MECHANICAL ENGENEERING DEGREE

FINAL DEGREE PROJECT

DESIGN OF AUTOMOBILE GEARBOX

SUMMARY

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SUMMARY

1. PURPOSE OF THE PROJECT

The aim of the following project is to develop the mechanical calculation and design of the elements that make up the gearbox of a car. To this end, the other elements that make up the transmission of the vehicle will be studied.

Precisely, the gearbox will be designed for the SEAT León 1.6 TDI 85kW (115 CV) car model, which has a maximum power engine of 115 CV and maximum torque of 250 Nm.
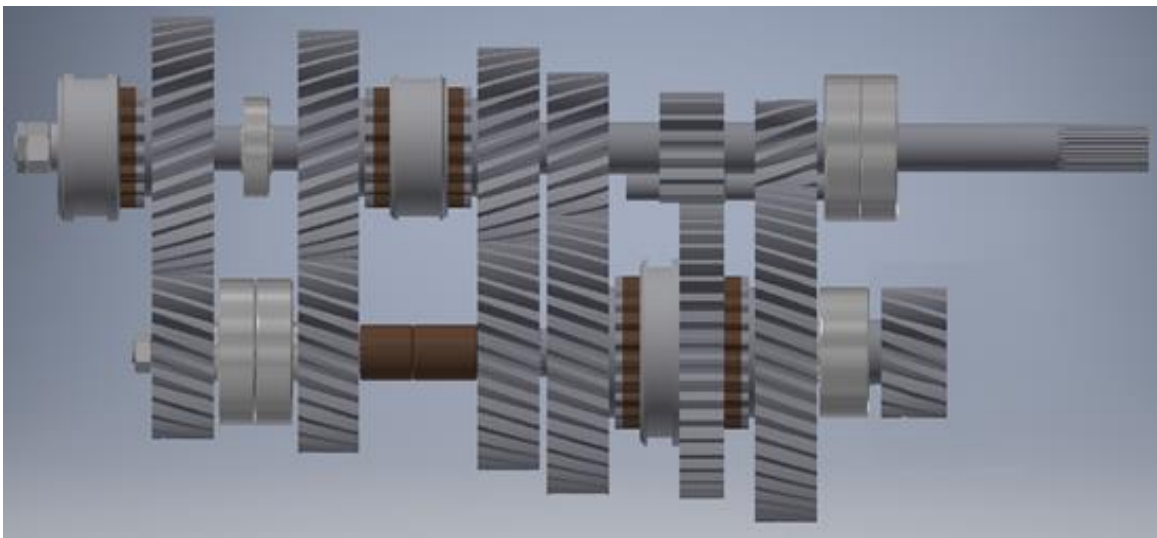
Picture 1.Gearbox.

Project's author: Lertxundi Saez, Eneko.

2. INITIAL DATA

In order to calculate the elements that make up the gearbox, it is necessary to know the characteristics of the engine, the technical characteristics of the vehicle and its main dimensions, because the design will depend on these initial data.

As mentioned above, the vehicle is a SEAT León 1.6 TDI and its main characteristics are the following ones:

Characteristics of the engine	
Cylinders / Valves	4 / 16
Cubic capacity	1598 cm^3
Fuel type	Diesel
Maximum power kW (CV) / rpm	85 (115) / 3250-4000
Maximum torque Nm / rpm	250 / 1500-3250 rpm (2375rpm)
Position	Front, transversally mounted
Characteristics of the vehicle	
Maximum speed	197 km/h
Acceleration 0 - 100 km/h (s)	9,8 s
Weight	1260 kg
Maximum mass	1810 kg
Wheel type	205/55 R16 91V
Characteristics of the transmission	
Drive type	Front-wheel drive
Gearbox	Manual, 5 speed
Transmission ratios	
1st speed	3,778:1
2nd speed	1,944:1
3rd speed	1,185:1
4th speed	0,816:1
5th speed	0,625:1
Reverse speed	3,6:1
Final reduction	3,647:1

1st Table.Technical Characteristics of the transmission.

The graph above shows the power and torque curves of the vehicle's engine.
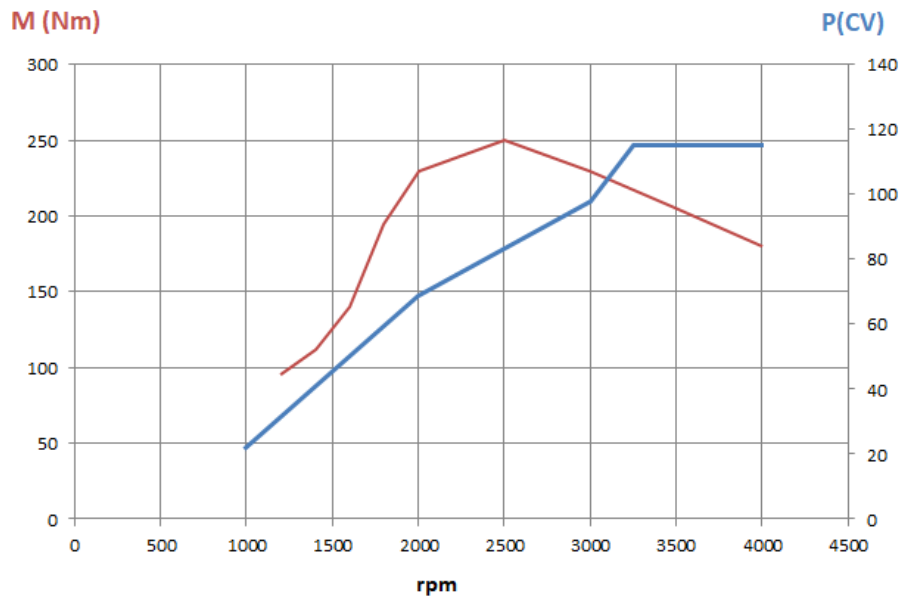
Picture 2.Power and torque graph.
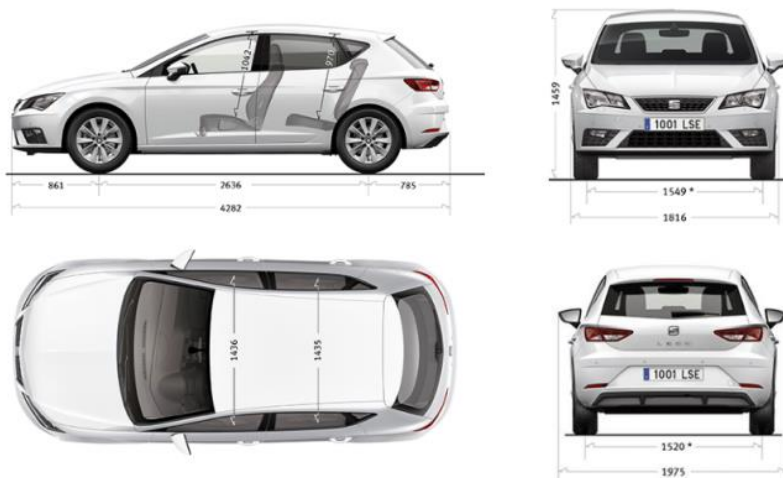
Picture 3.Car's dimensions.

3. CALCULATIONS

To design the gearbox, the following calculations have been performed:

▪ **Calculation of the resisting forces**: by means of this, the forces that oppose the movement of the vehicle have been calculated. These forces generate a resistant torque in the wheels and the gearbox will have to generate a greater torque to move the car. There are four types of resistant forces:
- Rolling resistance
- Slope resistance
- Inertia resistance
- Aerodynamic resistance

▪ **Clutch calculation**: in this section, the dimensions of the friction clutch required to transmit the power from the engine to the gearbox have been calculated. In addition, the dimensions of the rib that connects the clutch disc to the primary shaft have also been calculated.

▪ **Gearbox calculation**: once the input and output conditions of the gearbox are known, all components have been calculated.

First, taking into account the resisting forces and gear ratios specified by the vehicle manufacturer, it has been verified that the car is capable of overcoming these forces, and then, the number of teeth and the dimensions of all gears have been calculated.

After that, the contact forces between gears have been calculated and by means of these, the primary shaft, the secondary shaft and the reversing shaft have been dimensioned.

Finally, taking into account the reactions of the supports of each axle, the appropriate bearings have been chosen from the SKF manufacturer's catalogue, and after that, the dimensions of the elements of each synchronizer have been calculated, which will be necessary for changing speeds.

4. DRAWINGS

After having dimensioned all the elements of the gearbox by calculation, they have been modelled using the computer software Autodesk Inventor. Subsequently, the standardised drawings of the assembly and of each component have been drawn up.

The dimensional and geometrical characteristics of each component have been mentioned in the plans. In this way, all the necessary information for the manufacturing of the gearbox has been specified.
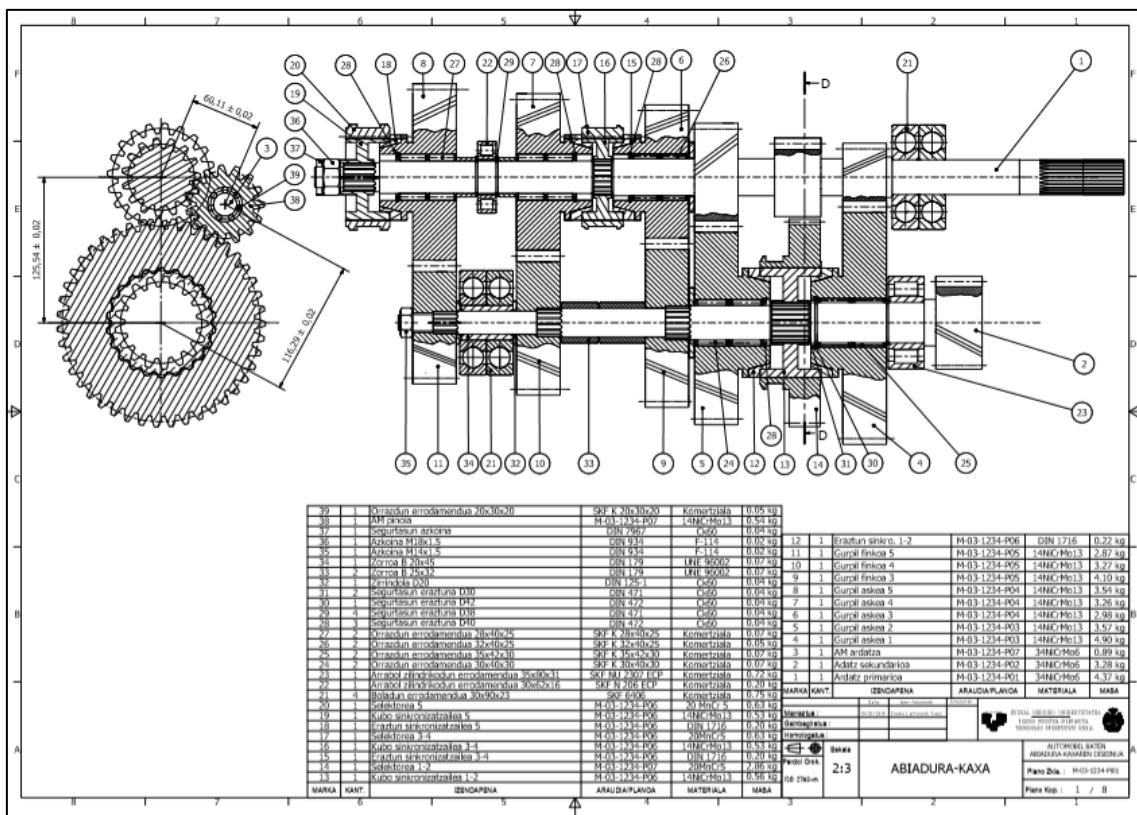
Picture 4.Drawing of the assembly.

5. BUDGET

In the sixth document that forms part of the project, the price of each component and the price of all the factors necessary to carry out the project have been indicated. In this way, the manufacturing price of the gearbox has been calculated. The total budget of the product is the following:

Execution budget .... 4726,71 €

Remuneration .... 1134,41€

TOTAL BUDGET:..**5861,12 €**

The cost of the total budget is: FIVE THOUSAND EIGHT HUNDRED AND SIXTY-ONE EUROS AND TWELVE CENTS.

6. BIBLIOGRAPHY

Books

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Catalogues

- SACHS
- SKF
- ThyssenKrupp
- Beneri

Websites

- www.skf.com
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