KOKKUVÕTE

Eesmärgiks oli saavutada uuendatud kujuga Estonia 168 malmraam, mis sarnaneks disainilt Estonia klaverivabriku teiste klaveridega nagu näiteks Estonia 190 ja Estonia 210. Lisaks oli vaja eemaldada kinnituspoldid malmraami spreitsidelt, et ära hoida kõlalaua murenemist temperatuuri ja niiskuse kõikumise tõttu. Kõige lõpuks oli vajalik vähendada massi võttes arvesse klaverivabriku varasemaid kogemusi ja kaasaegse valutehnoloogia tootmisprotsessi võimekusi.

Malmraami disain suudeti kaasaajastada edukalt luues selle jaoks hindamismaatriks koos Estonia klaverivabriku poolt antud tingimustega. Uuendatud disainil eemaldati horisontaalspretsid ja lisati diagonaalspreits, mis suurendas malmraami jäikust ning vähendas massi. Spreitside pealt eemaldati kinnituspoldid ning kompenseeriti nende jäikust suurendades vastavate spreitside ristlõiket.

Klaveri malmraami tootmise lihtsustamiseks ühtlustati materjali ristlõigete üleminekuid, et valamise ajal jahtumine oleks ühtlasem ning selle kaudu väheneksid uues malmraamis sisepingeid ja jääkdeformatsiooni. Muudeti virbliploki „pesa" kuju uues malmraamis, et virbliplokki oleks võimalik toota freespingis, mitte käsitsi nagu varasemalt seda tehtud oli.

Klaveri malmraami massi vähendamiseks võeti kasutusele mitmeid võtteid. Vähendati ebavajalike elementide seinapaksuseid ning materjali kao kompenseerimiseks lisati tugevdusribisid.

Kokkuvõtteks võib öelda, et töös esitatud eesmärgid saavutati ning tulemused on kliendile rahuldavad. Uus Estonia 168 malmraam on jäigem kui esialgne malmraam ning kaalub vähem. Arvestades, et Estonia 168 disaini kaasajastamine lisas ka juurde elemente, nagu näiteks logo, mis ei suurenda Estonia klaveri jäikust, siis on saadud tulemus väga hea.

Tulevikus võiks uurida, kas nii väiksel klaveril on diagonaalspreitsi lisamine vajalik, kuna esialgsed arvutused näitavad, et diagonaalspreitsita malmraam on vähem jäigem kui diagonaalspreitsiga disain, aga jäigem kui esialgne disain. Diagonaalspreitsi mitte lisamine vähendaks malmraami massi veelgi. Oleks vaja teha põhjalikum analüüs, et hinnata klaveri kere mõju malmraamile, kuna sellisel juhul oleks võimalik malmraami massi veelgi vähendada.

SUMMARY

The goal was to achieve a redesigned Estonia 168 cast iron frame that was similar in design to other pianos such as the Estonia 190 and Estonia 210. In addition, it was necessary to remove the mounting bolts from the cast iron frame stress bars to prevent temperature and humidity fluctuations from cracking the sound board. Finally, it was necessary to reduce the weight, taking into account the piano factory's previous experience and the capabilities of the modern casting technology production process.

The design of the cast iron frame was successfully modernized by creating an evaluation matrix for it together with the conditions provided by the Estonian piano factory. In the updated design, horizontal stress bars were removed and a diagonal stress bar was added, which increased the rigidity of the cast iron frame and reduced the weight. The mounting bolts were removed from the stress bars and their stiffness was compensated by increasing the cross section of the respective stress bars.

In order to simplify the production of the piano cast iron frame, the cross-sectional transitions of the material were harmonized so that the cooling during casting would be more even and thus the internal stresses and residual deformations in the new cast iron frame would be reduced. The shape of the "nest" of the pin block in the new cast iron frame was changed so that the pin block could be produced in a milling machine.

Several techniques have been used to reduce the weight of the piano cast iron frame. The wall thicknesses of unnecessary elements were reduced and reinforcement ribs were added to compensate for the loss of material.

In conclusion, it can be said that the goals presented in the work were achieved and the results are satisfactory for the client. The new Estonia 168 cast iron frame is stiffer than the original cast iron frame and weighs less. Considering that the modernization of the design of Estonia 168 also added elements such as a logo that do not increase the rigidity of the Estonian piano, the result is excellent.

In the future, it could be investigated whether the addition of a diagonal stress bar is necessary for such a small piano, as preliminary calculations show that a cast iron frame without a diagonal stress bar is less rigid than the design with a diagonal stress bar, but stiffer than the original design. Not adding a diagonal stress bar would further reduce the weight of the cast iron frame.