UNIT TO SIMULATE ATMOSPHERIC CONDITIONS BY INDEPENDENTLY CONTROLLING PRESSURE AND TEMPERATURE IN THE INTAKE AND EXHAUST OF RECIPROCATING INTERNAL COMBUSTION ENGINES

DESCRIPTION OF THE INVENTION

The test and characterization of reciprocating internal combustion engines often require the precise control of the pressure of the aspirated air, in both the intake and the exhaust of the engine, and/or the intake temperature. This occurs in the case of tests of the calibration of the engine control with the altitude, studies on cold starting, repetitiveness of reference conditions in long-term test campaigns, etc. The most common problem is to obtain control over the pressure in order this is below the atmospheric pressure with regulation over the temperature between 40ºC and -30ºC, but sometimes is necessary to increase the ambient pressure in order to reproduce the pressure conditions of the atmosphere at sea level. This is the case of rehearsal rooms geographically located at a high altitude.

The unit designed by the CMT-Motores Térmicos institute allows researchers to reproduce, with a low energy cost, the pressure conditions of the air aspirated by a reciprocating engine depending on the height above sea level. This pressure often refers to the standard atmosphere established by the ISA (ICAO Document 7488/2). The unit is able to maintain the pressure at a constant value, identical in both the intake and the exhaust of the engine. At the same time, it is able to regulate the intake temperature within the range of interest during the testing of the reciprocating internal combustion engines, whether the temperature is higher or lower than that established by the ISA according to the altitude.

Moreover, thanks to its reversible functioning, the unit can reproduce overpressure conditions with regard to the atmospheric pressure at a low energy cost. This capacity is necessary in order to simulate the atmosphere at sea level in engines located in systems at geographically high levels. It also simulates the working environment of engines that work in mines located below sea level.

Moreover, it can uncouple the temperature conditions that it is able to generate in the intake air due to the pressure that could be required. On the one hand, it is possible to increase the temperature with regard to the on-site ambient temperature; to do so, a regenerator uses the energy of the exhaust gas. On the other hand, the temperature can be reduced with regard to the on-site ambient temperature through the combination of a polytropic expanding process (with an isentropic capacity of between 40% and 80%) with a cooling process close to isobaric conditions.

For the test, the unit designed from the CMT-Motores Térmicos institute is connected to the intake and the exhaust of the engine tested, so it works between the ambient atmosphere conditions of the test room and the alternative engine that is going to be tested in that room.

In addition to connecting to an engine for its experimental characterization, the system could also be connected to the input or output of any isolated part of the engine, which interacts with the atmospheric flow, and whose fluid dynamic behaviour we wish to characterize, such as air filters, mufflers, items for cleaning exhaust gases (aftertreatment), etc.

APPLICATIONS

The system has applications in test rooms of manufacturing centres or reciprocating internal combustion engine developing centres. It is designed to simulate in these rooms the operating conditions of the engine when it is working at different levels, whether higher or lower than the room.

TECHNICAL ADVANTAGES AND INDUSTRIAL BENEFITS

Today, there are no units on the market with the features that the system designed by the researchers of the CMT-Motores Térmicos of the Universitat Politècnica de València has. For land vehicle engines that drive at high altitudes, the existing units separate the cooling processes from the vacuum generation processes, which make them much more expensive. For that reason, main advantages are:

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- Low price of its components regarding to the alternative technologies used in the automobile industry, which entails the construction of expensive altimetric rooms.
- Small-sized components, which makes it a compact and portable unit that can be moved between the different rehearsal rooms of a technical centre.
- Low energy cost during the operation. The energy consumption for operating this system (with all of its features) is much lower than the standard technologies used for the same purpose.
- Flexibility in the system configuration. According to the different configurations suggested in the patent, the installation can be easily reconfigured depending on the preferences or the necessities of each user.
- It allows the researcher to analyse the global functioning of the engines or the functioning of certain components, such as the air filter, the turbine-generator set or the exhaust gas aftertreatment systems.

STATE OF DEVELOPMENT

The research group has built a prototype whose proper functioning has been proven through various tests.

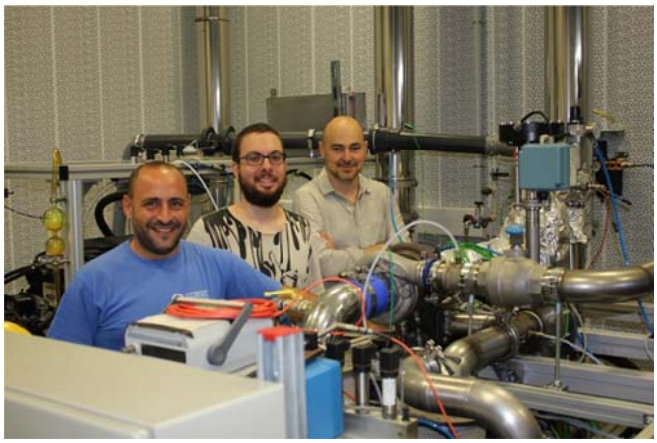
IP

On January 24, 2014, the Universitat Politècnica de València requested patent protection at the Spanish Patent and Trademark Office, with the reference P201430071.

DESIRED COOPERATION

The UPV is searching for companies interested in establishing arrangements to licence the patent and commercialize the system

RELATED PICTURES



Picture 1: Researchers of the CMT at the UPV beside the prototype

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