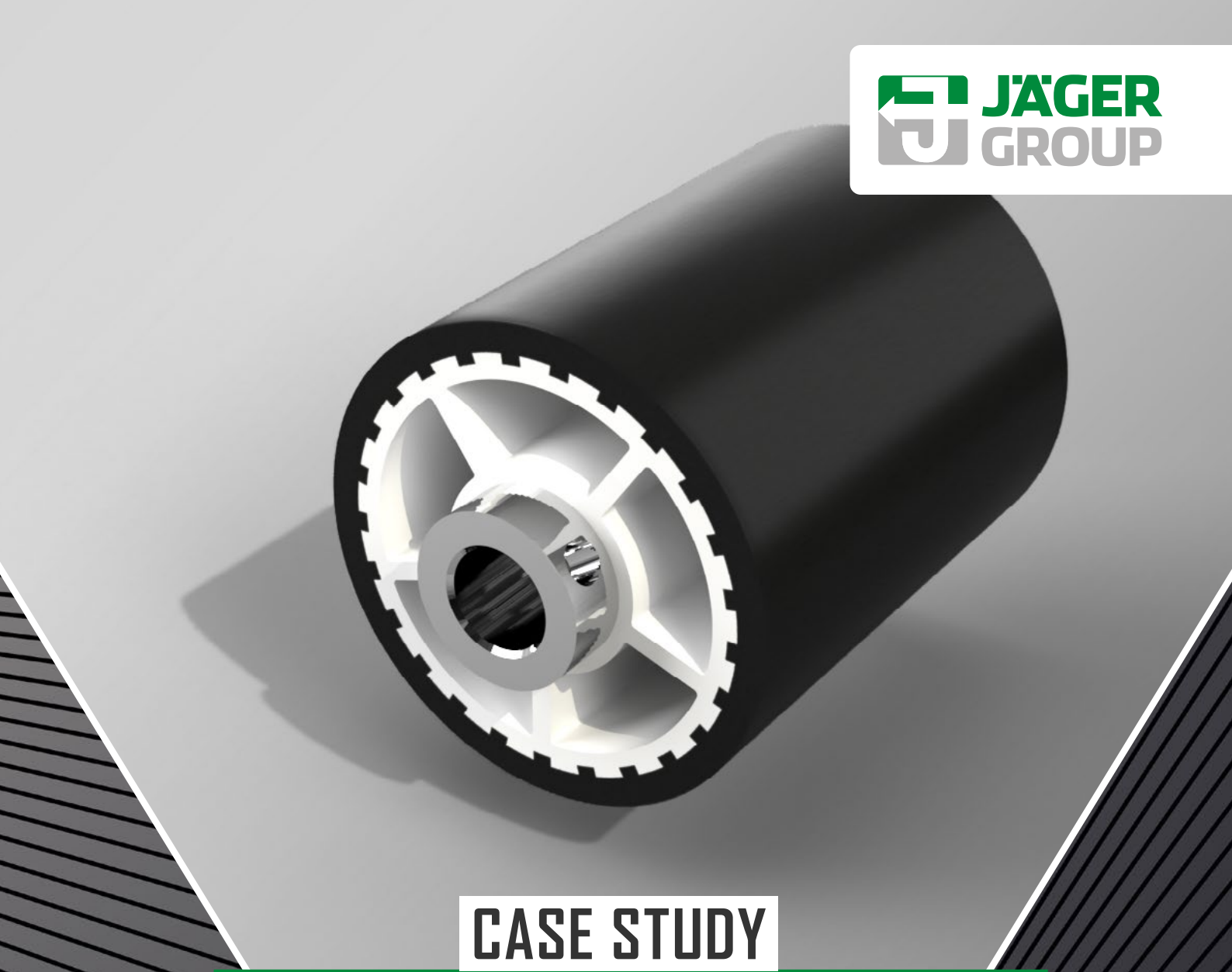
JÄGER GROUP



CASE STUDY

RUBBER PRESSURE ROLLERS FOR CONVEYOR BELTS

INTELLIGENT MATERIAL SUBSTITUTION FOR LOWER ENERGY CONSUMPTION

CHALLENGE

High weight and starting torque of the system

Long heating times in the production of previous pressure rollers

High energy demand and costs

SOLUTION

Value analysis of the materials used and the manufacturing process

Plastic construction replaces solid rubber roller

Subsequent adaptation of the process through material knowledge

RESULT

Significantly reduced heating times and reduced energy requirements

Lower weight ensures lower starting torque

Less material required due to material substitution

CHALLENGE

REROLLING STANDARDS

Conveyor belts are used in all industrial sectors to transport goods quickly and safely. The use of belt conveyors is generally very energy-efficient, because conveyor belts are characterized by long conveying lengths, quantities, and speeds with low drive power. In addition, they offer low wear and low maintenance and investment costs. In addition to the actual conveyor belt, Jäger manufactures a wide variety of rubberized drive rollers, support rollers and pressure rollers. Wear resistance, damping and torque transmission are essential criteria. Our main applications are in food processing, harvesting machines, warehouse technology and livestock farming. While conveyor belts are usually specifically adapted to the material to be conveyed, standard elements are often used for the rollers. These usually make the overall construction unnecessarily heavy and bulky and thus ultimately expensive to purchase and maintain.

CHALLENGE

EFFICIENCY INCREASE THROUGH PRODUCT OPTIMIZATION

A simple variant of the pressure rollers manufactured by Jäger consists of a steel pipe, which is overmolded with a thick rubber layer made of SBR. In use, the steel pipe, which is clamped onto a shaft, provides the power transmission to the roller and conveyor belt. The rubber layer, on the other hand, ensures a smooth and safe operation of the belts. Thus, the design of the roller is quite effective for the basic operation of the system. However, the high weight results in unnecessarily high start-up torques during operation of the entire line and thus for high costs. For these reasons, the experts at Jäger set themselves the task of reducing the weight, assembly and maintenance costs as well as the price of the individual rolls. At the same time, the use of raw materials and carbon emissions are to be deliberately reduced.

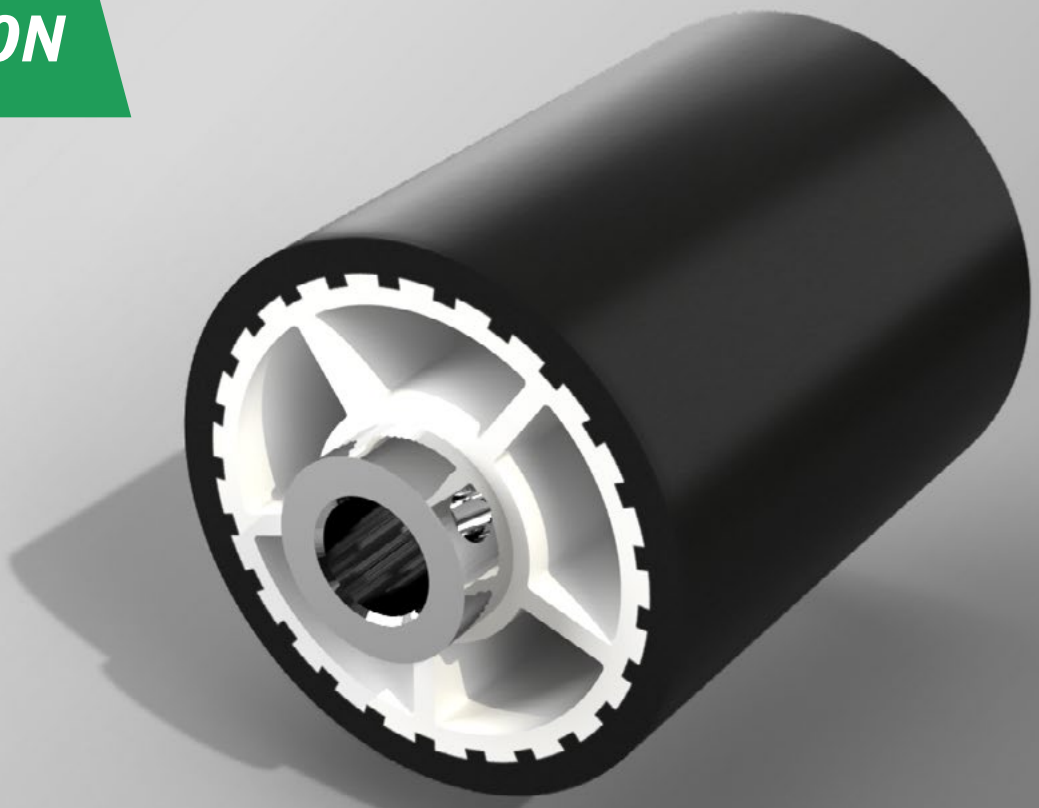
SOLUTION

RETHINKING RUNNING SYSTEMS IS KEY

By methodically applying value analysis, it was relatively quickly determined that more than 80 % of the manufacturing costs of the pressure roller were caused by materials and production. Since the vulcanization of rubber through pressure and temperature is a comparatively energy-intensive process, there is clear potential for optimization. The thicker the rubber, the longer the heating time required for the pressure roller. This results in a correspondingly high energy requirement and carbon emissions.

For this reason, the heavy solid rubber roller is to be replaced by a much lighter “spoke construction” made of plastic. A thin rubber layer will then be force-fitted onto this plastic component. In this way, the good damping and friction behavior of the component is retained. In a first process step, the plastic spoke body is injection molded onto the steel shaft, and the rubber layer is then vulcanized on in a second mold.

SOLUTION



CONVINCING MATERIAL EXPERTISE

Initial considerations with low-cost polypropylene (PP) proved to be unsuitable, because PP is not heat-resistant enough to withstand the injection-molded and subsequently vulcanized rubber component. As an alternative, the Jäger development team has therefore chosen polyamide (PA). A material that is significantly more resistant to the vulcanization temperature of more than 160 ° Celsius. The problem: Although the temperature-resistant polyamide is technically suitable for the process, it turns out to be too cost-intensive to achieve the desired target price. After some deliberation, the solution to this problem turns out to be as simple as it is ingenious. The rubber running layer and the shaft overmolded with PP are produced in two separate molds. The vulcanized rubber component is then pulled onto the PP substructure like a kind of heat-shrink tubing, thus joining the two materials with each other.

RESULT

QUICK FACTS

VOLUME

752 cm^3 RUBBER	- PLASTIC	227 cm^3 RUBBER	258 cm^3 PLASTIC

HEATING TIME / CYCLE TIME

60 min RUBBER	- PLASTIC	12 min RUBBER	2 min PLASTIC

CO_2-EMMISSIONS*

1925 g	891 g

WEIGHT**

876 g	476 g

*raw materials incl. processing
**total weight per unit without steel shaft

OPEN POTENTIAL

SUBSTITUTION OF THE STEEL SHAFT

Further savings are possible by eliminating the steel shaft. By substituting this material, using an all-plastic design, there is further potential for savings in terms of weight and material, with comparable torque transmission. This promising solution is being extensively tested in the laboratories and plants of the JÄGER Group. Among other things, further FEM calculations and application simulations are taking place in order to optimize the pressure roller under economic and ecological aspects. By rethinking existing processes, a running product can thus be adapted under ecological aspects. At the same time the required target price can be realized. Some ideas from this project can now be transferred to other customer´s projects from Jäger to ensure innovative products at a fair price.

CONTACT

Sascha Winter
Product and process development expert

+49 511 535 823 0
s.winter@jaeger-gk.de

www.jaeger-gk.de
Jäger Gummi und Kunststoff GmbH
Lohweg 1
30559 Hanover
Germany