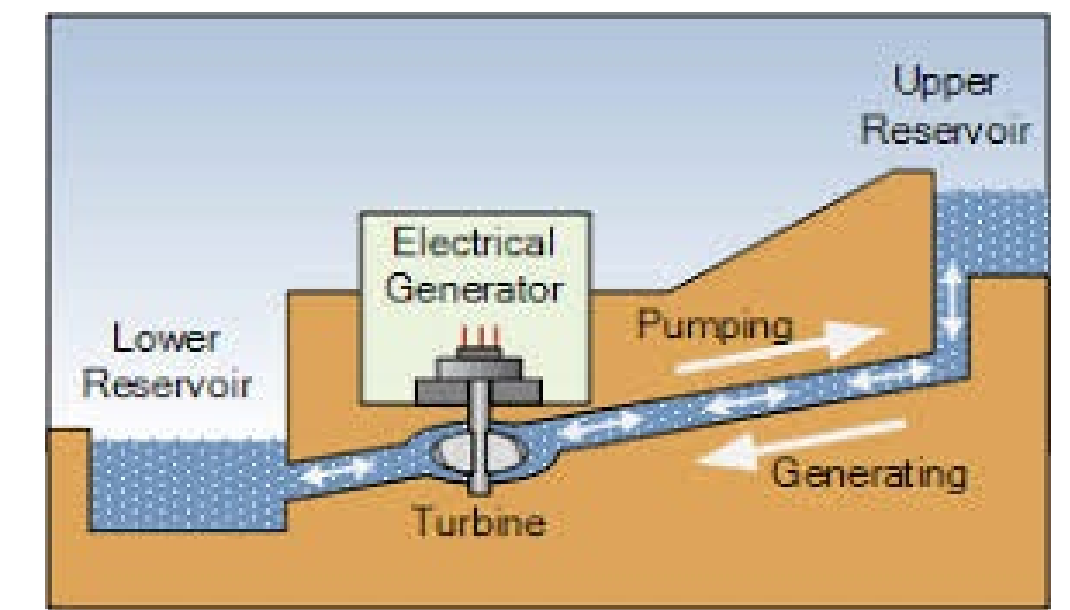


Hydro-Power Energy Store Device Utilizing Elastic Energy

Project Description:

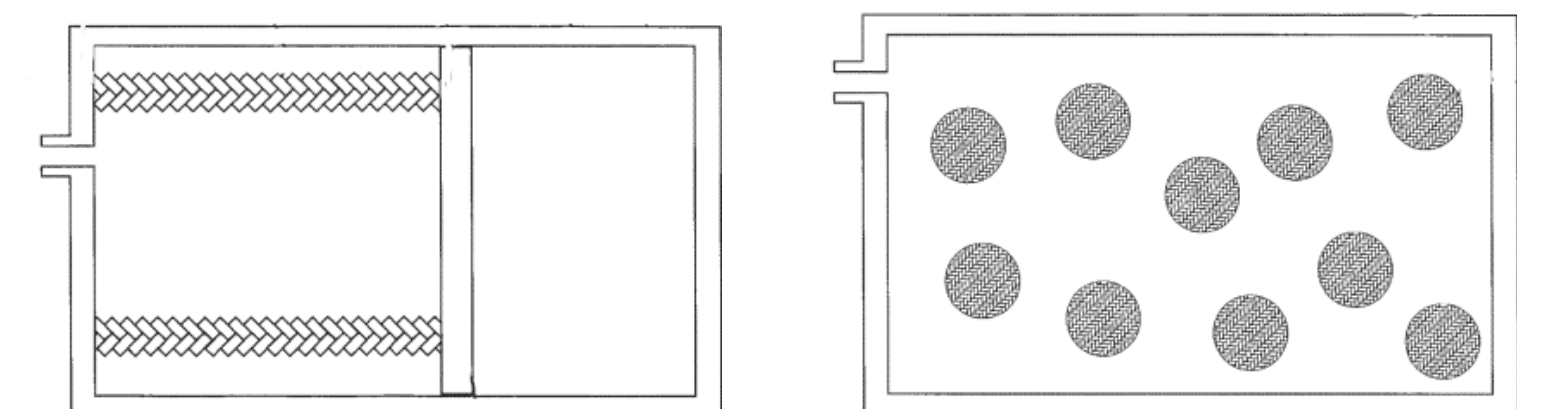
Tensilastic Energy is a start-up company planning to revolutionize the renewable energy market with a modular pumped hydro-energy storage device that utilizes elastic materials to store energy. The idea behind the device comes from replacing the gravitational energy usually found in hydro energy systems with elastic potential energy from the squeezing or stretching of elastic materials. The capstone team will produce a prototype of a scalable storage device using an elastic material in ropes or spheres to store energy. A piston or torsional design will utilize tension or compression within the elastic material to “charge” the energy storage device. To “discharge” the energy storage device a reversible valve will use stored energy to push fluid through a turbine generator to produce electric energy.



Traditional Stationary Pumped Hydro – Utilizing Gravity

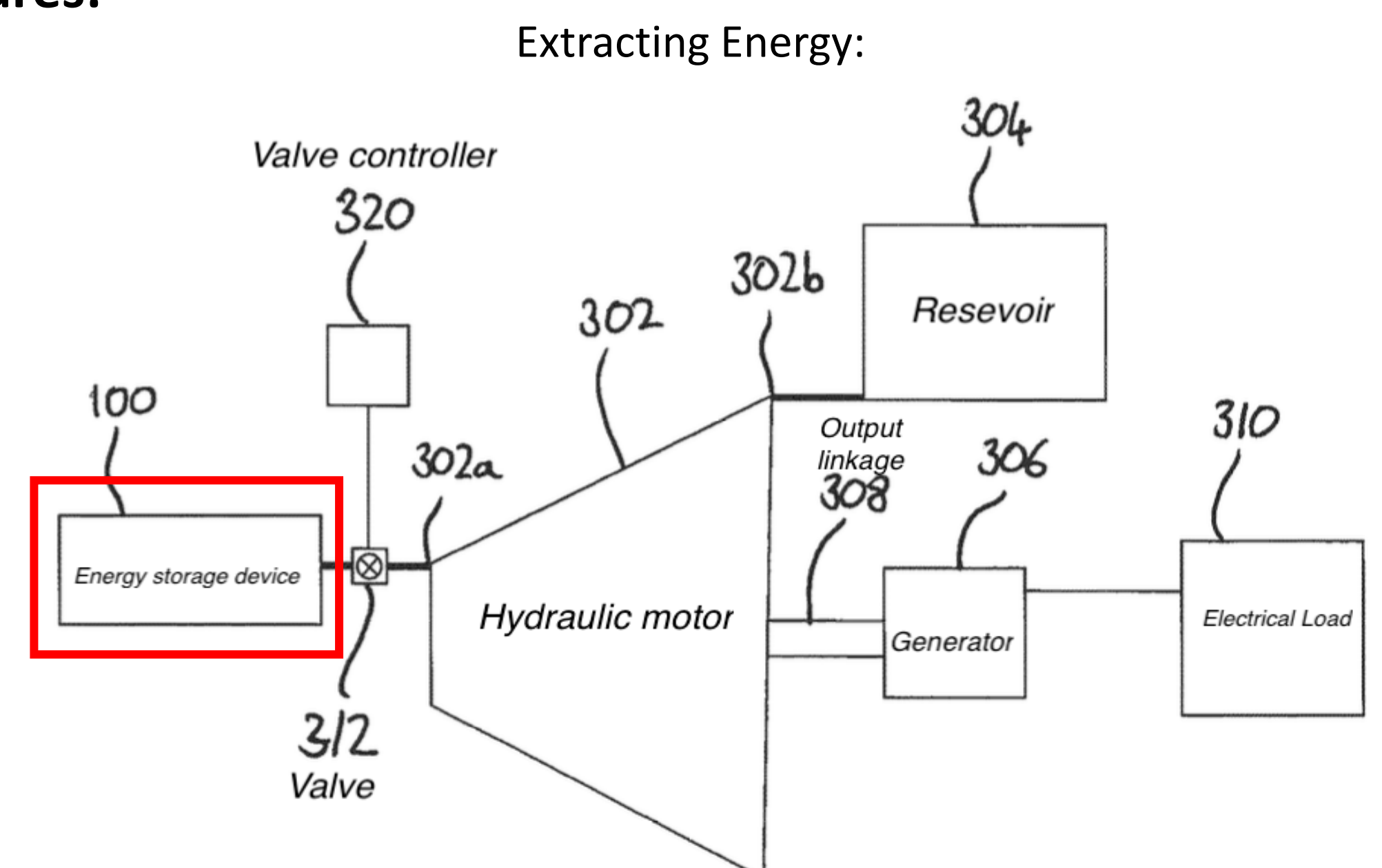
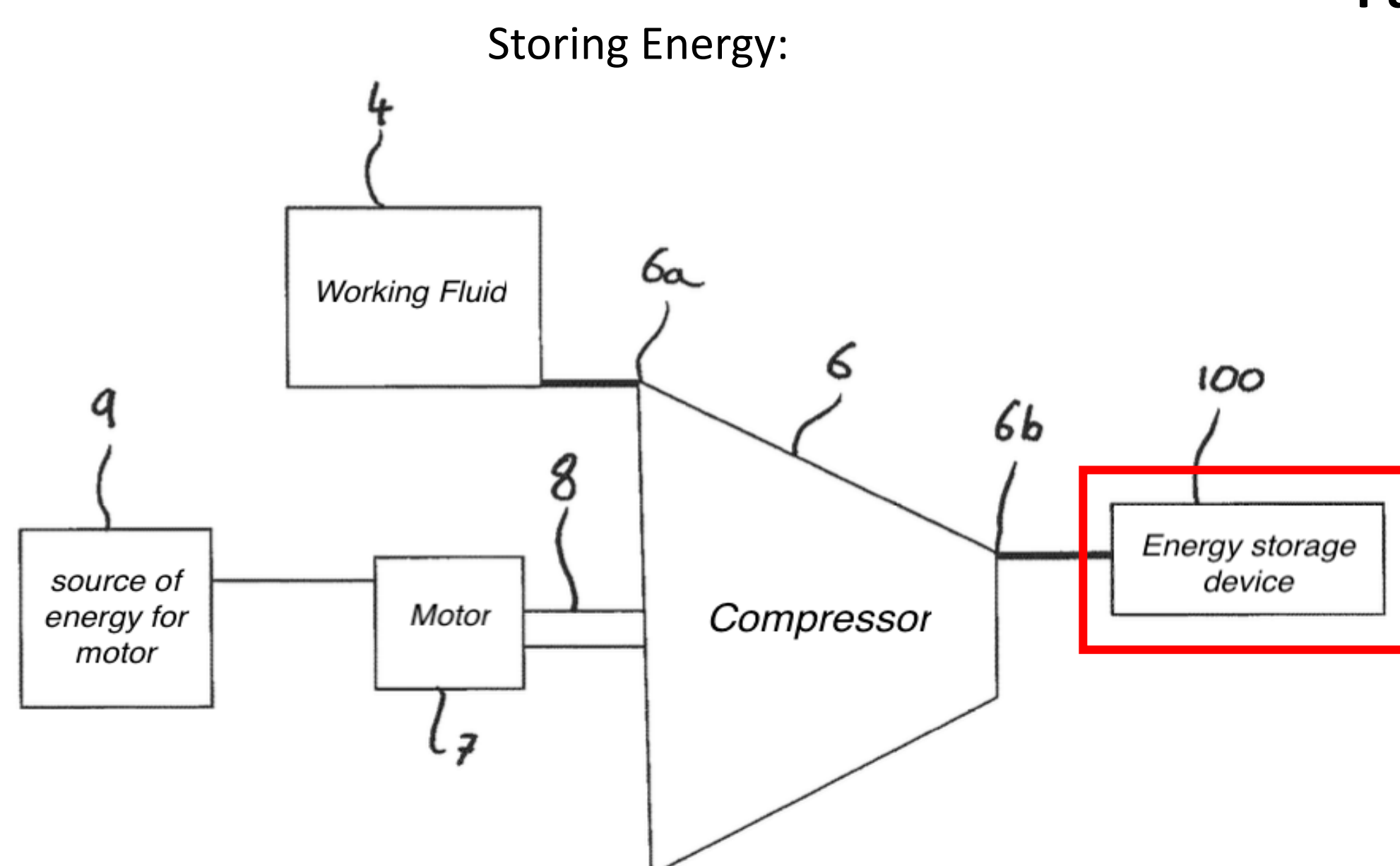
Current Progress:

- The team has read through the patent to understand the scope of the process and constraints
- Multiple ideas are being evaluated such as using piston, bladder, and torsion designs
- Materials for the cables or spheres are currently being researched and considered
 - Spider silk, recycled carbon fiber, and other materials that fit the material properties needed
- CAD modeling has been done for design concepts
- MATLAB calculations are in progress to help narrow down materials and understand feasibility
- Considering possible ways to test a prototype



Elastic material ropes (left) and spheres (right) shown in a pressurized hull from patent

Patent Figures:

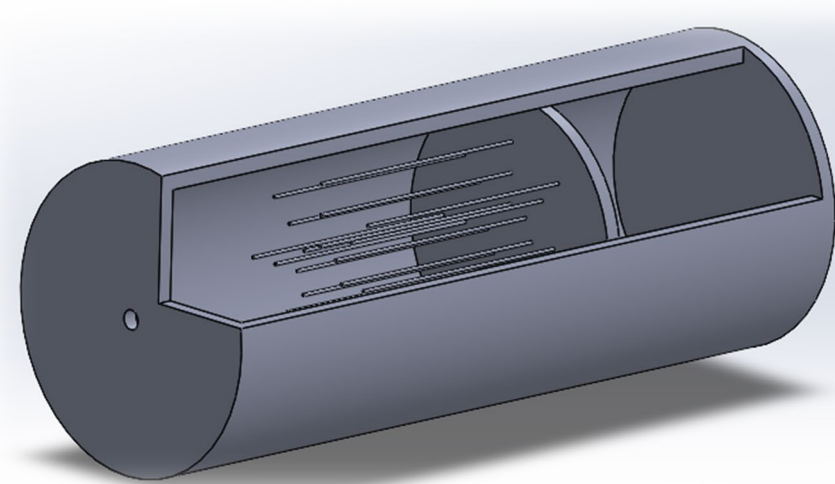


Notes for Patent Figures:

- After storing energy in the energy storage device (100) the device can be transferred to a desired location where the energy can be extracted – like a battery
- The output linkage (308) could be connected directly to a mechanical load if electrical generation is not desired
- Some components (Such as 312, 320, 6, 7, 9) may be omitted or replaced from the final design of the process in accordance with the patent
- The patent allows for a broad range of possible elastic materials and configurations that can be used

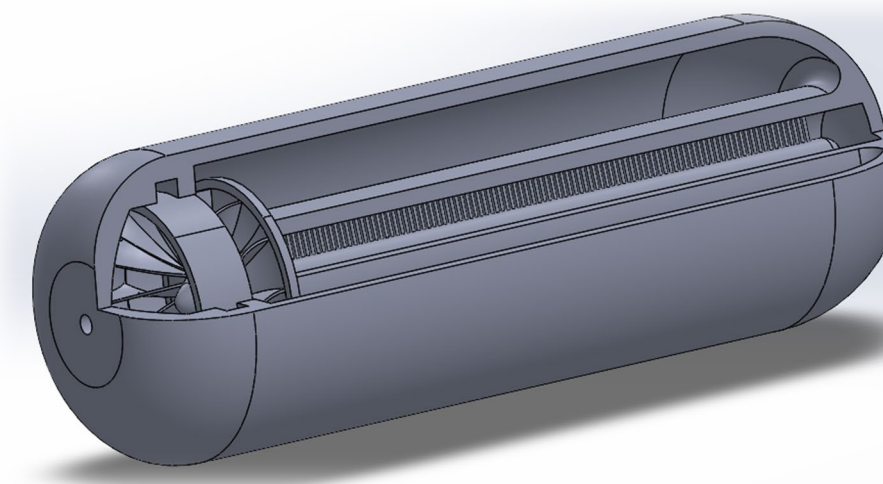
Early Design Concepts:

Piston Type:



- ✓ Easier to manufacture
- ✓ Likely able to prototype and test using Pump33DDS
- ✓ Maximize elastic material able to be contained in hull volume
- ✗ Elastic material operates in working fluid

Torsion Type:



- ✓ Likely easier to control flow in and out of energy storage device
- ✓ Able to keep elastic material separate from operating fluid
- ✗ Harder to maintain
- ✗ Likely more expensive

Semester Deliverables:

1. Create a risk memo, with models and simulations of the Hydro-Power Energy Storage Device
2. Use ANSYS and MATLAB to test design models
3. Present a critical design review, with overview of progress made throughout the semester
4. Final Presentation

Testing and Simulations:

- Use MATLAB model to explore various variables, such as flow rate and elastic potential energy
- Use ANSYS to simulate design model (structural analysis, fluid analysis, etc.)
- Use Pump33DDS to test a physical prototype
 - A syringe will be utilized to control flow rate of fluid and run tests for expected pressure within the vessel



Pump33DDS

Patent: US 11,852,170; EU EP3983675; UK GB2575916; India 511203; Israel 288786; Japan 7361136 Patent Pending in other jurisdictions.



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