai

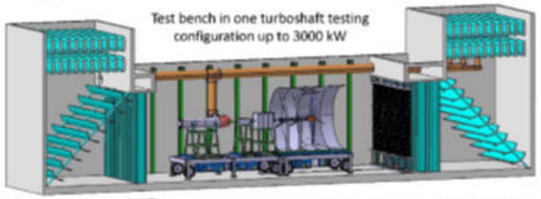
General description: The invention relates to a gas turbine test bench designed for testing various engine types, such as turboshaft and turboprop engines, with shaft power outputs of up to 3000 kW. The test bench uses an aerodynamic dynamometer, in the form of an aviation variable-pitch propeller. The technical solution allows for testing of experimental aviation propellers and turbojet engines without requiring structural modifications to the test bench only minor replacement of specific component assemblies, depending on the testing application.

Technical description: The universal test bench for gas turbine engine testing includes a test cell in which the engine is mounted on a mobile support assembly. Through a mechanical transmission system, the engine is connected to a dynamometer assembly that incorporates a variable-pitch propeller. The propeller dynamometer measures torque and shaft power during engine operation by adjusting the propeller's blade pitch via a hydraulic system. This system modifies the aerodynamic load on the propeller to achieve the required torque and rotational speed.

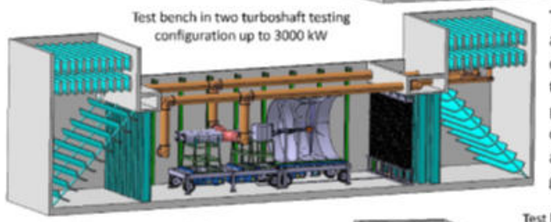
Engine and propeller dynamometer assembly



Test bench in one turboshaft testing configuration up to 3000 kW



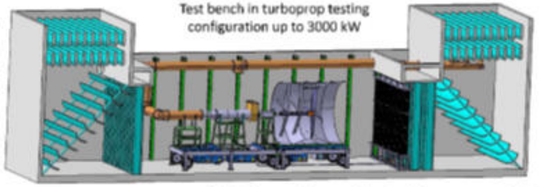
Test bench in two turboshaft testing configuration up to 3000 kW



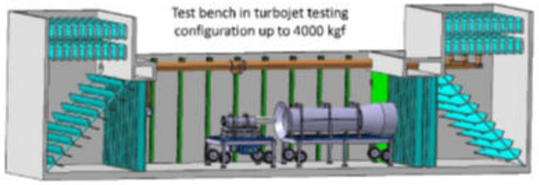
The variable pitch propeller is equipped with a duct section to increase efficiency and compensate for mechanical losses caused by the transmission system. The engine and propeller dynamometer features a dedicated oil supply and cooling system, which includes a heat exchanger cooled by the airflow generated by the propeller.

Particularities: 1. Capability to test two turboshaft engines simultaneously, as in a helicopter installation configuration. 2. Specific configuration of the variable pitch propeller by installing different blade geometries and varying the number of blades 3. Specific instrumentation for calculating the propeller performances based on measured parameters.

Test bench in turboprop testing configuration up to 3000 kW



Test bench in turbojet testing configuration up to 4000 kgf



4. Testing engines with a turbine power shaft located at the front or rear. 5. A more accessible alternative due to the low cost of execution, acquisition, and maintenance compared to hydraulic and electric dynamometers, especially considering the specific configuration of torque and speed operating limits, which depend on the engine power or thrust class

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The 22th International Exhibition of Inventions

"PRO INVENT 2025" Cluj Napoca, Romania

15-17 October 2025

Title: Aircraft Engine With Mixed Combustion

Patent Application: **RO 138385 A0**

Author/s: Panaitescu Costin, Secăreanu Rareș - Andrei, Burcioiu Ionuț - Răducu

General description: The invention relates to the construction of an aircraft engine with mixed combustion, equipped with a propeller reinforced with an aerodynamically designed ring, allowing the blades to rotate at their extremities at relative supersonic speeds. The engine features a three-stage compressor, consisting of one low-pressure stage and two high-pressure stages operating at different rotational speeds.

Technical description: A mixed-combustion engine characterized by the fact that it is made up of subassembly (A) of the engine's resistance body, consisting of the cylinder head (21), the crankcase (19) equipped with air intake slots (22) from the cooling cavity (23) of the cylinders (6) through the fixing diffuser (24) and for the operation of the starter unit compressor (25) APU, joined by three rods (26) arranged at 120 degrees and fixed to the cylinder head (21), the upper resistance body (27), and the lower resistance body (28) through bolts (29). Subassembly (B) consists of the compressor together with the reinforced composite propeller (2) designed to operate at high speeds, with blades profiled for supersonic speeds. It is made up of the air intake body (48), which directs air from the propeller (2) along the blades of the first stage (49) of the low-pressure compressor (8), which is mounted on the shaft (50) along with the propeller (2) and coupled through the satellites (51) of the reducer (52), which reduces the speed of the intermediate shaft (53) of the Z-shaped crankshaft (54) by a factor of three. It also includes the blades of the two stages (55) of the high-pressure compressor (9), which is driven in rotation via the intermediary (56) of the Z-shaped crankshaft (54) and through the articulated end of the shaft (57) in the bushing (58), which is integrated with one of the two geared wheels (59) meshed with the fixed gear wheel (60), ensuring the locking of the oscillating platform (61).

Subassembly (C) consists of the starting system, engine operation, and external combustion initiation. It includes the APU unit for starting the two-stroke engine, the intake ramp (67) for the air-fuel mixture from the APU, controlled by valve (69), which is open only during engine start-up. Valve (72) allows air from the high-pressure compressor (9) to enter the ramp (67) after engine start-up, while the fuel for mixture formation is distributed from the injection pump (39) through valve (74) to the engine combustion chamber and to the injectors (13) of the external combustion chamber (12) or separately to one of them.

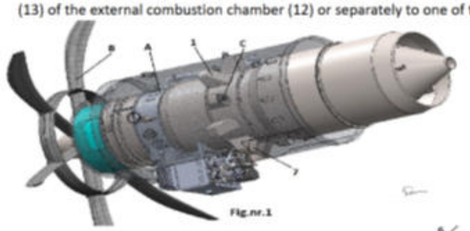
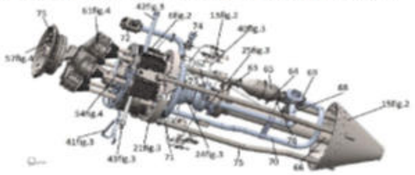


Fig.nr.1



Particularities:

1. The aircraft engine with mixed combustion, according to the invention, provides constructive solutions for stable flight at low speeds, enabling short takeoff distances and achieving an hourly fuel consumption that is 2.32 times lower than that of an equivalent thrust turbojet engine with afterburning.

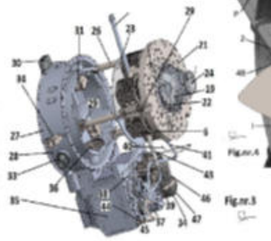


Fig.nr.3

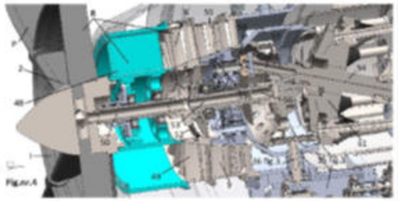


Fig.nr.4

Advantages: By design concept and technical solution of the invention it results certain main advantages such:

1. The takeoff distance of an aircraft equipped with the mixed-combustion engine is shortened by utilizing external combustion and increased thrust, achieved through the high maximum rotation speed of the propeller. The propeller is reinforced with an aerodynamically designed ring, allowing the blades to rotate at their extremities at relative supersonic speeds.
2. Significantly lower fuel consumption compared to an equivalent afterburning turbojet engine.

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