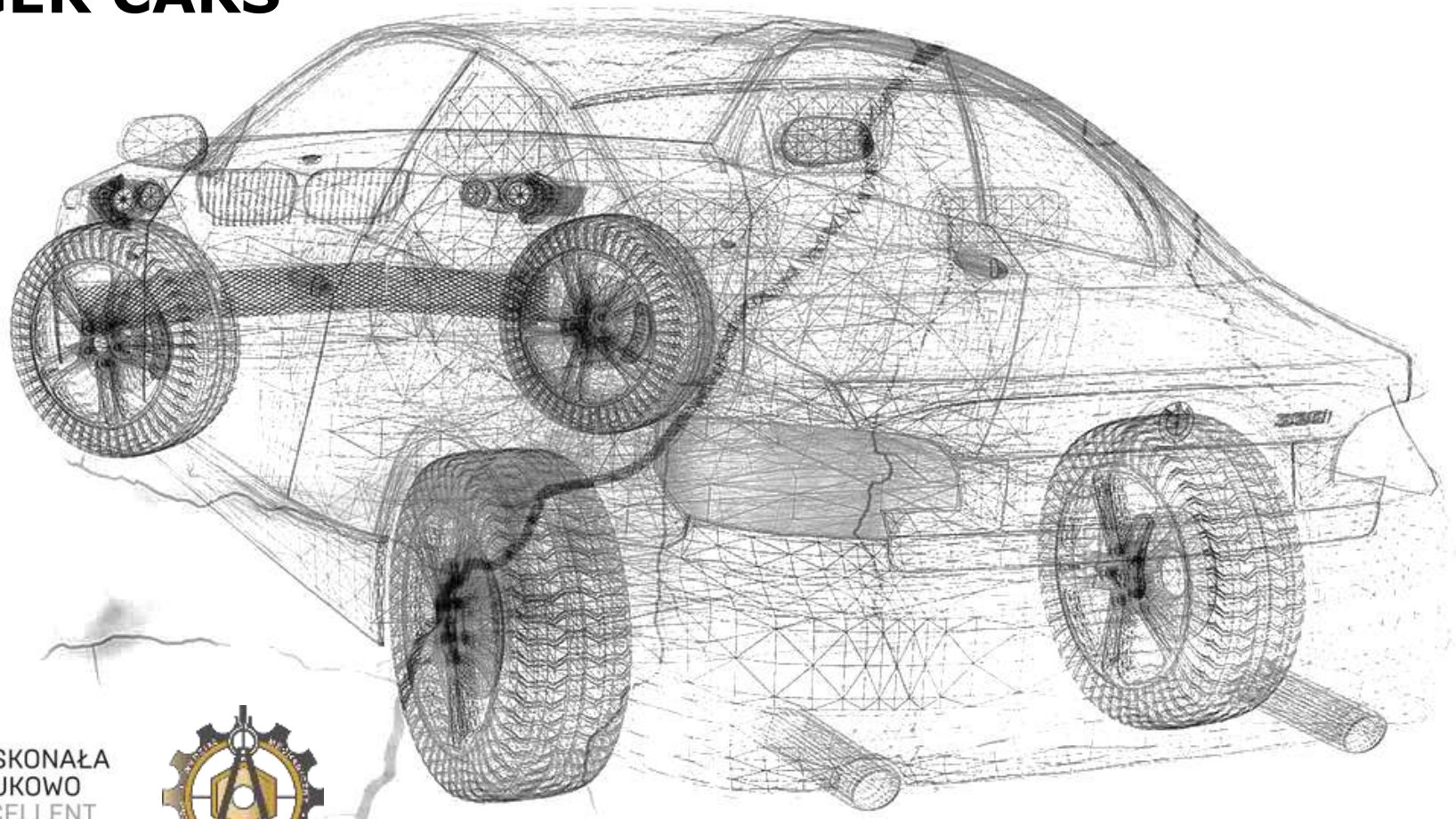
THERMAL ENERGY RECOVERY AND STORAGE SYSTEM FOR PASSENGER CARS

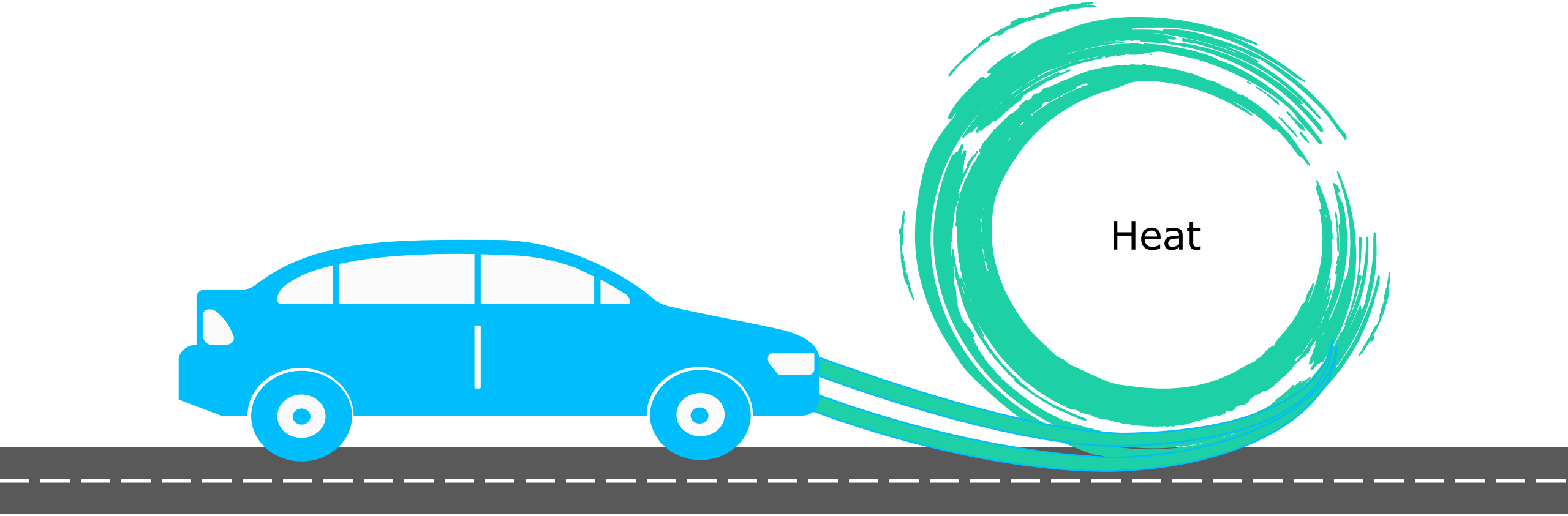


POLITECHNIKA LUBELSKA
LUBLIN UNIVERSITY OF TECHNOLOGY

DOSKONAŁA NAUKOWO
EXCELLENT IN SCIENCE

Invention Aim

Storage and reuse of heat from the engine cooling system



Concept

Heat storage

Use of phase transformation for heat storage

Przekazanie ciepła

Heat transfer from the system to the heat accumulator

Heat recovery

Heat release during crystallization of salt hydrate

Melting

Crystallization

Heat recovery

Odzyskanie ciepła z układu chłodzenia silnika

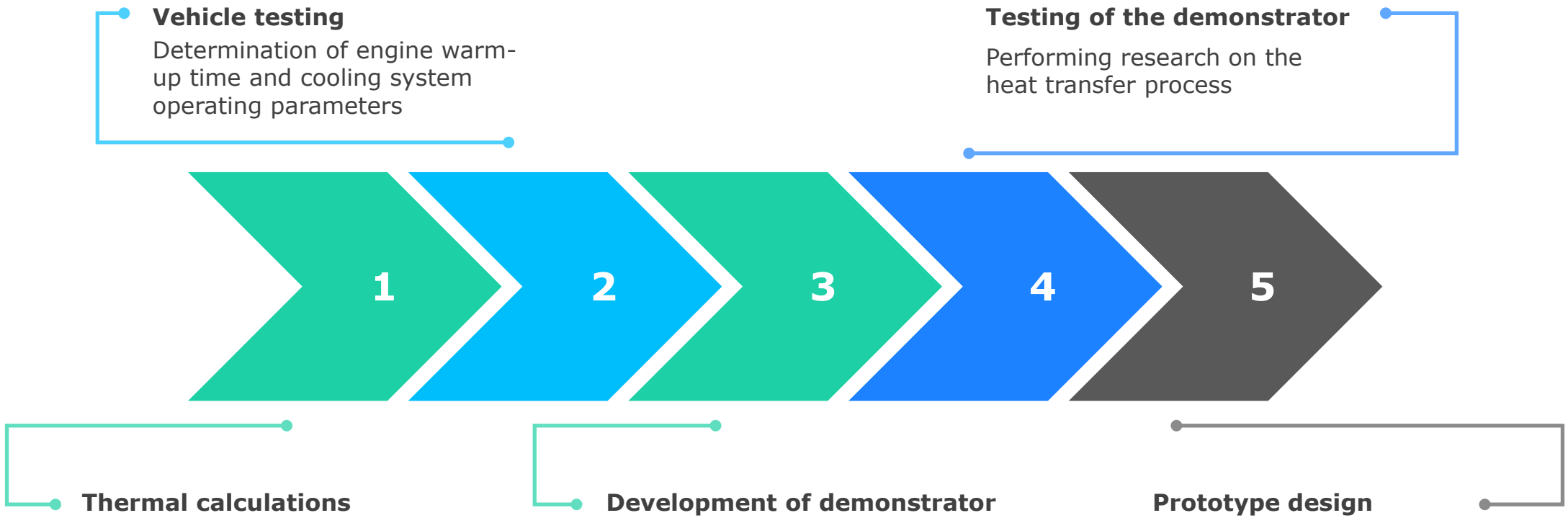
Combustion engine LPG supply

Skrócenie czasu pracy silnika zasilanego benzyną podczas procesu rozgrzewania

Heat transfer from the cooling system

Heat transfer from the accumulator to the LPG pressure regulator

Completed work



1 Thermal calculations

Define the type, amount of heat storage material and develop functional assumptions of the system

2 Vehicle testing

Determination of engine warm-up time and cooling system operating parameters

3 Development of demonstrator and measurement system

Build a thermal accumulator demonstrator and measurement system to determine the amount of stored heat

4 Testing of the demonstrator

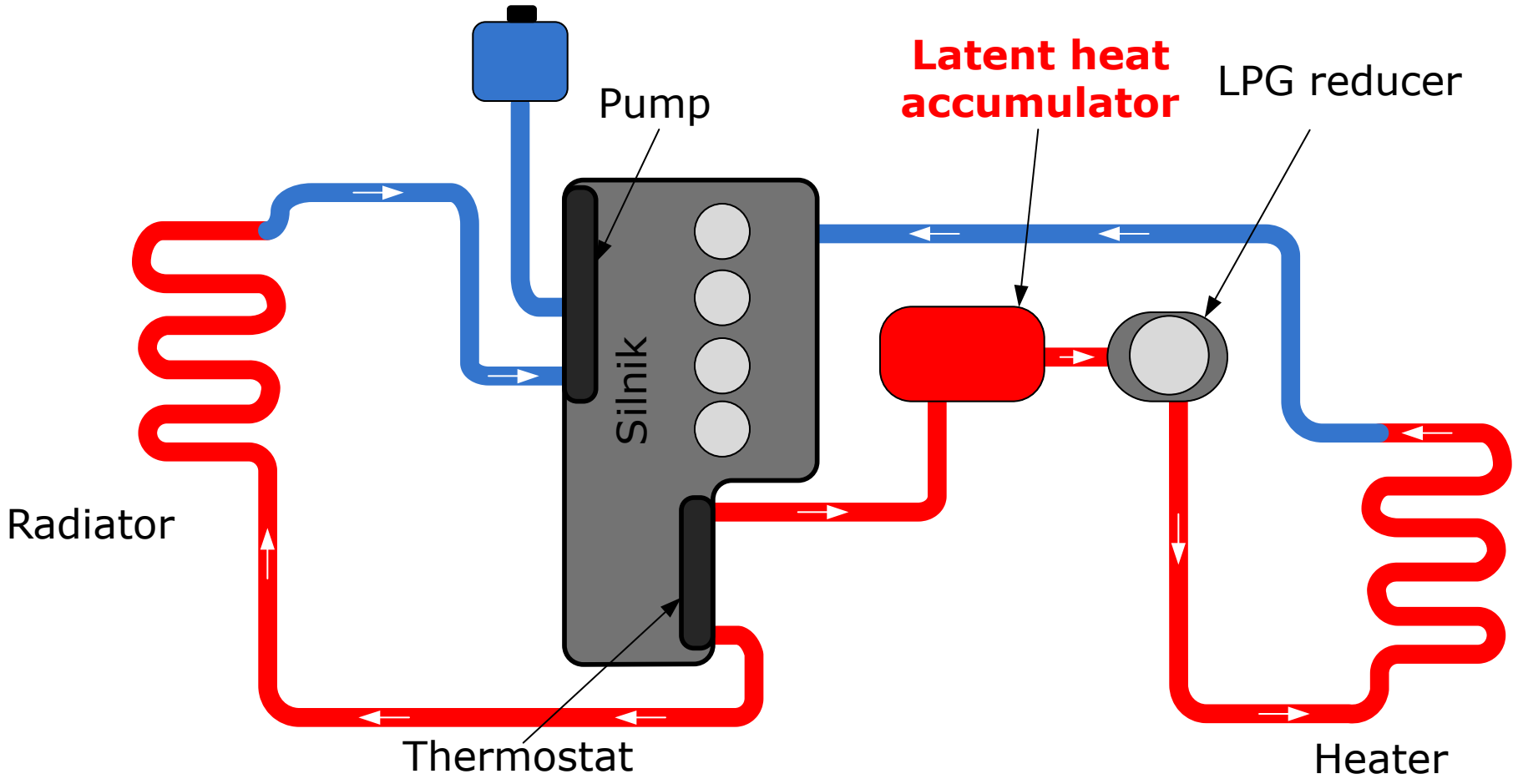
Performing research on the heat transfer process

5 Prototype design development

Development of a CAD model of a prototype heat store

1

Demonstrator - system diagram



1

Thermal calculations

Assumptions

Sodium acetate hydrad

Heat of phase transformation 264 kJ/kg

Transformation temperature 58 ºC

Density 1.53 kg/dm3

Specific heat 2.5 kJ/kgK

Mass 3 kg

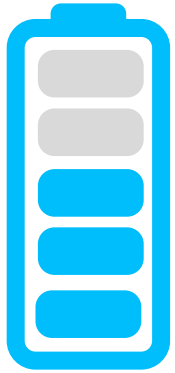
Heat required to heat up LPG and heat up liquids792 kJ

Accumulated heat

792 kJ

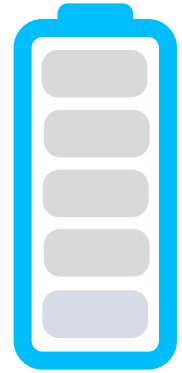
Heat required to heat the reducer and the water in the reducer

187 kJ



Heat required to vaporize LPG fuel

200 kJ



Heat required to heat LPG and PCM material and 10% losses

405 kJ

3 kg WILL HEAT THE LPG REDUCTOR AND COVER A DISTANCE OF 5 KM

2

Vehicle test - test stand

Engine warm-up time

Texa OBDLog

Tests of engine coolant temperature with a device that allows recording of parameters from the OBD II diagnostic system

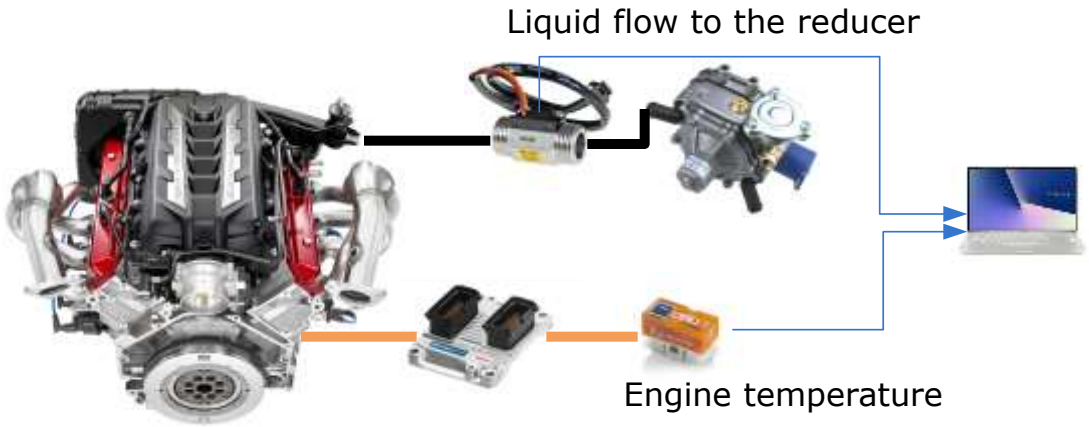
Ford Mondeo MK 4

Equipped with Stag Drag 300 Premium LPG fuel system

Coolant flow rate

NI card, LabView, flow meter

Studies of the mass flow rate of the coolant in the heating circuit of the LPG pressure regulator



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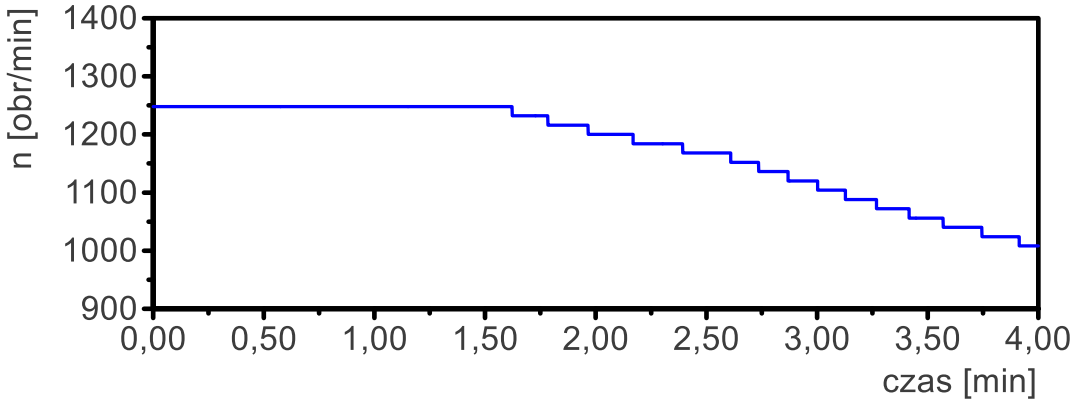
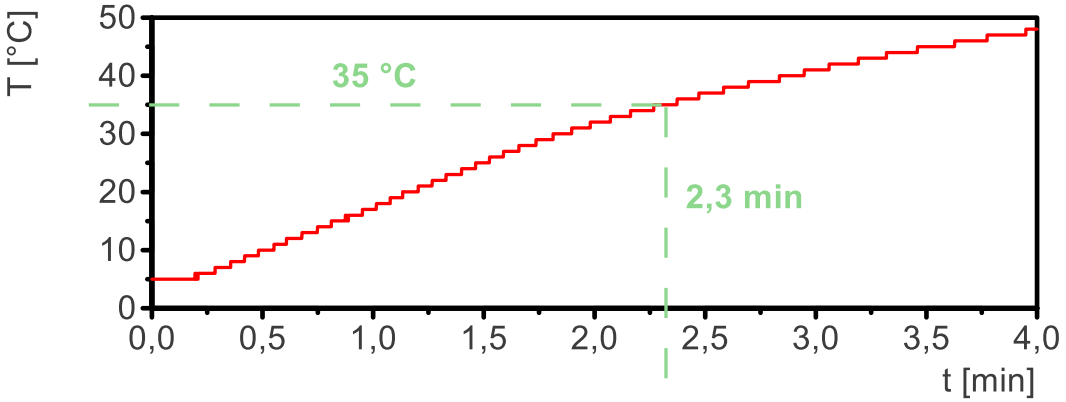
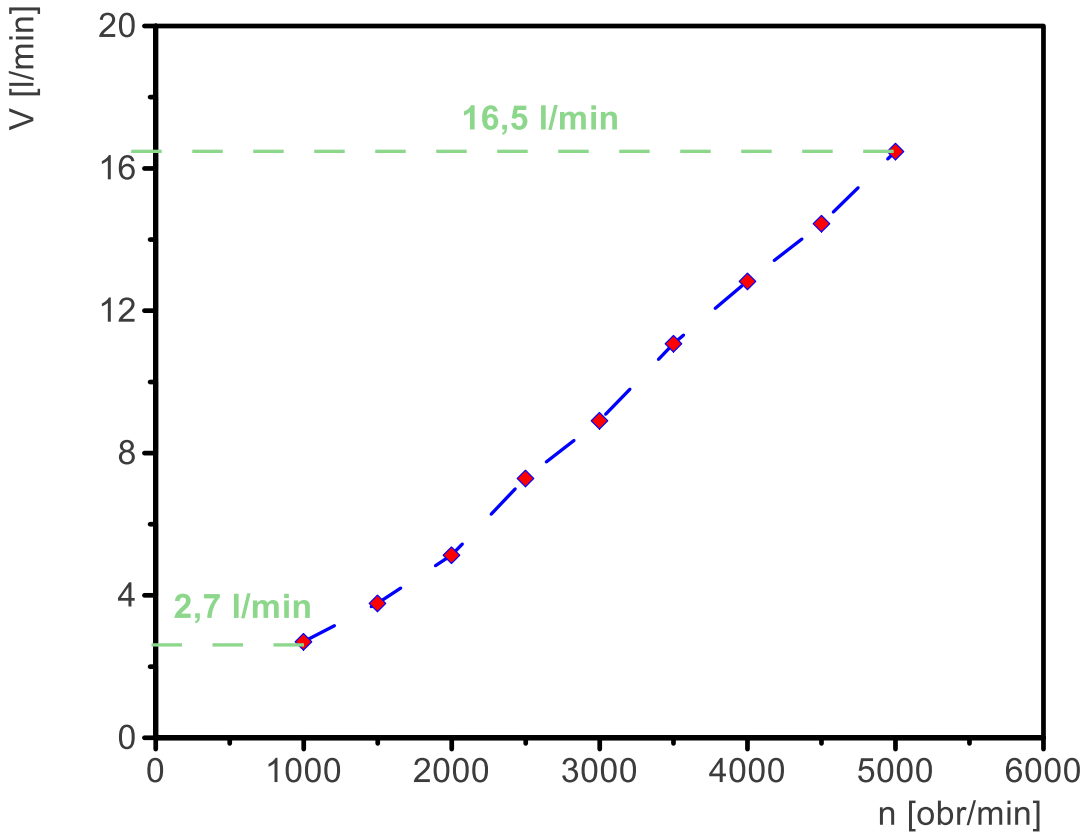
Vehicle test results

Engine warm-up time

Coolant flow rate







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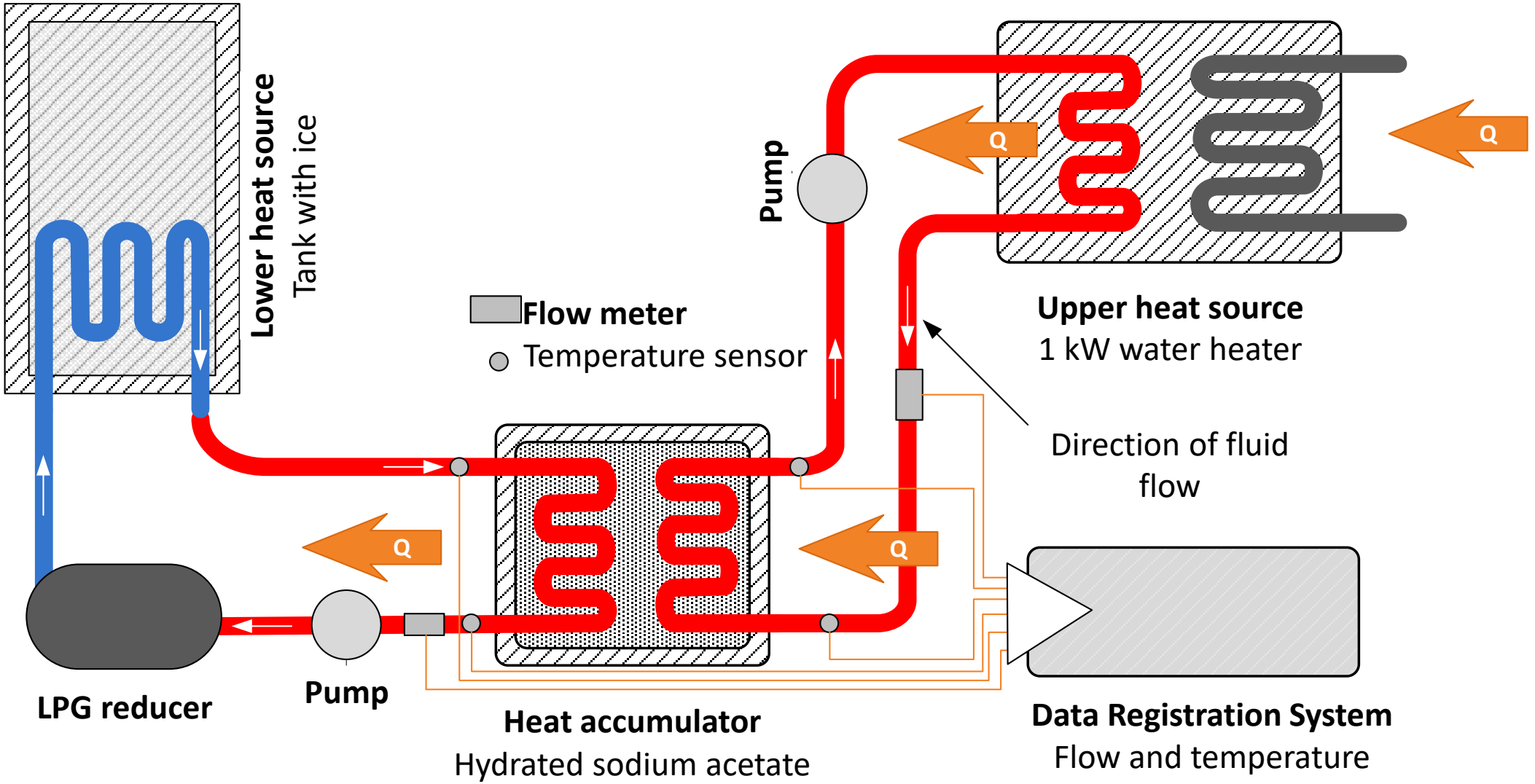
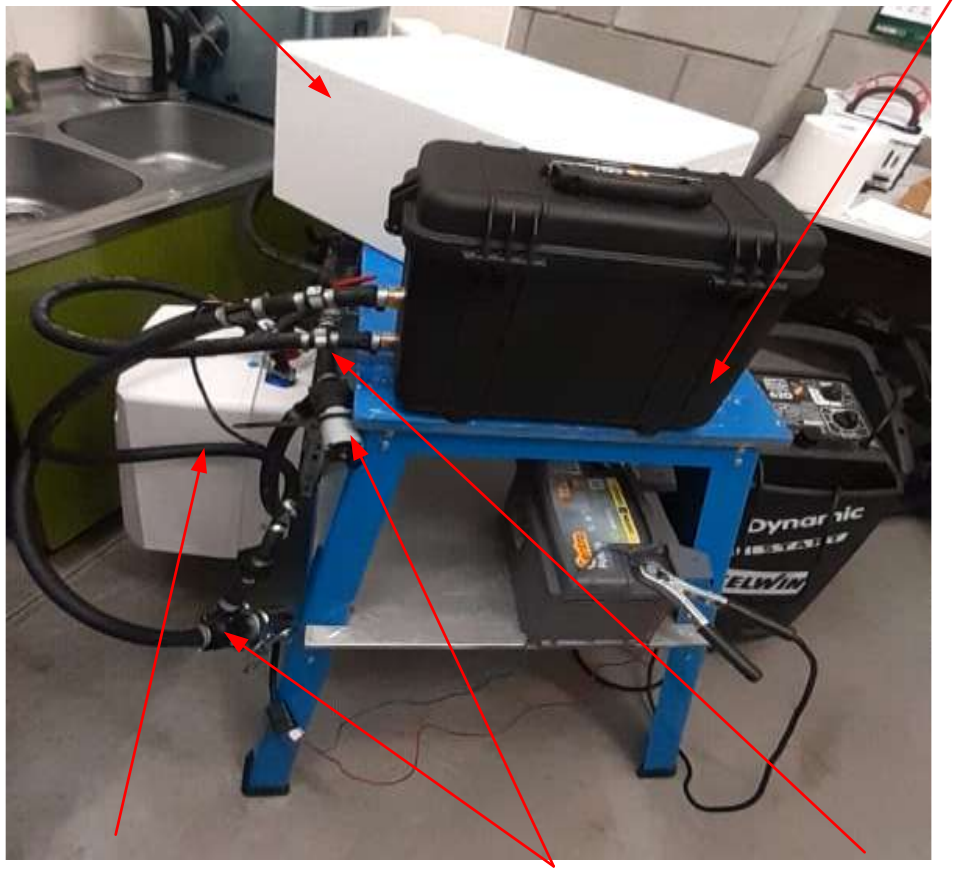
Demonstrator - schematic of the stand

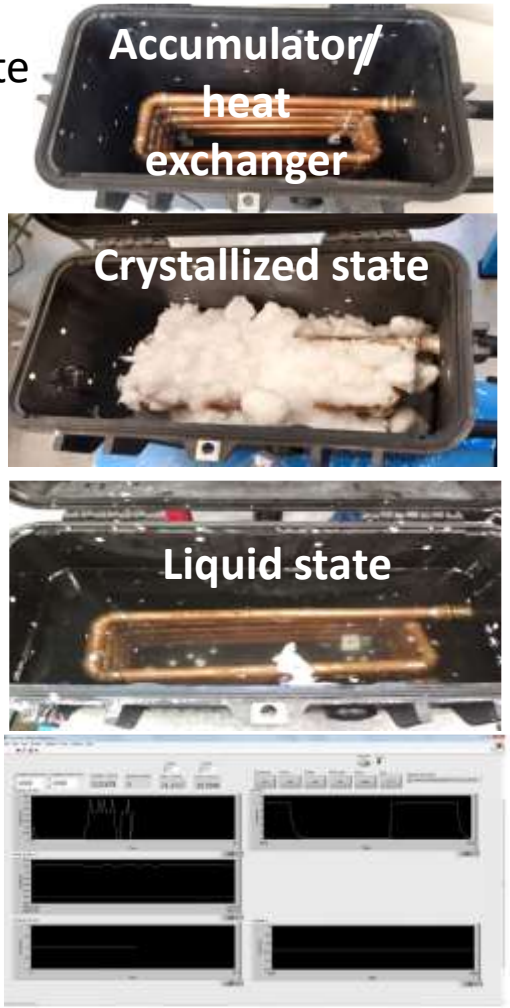


Demonstrator - research results

Lower heat source
Tank with ice

Heat accumulator
Hydrated sodium acetate





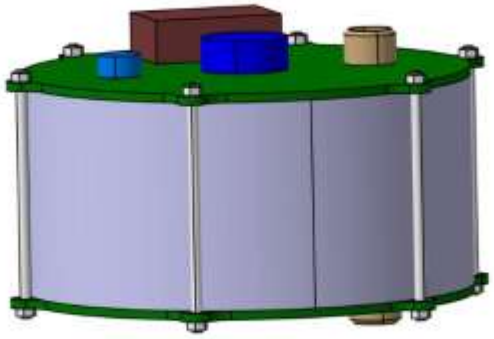
Upper heat source
1kW water heater

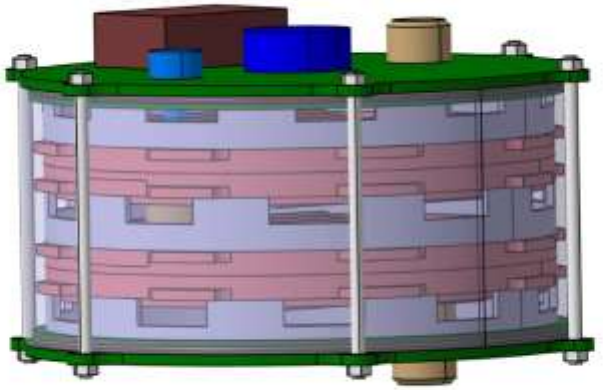
Circulation pumps

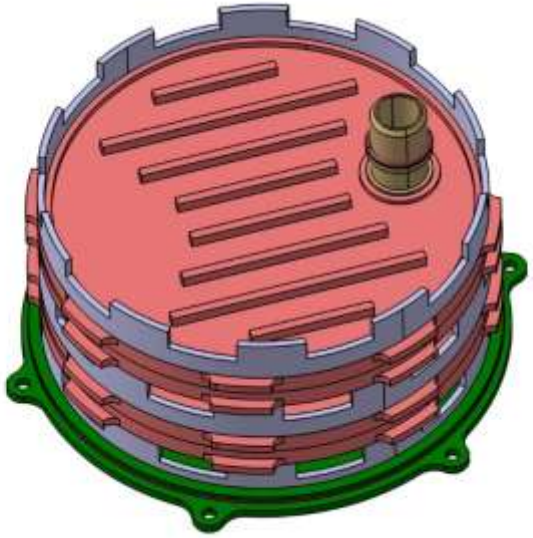
Sensors
Flow meters and temperature sensors

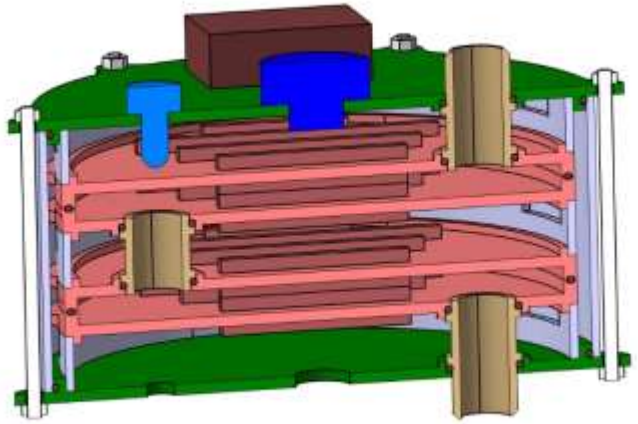
LabView

Accumulator prototype design









Trigger for crystallization prototype design

Claimed invention P. 243357 „Trigger for crystallization of latent heat accumulator, especially used for the LPG gas vaporizer heater”

1 – actuator

1.1 - solenoid coil

1.2 – pusher

2 - conical element

3 – chamber

3.1 – base

3.2 - conical wall

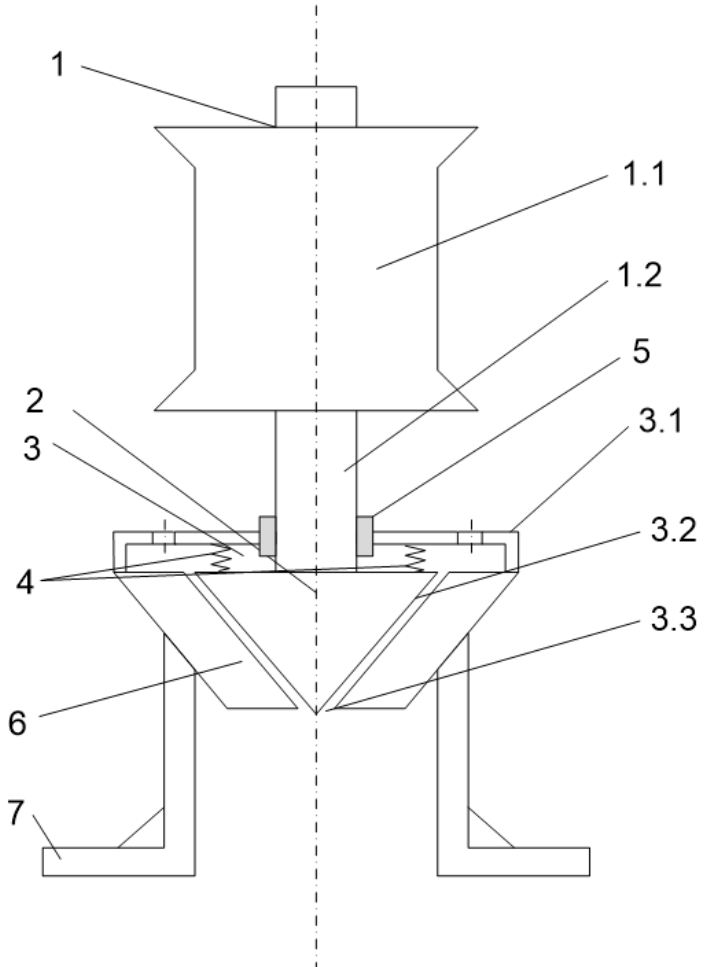
3.3 - outlet hole

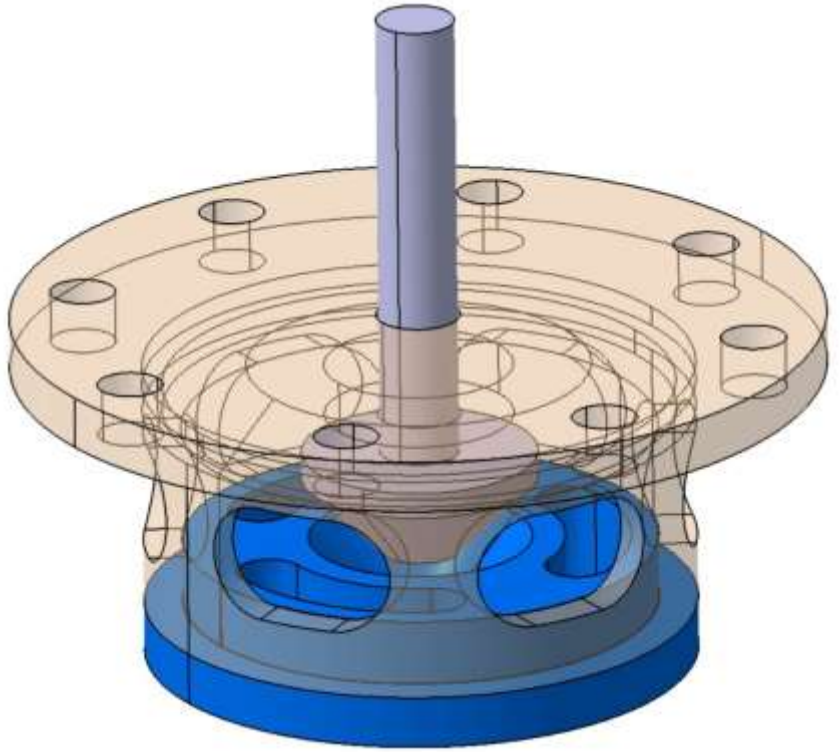
4 - spring elements

5 – seal

6 - conical outer body

7 - elements fastening the trigger to the wall of the heat accumulator





Thank you for your attention

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