Cast Saw Cooling Device

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Client Overview

- Dr. Rahul Samtani
    - Orthopedic Surgeon
- Speciality
    - Sports injury
    - Degenerative disease
    - Joint repair and replacement

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Problem statement

- Friction from cast saws generate heat capable of resulting in 3rd degree burns
  - 130°F for 30s and 150° for 2s[A]
  - Some saws reach 215°[B]
- Patients are occasionally burned during cast removal -injuries should not be created in a hospital unnecessarily!
- Cast materials: plaster and fiberglass

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Cast Cutting Demo

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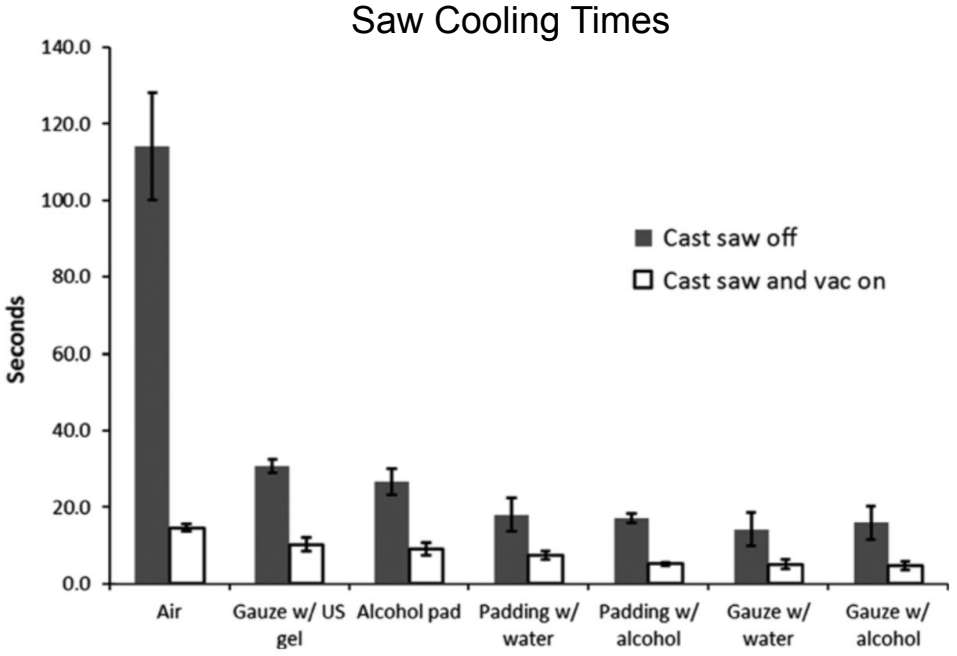
Background

- Vibratory device
- Saw blade oscillates to cut
- Blades tend to heat up during cutting process
- Causes burns and blisters on patients
- Previous research papers suggest water or ethanol cooling



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Product Design Specifications

- **Performance requirement** : Blade temperature < 44°C (Burning temperature of skin)
- **Life in service** : same as the blade durability
- **Operating environment** : Examination room(room temperature), withstand a range of conditions- not limited to indoor clinical settings.
- **Size/Weight :** Held in one hand, not impede cutting ability (entire assembly < 3kg).
- **Material:** compatible with coolant and metal blade.
- **Product cost:** No budget limits but need to state purpose /proposal before receiving budget
- **Standard & Specifications:** CFR Class I (General controls: exempt from premarket notification) [c]

Design Compatibility

BAOSHISHAN Electric Cast Cutter Plaster

- $517

M-PACT

$68 -cheap

Stryker 940

- $1,995
- Has vacuum
- compatible with Ion Nitrided, Stainless steel, and Titanium Nitrided blades

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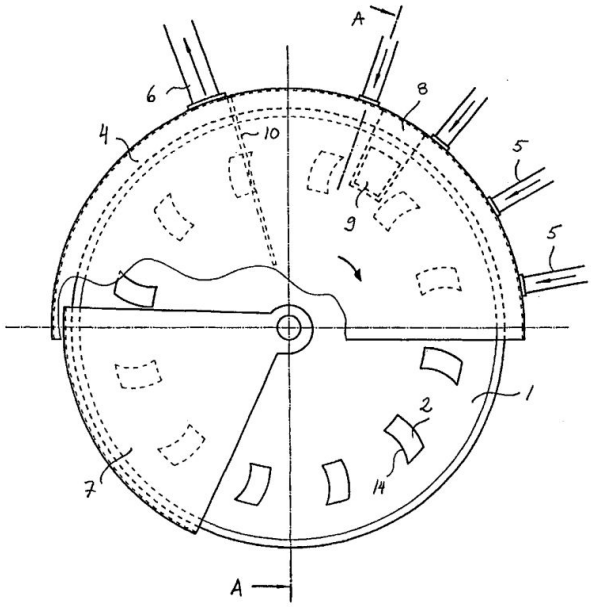
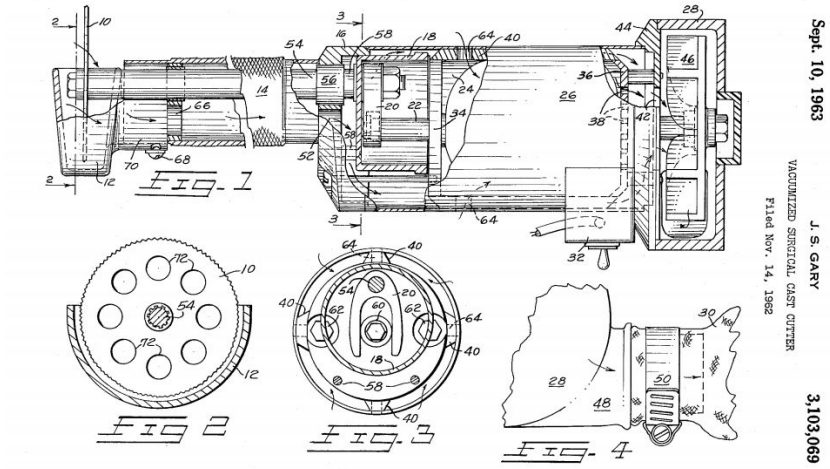
Competing Designs

Cooling System for Rotary Blade



Vacuumized Surgical Cast Saw Cutter

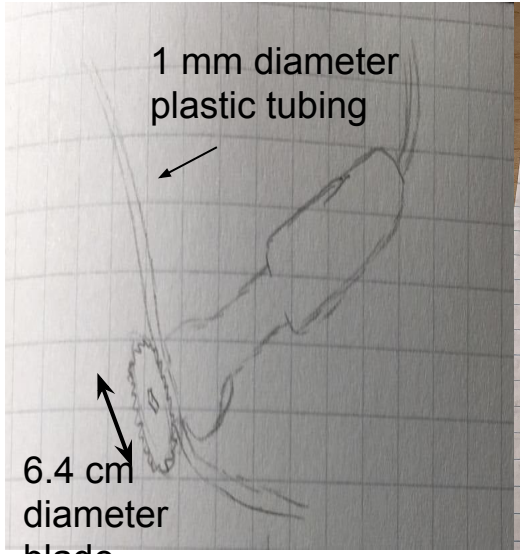


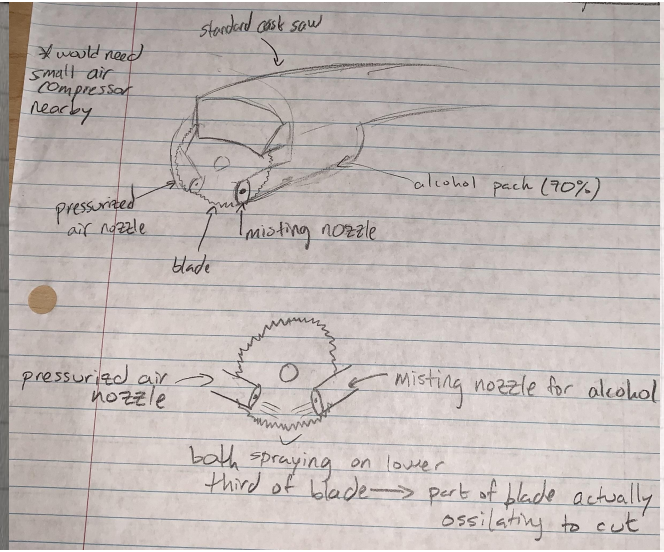
Design Ideas

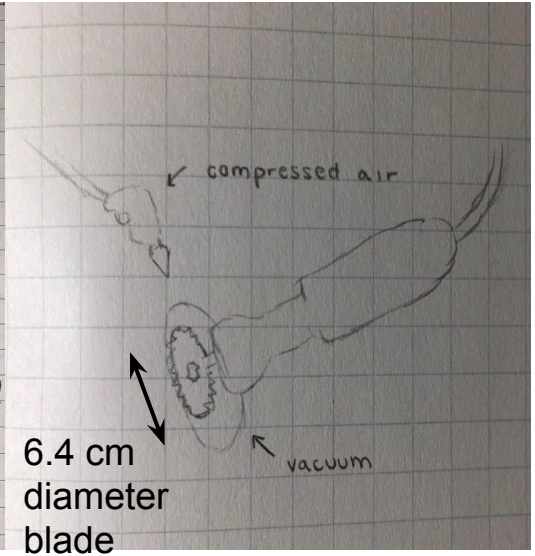
Cold Tubing

Mist + Vacuum

Compressed Air + Vacuum







Design Matrix

Design Criteria	Cold Tubing	Mist + Vacuum	Compressed Air + Vacuum
Cooling Reliability (35)	4/5 28	5/5 35	4/5 28
Ease of Fabrication/Assembly (15)	5/5 15	4/5 12	3/5 9
Ergonomics/Ease of Use (10)	3/5 6	2/5 4	2/5 4
Durability (10)	2/5 4	4/5 8	4/5 8
Aesthetics (10)	3/5 6	4/5 8	3/5 8
Cost (10)	4/5 8	4/5 8	3/5 6
Safety (5)	5/5 5	4/5 4	3/5 3
Fear Factor (5)	4/5 4	2/5 2	1/5 1
Total (100)	76	81	67

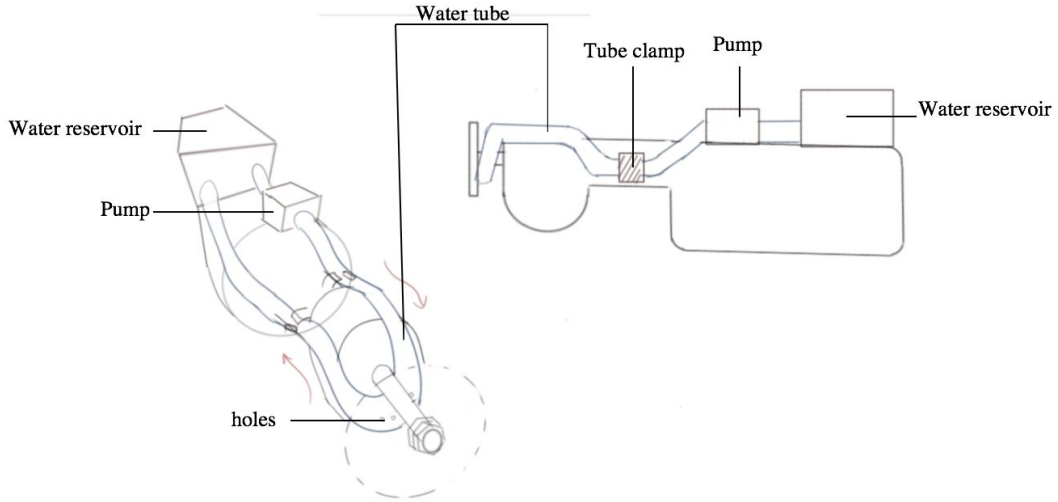
- 6-7 turns to make cast
- Two cutting process in a row
- Infrared camera to record temperature

Preliminary Testing

	Blade Temp (°C)	Cast Temp (°C)
Stationary	22	22
Control	113	47
Cold tubing	50	46
Mist	32	45
Compressed air	43	25 (after 30s)

Future Work

- Install mist system combined with cold tubing
- Do more testing with cold tubing (varying wall of the tube, diameter & material)
- Consider skin temperature and dust production.
- Find material that could mimic skin's thermal properties for testing



Acknowledgements

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Dr. Rahul Samtani - *Client*

References

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[D] Puddy, Alan C, et al. Cast Saw Burns: Evaluation of Simple Techniques for Reducing the Risk of Thermal Injury.

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