

Which gears for electric vehicles?

G The current geo-political scenarios affecting the entire world, even if in a different manner, are increasingly placing some important issues in the spotlight, amongst which and by no means a secondary issue, the increased energy prices and the difficulty to retrieve raw materials. At the moment of writing this article, the levels reached up to date do not seem, however, to challenge the future of electric mobility, even if the entire supply chain rightly shows all its worries and some criticalities. In addition, the companies doing business in gear manufacturing are also part of this supply chain, and are requested to meet the new needs of electric mobility. Which are the new trends in place in this respect? What do the manufacturing realities doing business in this sector think from their privileged point of view? We have asked this to some of them, focusing our attention on some aspects, amongst which, for instance, the NVH behaviour, one of the strictest requirements for electric vehicle transmissions. Another issue under reflection has been power skiving, gearing technology, as well as food for thought. The opinion given on the possible consequences arising out of the lower sprockets needed by an electric vehicle compared to that needed by an endothermal engine vehicle is not less important and, last but by no means least, a remark on the possible future scenarios for the Italian gear industry, in the short and medium terms.¹⁾

¹⁾ Please note that the declarations made by some companies we have interviewed took place prior to the outbreak of the war in Ukraine. (Editor's Note)

- 1.** The NVH (Noise Vibration Harshness) behaviour is one of the strictest requirements for the transmission of electric vehicles. Based on your experience, what are the consequences on the features required for gear surface, as well as on tolerance requirements in general? Consequently, what is the impact on the skiving processes?
- 2.** As regards gear processes, power skiving is increasingly catching on. In particular, the geometric features of some gears typically used in the transmission of electric vehicles are well suited for manufacturing with this technology. What's your opinion? Have you got a significant case to speak about?
- 3.** It is clear that the number of sprockets that are needed in an electric vehicle are significantly lower compared to (Internal Combustion Engine) vehicles. Which is your forecast as to the economic consequences of this trend.
- 4.** The Italian gear industry seems to have recovered in the best possible way from the crisis caused by the pandemic. What do you think? Which is your forecast for the next months and years?

Cattini e Figlio A new life to gears

1. The by now established trend for electric vehicles – as stated by Lorenzo Cattini, managing director and CEO of Cattini e Figlio – is that of developing gears with high levels of quality already from the components' design phase. Indeed, with the lack of an endo-thermal engine noise filter, each source of noise is immediately obvious, at least up to the speed at which the aerodynamic and rolling noise prevail over the mechanical components. In short, the gears will be less in number but will increase in quality, also since specific gear corrections will have to be studied and carried out, we are speaking about micro-geometry of the gearing, which are not within the reach of all companies. It will thus be necessary to achieve the greatest possible integration between who designs the transmission and who will have to make it happen, in order to develop specific techniques which may then be kept throughout the framework of the series production.

2. Cattini e Figlio uses the new power skiving generation, mainly for the manufacturing of internal epicycloid gears. «After a very first experience developed in the second half of the eighties – as recalled by Lorenzo Cattini – at a time at which we spoke about 'peeling' of the component, our company has waited until such technology developed properly, both at the level of machines and of tools, before using it again. It is clear that power skiving, with its possibility to make both external and internal gears, is one of the most interesting methods for the next venture, even for the making of gears aimed at transmission for electric vehicles. However, also this solution shows some limits which, in our case, are basically shown by the minimum distance between two gears placed side by side, that is stepped gears and, thus, by the crossing angle of the axes, which allows sufficient removal of material. This is an unavoidable limit and it must be considered with the greatest attention during the design phase. Even the possibility to carry out the so-called hard skiving of such half-blind gears is, in theory, very interesting. Clearly, the rigidity of the manufacturing platform and the quality of the tools used will play an important role». The alternative to skiving for stepped gears, which has already been experimented by Cattini

e Figlio for a long time, is that of making the gears separately and of joining them with cutting-edge welding technology, that is vacuum made electron beam. «In this case – Lorenzo Cattini adds – quality is of the highest level since both gears are rectified but costs are higher. This is a solution adopted more for professional vehicles than for automotive applications, where price is the most important priority».

3. As regards gear reduction for application on electric vehicles, Cattini e Figlio forecasts a reduction in quantitative terms of at least 50%. «Mechanics, then – Lorenzo Cattini explains – will turn out strongly scaled from the comparison with the electric world, but it will carry on living a new life, for sure, of high quality».

4. The Italian gear sector – Lorenzo Cattini concludes – has represented for a long time an important presence in the world. In Assiot, this concept is understood well and we are committing to corroborate it, by being convinced about the fact that it is only possible to win in the future together, only by creating a system and by globally promoting the professional competence of our companies. As regards the forecast the current chaotic situation in terms of energy costs, steel availability and, unfortunately, the war between Russia and Ukraine, we are not in a position to put forward reliable scenarios in the medium term. Unfortunately, we are playing it by ear and this is not a way of working that resonates with us. We hope that the conflicts in place will end as soon as possible: we can only actually build something positive in times of peace.

