


MEETINGS



“PEDETEMPTIM
SED INCESSANTER”.
THIS IS THE SAYING
ON WHICH THE
HISTORY OF
CATTINI E FIGLIO IS
GROUNDED, A GEAR
MANUFACTURER ALWAYS
AT THE SAME PACE AS
THAT OF NEW MARKET
DYNAMICS

Step by step
without ever stopping

ORGANI DI TRASMISSIONE



Cattini e Figlio was founded after the Second World War by Pierino Cattini who, during the years of the conflict, had developed significant experience in the field of gears for military vehicles. The initial production focused on cylindrical gears and, at the beginning of the 60's, the company started to supply national manufacturers of agricultural tractors; the product line expansion towards bevel gears dates back to the mid 60's. In the following years, the company evolved by meeting increasing market needs and requests for quality, thus enhancing its own skills and capabilities of managing increasingly complex applications. The manufacturing of planetary gearbox ring gears started back in the 70's, whilst the manufacturing of manual gear components started in the 90's, based on studies carried out in the 80's. It is in the new millennium, in particular, in 2010, that the offer was completed by entering into the world of power-shift gears. The diversification of the productive capacity comes side by side with the expansion of the technologies available in the company which, in addition to those strictly related to the



The metrological room, recently re-equipped, is equipped with the new Klingelberg P65 involutimeter with hybrid, tactile, and optical technology

Lorenzo Cattini managing director and CEO of Cattini e Figlio in Casarile (Milan)

making of sprockets, gradually include those necessary for the making of complex components such as, for instance, electron beam welding, or for the increase of the respective performance, such as shot-peening, without clearly ignoring the development in the field of gears and rectification, up to the recent development of closed-loop processes, faced at present.

Nowadays, the company has three plants, two in Casarile, respectively dedicated to cylindrical and bevel gears, and one in Cicognola, for thermal treatment, in which approximately 300 staff work.

More than seventy years of history of Cattini e Figlio have passed in the spirit of continuous growth of its productive capacity, skills, bent for managing increasingly complex projects, and for supporting the customer in the development, the reputation *vis-à-vis* customers, for which Cattini e figlio is a reliable partner: with the editor of Organi di Trasmissione we have visited the company to try to understand the secret of this success from the inside. Lorenzo, the son of the founder, and current CEO, will guide us in our visit.

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“PASSION” FOR RESEARCH

The support of Cattini e Figlio to academic and industrial research is part of a by now long-lasting tradition. As from the end of the 90's of the last century, Cattini e Figlio has participated, first with the CeNit project and then with the CeNit2 project, respectively concerning the gear foot and pitting fatigue resistance, to the research program sponsored by a pool of companies coordinated by ASSIOT and carried out at Politecnico di Milano, with an aim to research the impact on performance of material variations, of the thermal treatment, and of the manufacturing. Subsequently, Cattini supported “Iderplane”, a European project in the field of CleanSky2, aimed at defining the criteria for the design of more reliable planet-bearing for planetary gearboxes for aeronautical applications. The company's role in the project consisted in making a variation kit for an FZG type test bench, formed by a special gearbox needed for carrying out symmetrical alternating bending fatigue tests, as well as for preparing full scale test articles, that is sprockets cemented in aeronautical level material, with the bearing raceway fully retrieved in them. Finally, in the field of a PRIN (namely, the so-called Research Project of National Interest), aimed at reducing the noise of gear transmissions for electric mobility, in which some Italian Universities are involved, Cattini has made itself available to make gear prototypes with the micro-geometrical changes arising out of the theoretical studies, which are needed for the experimental validation of the findings of the simulations and of the design criteria.

A new metrological room for high quality

The visit of the cylindrical gear plant starts from the new metrological room which, according to a long-lasting tradition of the company, is equipped with Klingelnberg machines, amongst which the new CNC P65 automated control centre stands out, with hybrid, tactile, and optical technology, which is fundamental for controlling the external gears rectified with a grinding head based process. Through this manufacturing, indeed, very high quality gears are made, in particular, as regards splitting errors, for which the level of quality pushes itself to extreme values; furthermore, the tolerances obtained are generally narrower compared to those that also customers dare request and specify in the drawing. It is the second sample of hybrid technology sold on the Italian market; the possibility to use optical scanning which, in rolling the part, is in a position to check the splitting with micrometre intervals, or slightly more, combined with a more traditional tactile survey of the side, typically carried out on three teeth, allows to control the sprockets with the accuracy requested and in an effective manner, even as regards the time needed. The further evolution within controls is shown by the combination of the geometrical surveys with the rolling test (already customary in the bevel world): it is a trend that is starting to catch on, moreover, to foresee the gear's acoustic behaviour. The combination of the state-of-the-art manufacturing processes with control plans agreed with the customer is the fundamental condition to ensure qualitative performance that is not only high, but also and moreover, that may be repeated and constant throughout time: the reliability of the quality of the product is one of the elements underpinning the success of Cattini e Figlio on the international markets and, more in general, of the primacy of the gear manufacturing companies of the Italian system, as stressed by



The cylindrical gear production division

Lorenzo with national pride. For the record, 85% of the company's turnover is aimed at the foreign market and, amongst its customers, one may find the most famous manufacturers of agricultural tractors and industrial vehicles of the European countries and overseas, which benefit from the greatest reputation in their respective product sectors.

A cutting-edge machine fleet for cylindrical gears

We are now entering the production divisions, organised by separating the so-called 'white' and 'black' manufacturing, that is pre and post thermal treatment. The Cattini standard in the production of cylindrical gears is based on lapped gear hobbing and grinding head rectification. It is a process that, as a whole, allows to obtain the maximum currently possible in terms of quality of the product and low costs, but with some limitations, concerning the incompatibility with the internal gear or the impossibility to manufacture gears on complex parts, should there not be enough space for retracting the tool

as a result of other surfaces being close, as happens for instance with stepped sprockets, often used in gears for electric mobility. In these cases, regardless of the fact that the rectification with grinding heads allows to use small tools (indicatively up to 100 mm) which may even be brightened, there are intrinsic geometrical limits arising out of the cinematics of the gear hobbing and rectification processes. The current solution is based on the use of grinding, which is carried out in a separate warehouse, in order to avoid the vibrations it causes from being transmitted to the metrological room jeopardising the controls. However, Cattini's future investments will be aimed at blending Skiving and Honing, which allows to overcome the above-mentioned geometrical limitations with results that are by now compatible with the level of quality needed and the costs expected. The first surveys made by the company, which already uses skiving for internal gears, by using a machine placed in the grinding machines room have, indeed, revealed that also for external gears with new generation skiving it is possible to obtain high quality with reduced manufacturing time and with cycles that are marked, as a whole, by very reduced thermal treatment deformations, to the advantage of low costs of the final skiving. Furthermore, skiving also allows the carrying out of additional manufacturing, which is possible with gear hobbing, instead.

Investments in the immediate future in the technologies currently used are not foreseen, since they are by now state-of-the-art, not only in terms of single operation, but also and moreover as regards the integration of the entire process. Indeed, one of the key elements to obtain very narrow tolerances that may be repeated throughout time is the

carrying out of critical manufacturing for quality with the lowest possible number of placements of the component; this may be obtained by organising the manufacturing in correctly configured and automated islands, because the product sectors at which the company mainly aims require heavy parts and, thus, not very compatible with manual handling. Secondary manufacturing may take place, instead, beyond these islands, to the advantage of the overall low costs of the productive cycle. Also the same ways of handling the parts is fundamental in view of the quality of the final outcome: once the state-of-the-art technologies are used and once the entire details optimising the productive process are defined, we find out that the first cause of internal residual non-conformity is caused by the dents! Also these need to be remedied, by facing the problem in a structural way: within intelligent – that is flexible – automation, implemented by the company, the use of thermal-formed pallets is the final solution to the problem. The design of the component and the definition of the cycle are developed by starting from the requirements and the needs put forward, sometimes even implicitly, by the customer, with a level of interaction with the latter that varies as the case may be: if requested, Cattini may take the responsibility of the entire process and provide a range of prototype solutions to submit to the buyer's examination, who will give the final approval, in light of the use profile conditions, from which the performance parameters emerge, which will prevail in the overall assessment of the result. In view of the relevant long-term collaboration, situations arise in which the project evolves throughout time, in order to take into consideration the inevitable changes of requirements and performance requested or the new trends: the establishment of a long-lasting and customer loyalty rapport is an important aspect

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Detail of involute rectification.

of the company's philosophy, to which the actual support capability contributes within a trustworthy collaboration in addition to the already mentioned reliability in ensuring constancy of the qualitative performance.

Bevel gears that enhance human capital

Heading to the bevel gear plant gives us the opportunity to discuss another topic of the utmost importance for the company: human capital! The training of staff, their appraisal and loyalty are the main aims of Cattini's Academy project: the fact of meeting some young people at the entrance of the building confirms that the process of recruiting the younger generations has already started. Bevel gears are mainly made through dry-cutting, carried out on vertical Klingelberg machines. The productive cycle integrates the making of the tool, within the development of an overall geometry solution (macro- and microgeometry, above all), process and tool, by availing itself of the SW KIMoS. The making of the tool starts from the hard metal blades which are constantly sharpened, assembled on the cutting heads, and recorded with micrometric tolerance,

thanks to the use of very expensive machinery. The company has experience both in the field of Face Milling gears, generally preferred for rectification skiving gears, and of Face Hobbing gears, more common for lapped gears: the choice is however to be made by the customer. The company pushes itself in the direction of 'unlapping the gear', because the quality permitted by the rectification is compatible with this aim, provided that one is willing to bear the additional cost. In this respect, Cattini is in a position to support the customer in the development of individual parts (that is interchangeable and not to be used lapped) without any running-in period. Amongst the machines available, we may see the third Klingelberg C50, besides the C60, a horizontal machine in a position to manufacture up to 600 mm of diameter, with productivity and quality equivalent to vertical machines. The use of state-of-the-art technologies, skills, and experience in the design and definition of the productive cycle of complex components in every single detail, quality, and reliability 'passing the German test', support to the customer, and relationship of trust: it is what we have seen and heard in Cattini. Will these be the secrets of success? Maybe yes, but are they really secrets? •