THE HAGETRØ VIOLIN*

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A patented novel design enables quality instruments to be made from thin plywood.

Between luthiers and musicians "plywood" does certainly not have a good ring to it. Its esteem, however, may be due for revision after hearing a Hagetrø violin or viola. Acoustical as well as musicians' reports treat these instruments favorably and give credit for characteristics normally found in first-rate violins only. At present, these instruments are hand crafted, but the simplicity of the plate construction should make them well suited for competitive mass production.

The two basic ideas, upon which the design relies, are (1) lightweight "isotropic" top and back plates, and (2) an inner support system that promotes "pulsating" or "breathing" modes and takes the entire static string load off the top. The latter allows three-layer spruce plywood with thickness of a mere 1.5–2.0 mm to be used for both the top and back plates. (Unlaminated spruce this thin would have proven too soft across the grains.) Viewed from outside, the construction has similarities to the 18th centu-

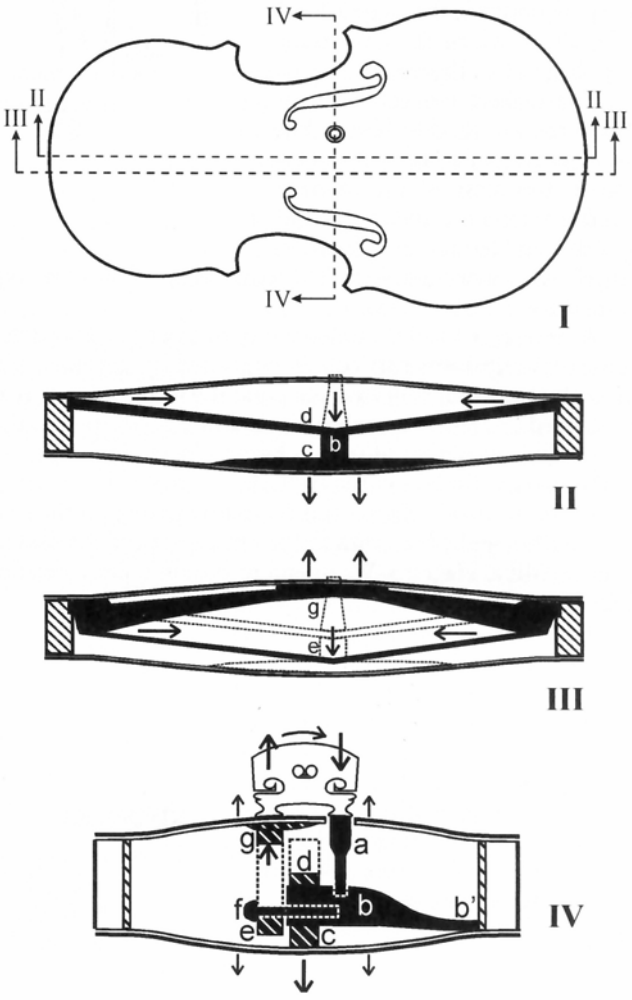

Figure 1 ■ Pressing down the sound post (a) causes the cross member (b) — fastened at (b') — to bend down (see IV). This forces the longitudinal member (c), and thus the back plate, down, while the support (d), the wooden pin (f) and chord (e) follow (see II and III). Since in a dynamic system, the center of gravity tries to maintain its position, the lowering of (e) pulls the neck and tailpiece blocks together, which causes the trestle (g) to bend up against a small patch glued to the top. An expansion of the body volume has been achieved. Pressing down the bridge on the bass side gives the reverse effect. Most of the string tension is taken up by the support (d), while (a), (b), (f), (e) and (g) counteract the vertical component, leaving both plates virtually undeformed.

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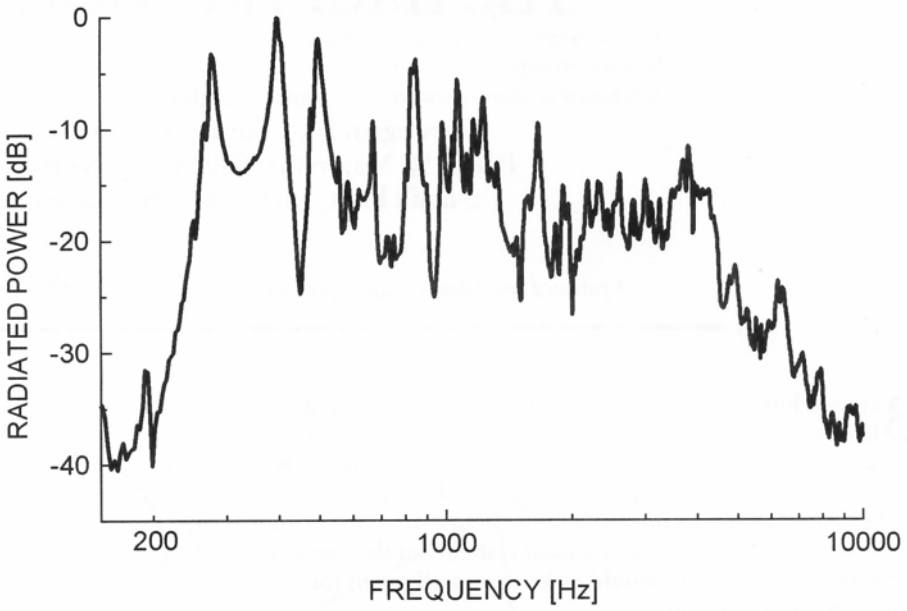
ry Charotta, as the bridge places one foot directly on the sound post, which comes up through a hole in the top without touching it. Inside, a patented combination of trestles and members causes the top and back plates to be driven with oppositely directed forces (see Figure 1).

Acoustical reports by Anders Buen and Lars Henrik Morset (ref.) show for the violins average Q-values of around 37–41, as for conventional instruments, but generally a slightly higher density of resonances and double resonances. Pronounced C3 and C4. "Pulsating modes" found up to above 670 Hz (C4). Good radiation between 800–1350 Hz followed by a less resonant range up to 2.1 kHz. A radiation peak occurs in the range 3.3–4.2 kHz, above which the downward slope begins (see Figure 2).

Figure 2 ■ Radiated power (calibrated for a constant force input) of a Hagetrø violin, as measured by L. H. Morset (ref). Some uncertainty exists for the spectrum above 1.5 kHz due to the radiation directivity and the limited number of microphones utilized in the measurements.



The earliest models were reported to have good brilliance, but a somewhat weaker bass. A reduction in the mass of the interior member system was then suggested by Buen, and has successfully been carried out in newer versions. The total weight of the inner system (a through g of Figure 1) is now less than 40 grams for the violin, and about 50 for the viola.

A while ago, I had the opportunity to listen to a Hagetrø violin and viola when played by two of the string professors of our music academy. I was particularly impressed by the viola, which in spite of its modest size (body length: 38 cm) sounded really big with a powerful firm bass and good tonal consistency. It also left the impression of an instrument very easy to play. The violin showed similar tone qualities in its low register, but compared to the fine Italians normally employed by my colleagues, the greater silkiness of the old Italians became increasingly apparent when played toward the higher range. Nonetheless, the Hagetrø design already displays virtues sufficient to make the instruments highly attractive for further analyses and development.

I want to thank Morset and Buen for passing on their reports and data, and in particular the producer of the instruments who kindly supplied me with the patent papers and detailed information on the structure, Toril B. Kyllo, a granddaughter of the inventor Mikal Hagetrø. We intend to submit a more detailed analysis of these instruments' properties in a future issue of the CAS Journal. **■ CASJ**

REFERENCE

Morset, L. H., "An Investigation of Vibrational and Acoustical Properties of the Violin using MLS and TV Holography," proc. Berlin ASA/EAA/DEGA March 1999. In this paper, the radiated and input powers of a Hagetrø violin are plotted against similar measurements of a conventionally built Italian instrument.