

Product Design Specifications

I. Function

The purpose of this design project is to develop a metronome device which will maintain a constant, adjustable tempo for the practicing musician. A key feature that the client requires is that the device's tempo-maintaining mechanism be inaudible. Such a feature allows the musician to practice and improve musical performance using a more intuitive approach—one that does not distract the musician while playing music (i.e. audible ticks, as used in conventional metronomes).

II. Client Requirements

- The device should accurately maintain the tempo.
- The tempo-maintaining mechanism should be inaudible, relying on some sort of tactile stimulus to interface with the performer (i.e. something that can be internalized while playing without causing a distraction).
- The device should not attach to locations on the body such as the arm or wrist—which are used to play the instrument—but rather at a location such as the waist, where the device does not interfere with musical performance but can still be used by the performer to maintain the tempo while playing.
- The device is intended primarily for day-to-day practice.

III. Design Requirements

1. Physical and Operational Characteristics

- Performance Requirements:** The tempo-maintaining mechanism must be essentially inaudible. The device should cover a practical playing-tempo range of approximately 40 to 250 beats per minute.
- Safety:** The device must not cause excessive discomfort or harm to the performer.
- Accuracy and Reliability:** The device must accurately and reliably maintain a constant tempo in a typical musical practice or performance environment.
- Life in Service:** The device should be able to operate for the duration of a typical practice session (i.e. 2 to 3 hours at a time).
- Shelf Life:** Indefinite; since the device will not involve any perishable materials, the shelf life is expected to be similar to that of typical consumer electronics devices.
- Operating Environment:** Room temperature for a typical practice session, and possibly higher temperatures in densely crowded concert halls during performances (if applicable).
- Ergonomics:** The device must be strategically placed on the body, so as to not adversely affect the performer's ability to play the instrument, and must be quickly adjustable and comfortable in a performance setting (if applicable).
- Size:** The device should have a base of about 3 to 4 in by 3 in, and a height of about 0.5 to 1 in. Thus, the device should be portable and should not be cumbersome.
- Weight:** The device should weigh approximately less than 1 lb. It should be lightweight in order to prevent distraction of the performer.

- j. **Materials:** Typical circuit elements (i.e. resistors, capacitors, 555 timer, etc.), a plastic case, and a battery (9 V).
- k. **Aesthetics:** The device should be rather plain in order to prevent attracting attention to it during practice or during a performance (if applicable). The device should attach firmly to the body and should not rattle or cause any other such undesirable noise.

2. Production Characteristics

- a. **Quantity:** One functional device.
- b. **Target Product Cost:** Up to \$100 for the production of a working prototype.

3. Miscellaneous

- a. **Standards and Specifications:** The device should have similar adjustability to other electronic metronomes, and it should be built in a manner which does not pose electrical hazards to the performer.
- b. **Customers:** Primarily the client, though there is a potential market for other musicians.
- c. **Patient-Related Concerns:** The device should be comfortable and should not harm the performer while playing music.
- d. **Competition:** Many electronic metronome devices are on the market, though few deal with the problem of an inaudible/tactile tempo-maintaining mechanism.