Cotton Belt Water Pump: A Novel Solution for Water Extraction in Remote and Arid Regions

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Traditional water pumps rely on expensive infrastructure and maintenance, substantial electrical power, specialized lifting equipment, with costs prohibitive for rural/remote communities. The challenge is lifting water from underground aquifers to surface. Submersible pumps in sandy areas have a short life due to corroding rotors. Water turbulence can create extensive well clogging, damage, and downtime. The objective was to design a resilient water pump that can operate efficiently in remote, rural, sandy, or off-grid areas. The Cotton Belt Water Pump uses a novel water absorption lifting system, which instead of pushing/pulling water through a pipe, uses a cotton belt to absorb water at depth and a mechanical squeezing system above ground to extract it. Water adheres to the cotton belt and is brought to surface. When reaching the water pump inside, the belt is squeezed between a roll by a rubber belt, and water is released and collected. The pump is actuated by a low power geared DC motor. The belt forms a continuous circuit, passing through the bottom roller assembly inside the well, a squeezing mechanism at surface, and tensioning wheels for alignment. The prototype achieved extraction rate of up to 19.7 gallons per hour (gal/hr) for the motor at 278 rotations per minute (RPM). The average water extraction for the motor speed (i) at 278 RPM was 19.5 gal/hr, (ii) at 200 RPM was 14.0 gal/hr, and (iii) at 100 RPM was 7 gal/hr. With mechanical components at surface and a flexible textile medium, the simplified system avoids structural issues of traditional pumps, reduces impurities, eliminates repair costs, corrosion, water turbulence and clogging. The prototype demonstrated it can reliably extract water with minimal turbulence and low energy consumption.

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