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Design and Development of Portable Ambulator Bag Ventilators

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Abstract: *In response to the critical demand for versatile and rapidly deployable respiratory support systems, this paper presents the design and development of a Portable Ambulatory Bag Ventilator (PABV). The device integrates the proven reliability of manual bag ventilation with automated control systems to deliver precise and adjustable respiratory support in emergency, prehospital, and resource-constrained settings. The design features a compact, battery-operated motorized mechanism that compresses a standard resuscitator bag, while a microcontroller-based control algorithm dynamically adjusts key ventilation parameters—including tidal volume, respiratory rate, and the inspiratory-to-expiratory ratio—based on real-time sensor feedback. Finite element analysis and computational fluid dynamics were employed to optimize the mechanical and fluidic components, ensuring both efficiency and safety. Bench testing under simulated clinical conditions demonstrated the system's capability to maintain consistent ventilation performance across a range of settings, with integrated alarms to alert operators to potential malfunctions or deviations from preset parameters. The PABV's user-friendly interface, low power consumption, and durable construction make it particularly well-suited for rapid deployment in emergency care and field hospital scenarios. This work lays the foundation for further clinical validation and the integration of advanced monitoring features, ultimately aiming to enhance patient outcomes in critical care environments.*

Keywords: Portable Ambulatory Bag Ventilator

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