



Mechanical Ventilator

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ABSTRACT

Mechanical ventilation is an enormous undertaking for a veterinary hospital in general and for any patient in particular. It is a team effort requiring large amounts of space, supplies, labor, and time. It requires committed owners and clinicians who communicate clearly with each other. It also requires a significant financial commitment initially from the hospital to obtain the equipment and expertise and then from the owner to maintain the patient. All members of the patient care team should have a basic understanding of respiratory physiology and ventilator mechanics. Clear goals for therapy and end points should be established. If they cannot be met, the goals should be reassessed in light of changes in patient condition. Weaning may be difficult and long, but once successful, it is most rewarding for the patient, family, clinician, and team.

Introduction

What is a ventilator?

A mechanical ventilator is a machine that helps a patient breathe (ventilate) when they are having surgery or cannot breathe on their own due to a critical illness. The patient is connected to the ventilator with a hollow tube (artificial airway) that goes in their mouth and down into their main airway or trachea. They remain on the ventilator until they improve enough to breathe on their own.

A ventilator is a machine that provides mechanical ventilation by moving breathable air into and out of the lungs, to deliver breaths to a patient who is physically unable to breathe, or breathing insufficiently. Ventilators are computerized microprocessor-controlled machines, but patients can also be ventilated with a simple, hand-operated bag valve mask. Ventilators are chiefly used in intensive-care medicine, home care, and emergency medicine (as standalone units) and in anesthesiology (as a component of an anesthesia machine).

Ventilators are sometimes called "respirators", a term commonly used for them in the 1950s (particularly the "Bird respirator"). However, contemporary hospital and medical terminology uses the word "respirator" to refer instead to a face-mask that protects wearers against hazardous airborne substances.

Mechanical ventilation is indicated when the patient's spontaneous breathing is inadequate to maintain life. It is also indicated as prophylaxis for imminent collapse of other physiologic functions, or ineffective gas exchange in the lungs. Because mechanical ventilation serves only to provide assistance for breathing and does not cure a disease, the patient's underlying condition should be identified and treated in order to resolve over time. In addition, other factors must be taken into consideration because mechanical ventilation is not without its complications [3] One of the main reasons why a patient is admitted to an ICU is for delivery of mechanical ventilation. Monitoring a patient in mechanical ventilation has many clinical applications.

Enhance understanding of pathophysiology, aid with diagnosis, guide patient management, avoid complications and assessment of trends.

In general, mechanical ventilation is initiated to protect the airway/reduce work of breathing and/or correct blood gases.

What's the difference between mechanical ventilation and intubation?

Intubation and mechanical ventilation often happen together, but they're not the same. When a provider intubates, they put a tube down your throat into your airway (trachea). Then, a provider will connect the tube in your throat to a ventilator. Sometimes a face mask connects you to the ventilator and you don't have to be intubated

Summaries for "Mechanical Ventilator Current Scenario":

1. The current state of mechanical ventilators in healthcare is a critical aspect of managing patients with respiratory failure. Understanding the evolution of ventilator technology and the challenges it faces is essential for healthcare professionals.
2. Mechanical ventilators play a crucial role in critical care settings, providing life-saving support for patients with compromised lung function. Examining the current scenario of mechanical ventilators is vital for healthcare professionals to ensure optimal patient care.
3. The COVID-19 pandemic has highlighted the increased demand for mechanical ventilators in managing respiratory complications. Understanding the impact of this global health crisis on ventilator utilization is essential for healthcare providers.
4. Despite technological advancements, current mechanical ventilators have limitations that warrant further exploration. Investigating these limitations and potential solutions is crucial for improving patient outcomes and healthcare efficiency.
5. Innovations in mechanical ventilator design and functionality are continuously emerging, offering promise for enhanced patient care. Exploring these innovations and their potential impact on the current scenario of mechanical ventilators is essential for healthcare professionals.
6. The future of mechanical ventilators in healthcare is a topic of ongoing research and development. Examining the current scenario and future prospects of mechanical ventilators will facilitate informed decision-making and strategic planning for healthcare organizations.

Mechanical ventilator Problem Faced in Current scenario

In the current scenario, some challenges related to mechanical ventilators include supply chain disruptions, increased demand, and the need for skilled healthcare professionals to operate and manage these devices. Additionally, ensuring proper maintenance and addressing potential technical issues are essential for the effective use of ventilators in critical care situations.

Purpose of mechanical ventilator

The main purpose of a mechanical ventilator is to allow the patient time to heal. Usually, as soon as a patient can breathe effectively on their own, they are taken off the mechanical ventilator.

The caregivers will perform a series of tests to check the patient's ability to breathe on their own.

When the cause for the breathing problem is improved and it is felt that the patient can breathe effectively on their own, they are taken off of the mechanical ventilator.

Overall, the goal of mechanical ventilation is to support gas exchange and sustain life until the cause of respiratory failure is resolved.

The overriding objective of mechanical ventilation is to decrease work and oxygen cost of breathing, enabling precious oxygen stores to be rerouted from the respiratory muscles to other vulnerable tissue beds.

Research and Literature Review: Conduct a thorough literature review on mechanical ventilators to understand design principles, functionalities, and metrological aspects.

Define Objectives and Scope: Clearly define project objectives and scope, focusing on specific aspects such as metrology, design considerations, or performance evaluation.

Data Collection and Analysis: Gather relevant data and information, including specifications, technical documentation, and research papers. Analyze collected data to identify key parameters and factors influencing ventilator performance.

Design and Development: Incorporate metrological principles into design processes, ensuring accurate measurement and control of ventilator parameters.

Metrological Evaluation: Develop calibration procedures and conduct tests to assess accuracy, precision, and reliability of measurements made by the ventilator system.

Testing and Validation: Perform comprehensive testing and validation under simulated or realworld conditions, evaluating performance in ventilation, patient monitoring, and dynamic response.

Data Analysis and Interpretation: Analyze test results to evaluate system performance in metrology, functionality, and safety. Identify areas for improvement.

Discussion and Conclusion: Discuss implications of findings in advancing mechanical ventilator technology and metrology. Provide recommendations for further research and development.

Recommendations and Future Work: Identify potential areas for future work or innovation, suggesting avenues for improving ventilator systems.

Documentation and Reporting: Prepare a comprehensive report or presentation summarizing methodology, findings, and conclusions.

DESIGN AND LAYOUT

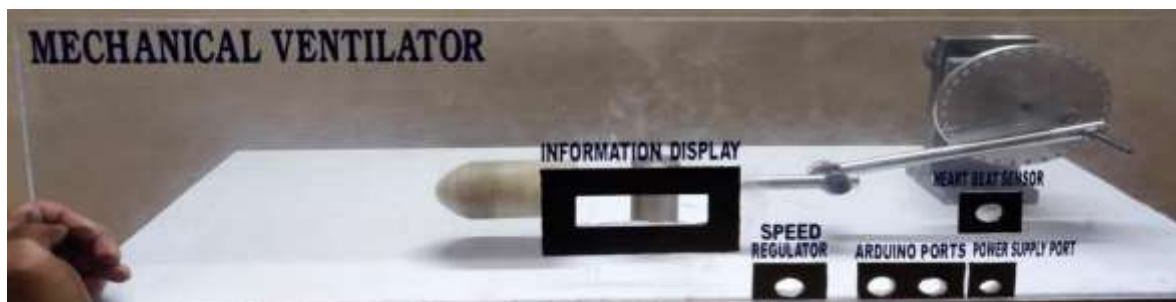
Working on lathe machine



Connecting rod and crank plate design



Outer body setup



Electronics**Reciprocate bag and Mask****Nut bolt and washer****Results**

1. This Mechanical Ventilator Uses Natural Air As A Working Medium And Doesn'T Require Oxygen Cylinder Backup.
2. 90% Cost Is Reduced As Compared To The Ventilators Available In Market.
3. Incase Of Power Cut, With The Help Of Resuscitator Bag,Oxygen Mask And Air Flow Pipe Can Be Used To Pump The Air To The Lungs Manually By Pressing Resuscitator Bag Again And Again To Save The Life Of Humamn Being.
4. This Mechanical Ventilator Is 90 % Portable And Efficient.

Advantages:

- **Life Support:** They Provide Life-Sustaining Respiratory Support For Patients Who Cannot Breathe Adequately On Their Own Due To Various Medical Conditions Or Injuries.
- **Controlled Breathing:** Ventilators Allow Healthcare Providers To Control And Adjust The Rate, Depth, And Timing Of Breaths, Ensuring Optimal Oxygenation And Ventilation.
- **Customizable Settings:** Ventilators Can Be Tailored To Meet The Specific Needs Of Each Patient, Such As Adjusting Oxygen Concentration, Pressure Levels, And Ventilation Modes.
- **Monitoring Capabilities:** They Come With Built-In Monitoring Systems To Track Vital Signs, Blood Gases, And Other Parameters, Enabling Healthcare Providers To Assess The Patient's Condition And Adjust Settings Accordingly.
- **Reduced Work Of Breathing:** Ventilators Can Relieve The Respiratory Muscles' Workload, Allowing Patients To Rest And Recover While Receiving Mechanical Support.
- **Long-Term Support:** Ventilators Can Provide Sustained Respiratory Assistance For Patients With Chronic Respiratory Failure Or During Prolonged Surgeries.
- **Emergency Response:** They Are Essential In Emergency Situations, Such As Respiratory Distress, Trauma, Or Sudden Cardiac Arrest, Where Immediate Respiratory Support Is Crucial For Patient Survival.
- **Enhanced Patient Comfort:** Modern Ventilators Are Designed With Features To Enhance Patient Comfort, Such As Humidification Systems, Noise Reduction, And Synchronized Breathing Modes.
- Overall, Mechanical Ventilators Play a Vital Role In Critical Care Medicine, Providing Essential Respiratory Support And Improving Patient Outcomes In Various Clinical Scenarios.

Disadvantages:

- **Risk Of Complications:** Prolonged Use Of Mechanical Ventilation Can Lead To Complications Such As Ventilator-Associated Pneumonia, Barotrauma (Injury Caused By Pressure Changes), And Ventilator-Induced Lung Injury.
- **Dependency:** Patients May Become Dependent On Mechanical Ventilation, Leading To Difficulties Weaning Them Off The Ventilator And Restoring Natural Breathing Patterns.
- **Invasive Nature:** Most Mechanical Ventilation Methods Require Invasive Procedures, Such As Intubation Or Tracheostomy, Which Carry Risks Of Infection, Airway Damage, And Discomfort.
- **Cost And Resource Intensive:** Ventilators Are Expensive Machines That Require Skilled Healthcare Professionals To Operate And Monitor, Making Them Resource-Intensive For Healthcare Facilities.
- **Discomfort And Compromised Communication:** Patients On Mechanical Ventilation May Experience Discomfort Due To The Presence Of Tubes And Constraints On Movement, And Communication Can Be Challenging While Intubated Or Connected To The Ventilator.

CONCLUSION

There Is Clear Technical Potential For Alleviating Ventilator Shortages During This And Future Pandemics Using Open Source Ventilator Designs That Can Be Rapidly Fabricated Using Distributed Manufacturing. The Results Of This Review, However, Found That The Tested And Peer- Reviewed Ventilator Systems Lacked Complete Documentation (With One Recent Exception) And That The Current Open Systems That Were Documented Were Either At The Very Early Stages Of Design Or Had Undergone Only Early And Rudimentary Testing (Although This Is Changing Rapidly). With The Considerably Larger Motivation Of An Ongoing Pandemic, It Is Assumed These Projects Will Garner Greater Attention And Resources To Make Significant Progress To Reach a Functional And Easily Replicated Open Source Ventilator System. There Isa Large Amount Of Technical Future Work Needed To Move Open Source Ventilators Up To The Level Considered Adequate For Scientific-GradeEquipment And Further Work Still To Reach Medical-Grade Hardware. Future Work Is Needed To Achieve The Potential Of This Approach NotOnly On The Technical Side, But Also By Developing Policies, Updating Regulations And Securing Funding Mechanisms For The Development AndTesting Of Open Source Ventilators For Both The Current Covid19 Pandemic, As Well As For Future Pandemics And For Everyday Use In Low-Resource Settings.

FUTURE SCOPE

The Global Mechanical Ventilators Market Is Currently Witnessing Strong Growth. Looking Forward, The Market Is Projected To Register a Cagr Of Around 6% During 2020-2025.

The Increasing Prevalence Of Chronic Obstructive Pulmonary Disease (COPD) And Respiratory Disorders Is One Of The Key Factors Driving The Growth Of The Market. Increasing Geriatric Population And Number Of Individuals Suffering From Other Ailments, Such As Diabetes, Hypertension And Cardiovascular Diseases (CVDs), Are Further Contributing To The Market Growth, As These People Are More Prone To Respiratory Disorders And COPD.

Additionally, Various Technological Advancements, Including The Development Of Portable And Non-Invasive Mechanical Ventilators, Are Driving The Product Adoption Rates In Both The Developing And Developed Economies. Manufacturers Are Equipping These Devices With High-Speed Signal Processing Systems And Making Improvements In The Design, Efficiency And Safety Measures Of The Equipment To Make Them More Patient-Friendly And Cost-Effective.

Other Factors, Including Improving Healthcare Infrastructure, Rising Awareness Regarding The Available Treatments For Respiratory Diseases And Extensive Research And Development (R&D) Activities, Are Projected To Drive The Market Further.

The Competitive Landscape Of The Industry Has Also Been Examined With Some Of The Key Players Allied Healthcare Products, Air Liquide, Asahi Kasei, Carefusion Corporation, Fisher & Paykel, GE Healthcare Company, Hamilton Medical AG, Maquet GmbH & Co. KG, Medtronic Plc, Mindray Medical International Ltd., Philips Healthcare, Resmed, Smiths Group Plc, Teleflex Inc., Etc.

Market Study Report Adds New Research On Ventilator Market, Which Is A Detailed Analysis Of This Business Space Inclusive Of The Trends, Competitive Landscape, And The Market Size. Encompassing One Or More Parameters Among Product Analysis, Application Potential, And The Regional Growth Landscape, Ventilator Market Also Includes An In-Depth Study Of The Industry's Competitive Scenario.

Global Ventilator Market Analysis, 2020 Market Research Report Depicts A Deep Dive Market Analysis Of Statistics Of Global Ventilator Market Which Consists Of Regional And Country-Wise Market Size, Forecast, CAGR Market Segmentation, Market Shares Of Diverse Regions And Countries, Market Share Of Various End-Users, Applications, Product Type, Technologies, Competitive Benchmarking, Etc.

According To Philips, Resmed, Medtronic, Becton Dickinson, GE Healthcare, Getinge, Air Liquide, Hamilton Medical, Smiths Group, Dräger, Fisher, And Paykel Are Few Of The Leading Covered In "Global Ventilator Market Analysis, 2020"