Historically, Dr. Bird might be said to be an issue of the U. S Army Air Corps where his initial interests in the mechanical ventilation of the lung and circulatory considerations were first introduced to him by his flight surgeon. This occurred during the development and airborne testing of a pressure breathing device for airmen during WW II.

Dr. Bird’s association with the US AAC School of Aviation Medicine involved the work of Dr. Harry Armstrong who is considered to be the “Father of Aviation Medicine”. To this end, Dr. Bird’s first textbook reference was a 1939 copy of Dr. Armstrong’s text on AVIATION MEDICINE. Over time and with endless tutoring by his flight surgeon and staff members of the School of Aviation Medicine, Dr. Bird was beginning to rationalize the importance of barometric pressure change and g forces on an airman’s physiology.

The physician who influenced Dr. Bird the most in his transitioning toward a medical education was Andre Cournand, M.D. This association started during a chance meeting during WW II when Dr. Cournand advised Dr. Bird he should become interested in biomedicine. At that time, Dr. Cournand described physiology as “God’s Engineering in the Body”. It was Dr. Cournand who later served to challenge Dr. Bird toward designing a magnetically controlled respirator using certain of his anti g suit regulator technology.

Dr. Bird’s learning curve in aviation medicine was greatly enhanced by his associations with the Altitude Chamber staff. Evolutionally, the next textbook that served to enlighten Dr. Bird was the comprehensive work of Fenn, Otis and Rahn. Theirs was a major treatise on physiology and clinical consequence. Here again, Dr. Bird had literally the best tutors (with great patience), including Dr. Rahn who was working on a Sampler Device creating cross interests in medicine and conceptual engineering.

Shortly after WW II, Dr. Bird had converted a military demand positive pressure airman’s breathing regulator, which allowed a manual positive pressure to be delivered to the airway with a Devilbiss #40 Nebulizer providing aerosol for deeper lung penetration.
Dr. Bird had made this therapeutic device for a close WWII friend’s father who had pulmonary emphysema. In the course of his medical education, Dr. Bird made a second prototype which he gave to Dr. Barach for his opinion relative to its clinical efficacy as opposed to nebulization alone.

Dr. Barach was a consultant to the Vaponefrin Company who made Racemic Epinephrine, the prominent bronchodilator of the time. Dr. Barach presented Dr. Bird with a textbook entitled the “Vaponefrin Aerosol Library” which he and a Dr. Munch of Temple University had completed for the Vaponefrin Company. Concomitantly, Dr. Barach introduced Dr. Bird to a principal of the Vaponefrin Company, Jess Smith, who was in the process of designing an advanced nebulizer. This proved to be an invaluable introduction which allowed Dr. Bird to develop a major learning curve about pharmaceutical aerosolization. It was Jess Smith who introduced Dr. Bird to many noted clinicians involved in the treatment of obstructive lung diseases.

Dr. Barach must be considered to be the Dean of chemomechanical (pharmaceutical / mechanical therapy) cardiopulmonary patient management. Dr. Barach’s contributions to cardiorespiratory care commenced in the early 1930’s.

Dr. Barach’s textbook, “Pulmonary Emphysema,” remains the classic, defining pulmonary emphysema and its consequences. When one examines the contributors to the textbook, it reads like “who’s who” in classical academic cardiopulmonary medicine.
Many of the contributors to Dr. Barach’s textbook on pulmonary emphysema were very helpful to Dr. Bird in the later development of the routine clinical protocols for the Bird “Mark Series” of medical respirators.

In 1951, Helmholtz and Fowler exposed the improper over use of IPPB, essentially stating that, “IPPB was a most expensive method of delivering a pulmonary aerosol”.

Dr. Barach made a major contribution to the design of the therapy breathing circuits used on the Bird respirators. This consisted of a mechanical Retard Cap on all Bird exhalation valves, which allows a variable expiratory flow retard to prevent the pulmonary airways of advanced COPD patients from collapsing during early passive expiration, reducing alveolar air trapping.

In the course of Dr. Bird’s diversified medical education he became acquainted with Dr. Robert Dripps, an anesthesiologist at the University of Pennsylvania. Dr. Dripps had organized a most unique congregation of highly knowledgeable research clinicians with major mathematical and physical understandings. Dr. Dripps introduced Dr. Bird to Dr. Julius Comroe, with whom Dr. Bird immediately found many mutual interests.

At that time, Dr. Comroe and a number of his colleagues were deeply engrossed in the creation of a pioneering text book with a unique method of introducing clinicians to “clinical pulmonary physiology” and the methodology of measuring pulmonary functions. Dr. Bird became enthralled with Dr. Comroe’s method of presentation, which later Dr. Bird would encompass as a style for his own presentations.

Dr. Comroe’s textbook, “The Lung,” became the eminent respected clinical introduction to pulmonary evaluation. His means of teaching clinicians cardiorespiratory physiology employed mathematics and physics in an understandable format, leading to mass acceptance of his classical presentations.
With an expanding knowledge of cardiorespiratory physiology, Dr. Bird was becoming interested in the pathological alterations in physiology induced by cardiopulmonary diseases. By good fortune, Dr. Bird was introduced to Dr. Hinshaw at Stanford University. Dr. Hinshaw was deeply involved in organizing and editing data toward the textbook entitled, “Diseases of the Chest”. This text became Dr. Bird’s greatest source of reconciling his understanding of the variants relating to cardiopulmonary pathologies.

Some years after WWII, after Dr. Bird had obtained a rather broad knowledge of general medicine with advanced understandings in cardiopulmonary pathophysiology, he became re-acquainted with Dr. Courmand at a Chest Seminar in Los Angeles. At that time, Dr. Courmand suggested that Dr. Bird employ the magnetic clutch arrangement he had developed for the anti g suit regulator in the development of a universal pressure limited medical respirator. This immediately stimulated Dr. Bird’s interests.

Apparently Dr. Bird stated to Dr. Courmand that, “while he had an extensive medical education, he had never attended a patient on his own recognition”.

Dr. Courmand’s apparent reply was, “If you can create a universal straight forward pressure limited assister controller respirator for clinical medicine, you will indeed be attending many patients as a medical educator”.

By that time Dr. Bird had a rather flexible military commitment with known commitments. This flexibility had allowed him to develop aeromedical research and development facilities on the former Palm Springs, California, Army Airfield. He immediately commenced work on creating a magnetically controlled respirator.

The Bird anti g suit regulator reduced the intracranial effect of g load during positive g maneuvers in jet aircraft, and served to decreased the “blackout effect”.

In order to employ it for a respirator, the magnetic clutch arrangement was positioned horizontally, with the superimposition of a diaphragm attached to the sliding valve assembly. The diaphragm was vented to ambient on the sensitivity side, and connected to the patient’s proximal airway on the pressure side.
The first magnetic assister respirator prototype used the magnetic clutch assembly and a diaphragm with a sensitivity and pressure adjustment.

The second magnetic prototype respirator was a refined assister. Both prototypes were completed within a year.

The third magnetic prototype was a more precise pressure limited respirator with a venturi oxygen air dilution system providing for fluidic clutching.

There was over a three year development period between the second and fourth Residual Breather prototypes, by which time the fourth prototype had become a pressure limited assister controller respirator. The assister controller feature would start the next programmed breath if the patient ceased assisted spontaneous breathing.
The first Residual Breather Circuits used a Vaponefrin nebulizer and a Barach variable mechanical retard on the exhalation valve.

The 1955 Residual Breather incorporated a number of the improvements discovered during patient studies with a number of earlier prototypes.

It was Dr. Courand who employed prototypes of Dr. Bird’s magnetically controlled respirator on patients who were iron lung dependent and required continuous mechanical ventilation. This great learning experience within New York’s Bellevue Hospital enabled the functional and clinical evaluations of the magnetically controlled respirator that led to the perfection of Dr. Bird’s Residual Breather Respirator on critical care patients.

Parallel to the Courand studies, Dr. Bird, with access to the USAF Wilford Hall Hospital, employed Residual Breather prototypes to develop confirming animal studies as well as the” people proofing” of his designs enabled by broad patient applications in the hands of average clinicians.

By 1957, the magnetically controlled respirator had gone through seven stages of development secondary to clinical studies to become the Bird® Mark® 7 respirator.

It was through Dr. Courand’s broad sphere of interests that Dr. Bird was to become initially acquainted with many of the world’s most knowledgeable individuals relative to cardiopulmonary functions, and who served to evaluate the Bird Mark 7 Respirators within their medical programs. Most of Dr. Bird’s initial medical educators were internists oriented toward cardiopulmonary medicine.
Anesthesiology soon developed a profound place in Dr. Bird’s clinical learning experiences. From these continuing experiences, Dr. Bird always claimed that the “educated hand” of the anesthesiologist on the anesthesia bag remains symbolic of all forms of the mechanical ventilation of the lung.

Following the rapid use of the Bird Mark 7 respirators world wide, a number of classical textbooks directed toward clinical “mechanical respiratory care” were published. One of the first texts published by anesthesiologists who were pioneering respiratory care was Dr. Peter Safar’s, “Respiratory Care”. Contributors to the Safar text represented a cross section of academic anesthesiology.

Another major contributing text from anesthesiology was the “Automatic Ventilation of the Lungs” by Mushin, Rendell-Baker and Thompson, which described how available mechanical ventilators functioned.
The demand for cardiopulmonary physiology accelerated, stimulating several qualified clinician researchers to advance what have become classical texts. Among these were:

Guyton’s “Textbook of Medical Physiology” was an all inclusive modern text reducing scientific studies to a level of understanding by the average clinician. This was followed several years later by Guyton’s classical treatise “Circulatory Physiology: Cardiac Output and its Regulation”.

Dr. Conroe’s textbook, “The Physiology of Respiration,” proved to be a classical companion to Dr. Guyton’s textbook on circulatory physiology.

During Dr. Bird’s clinical studies of his Residual Breather, he was honored by Dr. Penfield at Magill University Neurological Institute who allowed him to ventilate his neurosurgical patients. This was another great learning experience for Dr. Bird. During his studies with Dr. Penfield, Dr. Bird was able to spend considerable time with Drs. Bates and Christie who were developing an advanced text on “Respiratory Functions in Disease”. This became one of the true classical textbooks in the field of mechanical cardiorespiratory medicine.
In 1960 Dr. Bird founded the BIRD INSTITUTE OF BIOMEDICAL TECHNOLOGY with classrooms in the Bird Corporation complex on the Palm Springs, California, Airport. The curriculum was directed toward clinicians interested in managing patients with acute or chronic cardiopulmonary diseases. The unit was directed by John Raaphorst.

At that time, there were no comprehensive textbooks available covering chemomechanical cardiopulmonary care.

To this end Dr. Bird very carefully developed educational materials by extracting from standard classical medical textbooks where general consensus prevailed.

Subjects involving physics and mathematics were assembled and edited by Dr. Bird, paralleling typical college presentations.

The Bird Outpatient Clinic for patients with chronic cardiorespiratory diseases was staffed by physicians on sabbatical leave from their respective institutions. The goal of the research clinic was to develop advanced chemomechanical means to maintain chronic cardiorespiratory patients in their homes with an enhanced quality of life.

Many chronic cardiorespiratory patients gravitated to the dry climate of the California desert. For many years the clinic averaged about two hundred patients a day, which provided a large base of clinical data. All types of pharmaceutical aerosols were administered in various patient populations. The clinical facilities were funded by several agencies, pharmaceutical organizations and the Bird Corporation.

Essentially, the Bird Institute of Biomedical Technology was the prototype for later respiratory therapy schools. The educational data developed for classroom presentations and outside study was later employed in the early inhalational therapy schools.
The following Bird Corporation publications provided for basic curriculums:

PART I
A REVIEW OF PHYSICAL LAWS IN PREPARATION FOR PART II
RESPIRATORY PHYSIOLOGY

1. Mechanics
2. Tides
3. Speed and Velocity
4. Influence of Gravity
5. Force and Motion
6. Generation and Weight
7. Conservation of Momentum
8. Work and Power
9. Energy
10. Statics and Kinetics
11. Fluids
12. The Elements of Forces and Center of Gravity
13. Machines
14. Forces Involved in Circular Motion
15. States of Matter and Elasticity
16. Surface Tension
17. Viscosity
18. Density and Specific Gravity
19. Pressure in Flows at Rest
20. Resistance and Flow
21. Thermodynamics
22. Thermometry
23. Coefficient of Expansion
24. Expansion of Gases
25. Kinetic Theory
26. Colloidal State (mechanism of precipitation of salt crystals)
27. Heat Capacity
28. Change of State
29. Respiration and Exchange
30. Relationships Between the Four States of Matter

Using a clear format, the Bird Corporation of Palm Springs, California, has compiled this valuable outline taken from a Bird Institute lecture series. Some of the material is new and unique and all material is new and unique.

PART II
BASIC RESPIRATORY PHYSIOLOGY TAKEN FROM STANDARD TEXTS

The subject matter contained herein was condensed from a Bird Institute lecture series and is published by permission of the Bird Corporation, Palm Springs, California.

PART III
CARDIOPULMONARY MANAGEMENT WITH THE BIRD* RESPIRATOR

In the Physiology and Pathology of Acute and Chronic Cardiopulmonary Disease, Adjunctive and Pulmonary Chemotherapy in Control of Acute and Chronic Pulmonary Disease, and Pulmonary Therapy.

PART IV
DESIGN AND FUNCTION OF THE OUTPATIENT CARDIOPULMONARY THERAPY UNIT

THEORETICAL CARDIO PULMONARY CIRCULATORY DYNAMICS

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Some years ago Lucien Morris, M.D., a Waters’ alumni with many educational contributions to anesthesiology as well as equipment developments such as the Morris Copper Kettle for vaporizing anesthetic agents, presented Dr. Bird with a Tree of Lineage demonstrating the influence of Dr. Ralph Waters.

Dr. Waters created physicians who were among the great transitional educators in anesthesiology and later in acute cardiopulmonary care, with the founding of the Surgical Critical Care Units (SCCU) ultimately leading to modern critical care.

It will be M. Digby Leigh, M.D., who will historically be judged to be the “Father of modern Pediatric Anesthesia”. Dr. Leigh was a Ralph Waters, M.D., alumni who was most instrumental in Dr. Bird’s introduction to the mechanical ventilation of small babies.

THE PROTOTYPE VDR-4 ANESTHESIA VENTILATOR WITH AUTO GAS BALANCE

A LATE MODEL BIRD VDR-4A ANESTHESIA VENTILATOR
It was Dr. Leigh who clinically worked with Dr. Bird to finalize the Bird Mark 8 (push-pull) negative phase assistor controller respirator. Additionally, Dr. Leigh clinically assisted Dr. Bird toward perfecting the Universal Bird Mark 4 Anesthesia Respirator.

The Universal Bird Mark 6 Ventilator was the first combination minute and tidal volume ventilator with exhaled tidal volume presentation capable of ventilating critical patients with very low compliances. The Mark 6 Ventilator inherited the programming of the Bird Mark series respirators used to compress the bellows within the canister.
A very close colleague of Dr. Bird’s, Ray Ten Pas, M.D., (who was also a Waters’ alumni), first introduced Dr. Bird to Dr. Waters’ 1921 work on the influence of intrathoracic pressures upon cardiac output.

Academically, it was Robert Dripps, M.D (another of Dr. Waters’ alumni) who developed a literal research powerhouse of cardiopulmonary and renal textbook understandings. Dr. Dripps demonstrated to Dr. Bird that 25 cm H2O peak positive pressure, as prescribed by the AMA Physical Practices Committee for resuscitators, was obsolete. Dr. Bird accordingly developed two peak pressures on his magnetically controlled respirators. One was 50 cm H2O and the second was 150 cm H2O on his Bird Mark 9 Assister Controller. Dr. Bird then was able to literally ventilate the lowest compliance lungs capable of being mechanically ventilated.

Dr. Waters’ Pneumatic Systole concept is reality with Vesicular Peristalsis.
Later, Dr. Robert Dripps made it possible for Dr. Bird to evaluate his pneumatic systole devices on animals at Jefferson, and then terminal human patients at Penn. This ultimately led to Dr. Bird's routine “vesicular peristalsis” employed clinically with his intrapulmonary percussive ventilation concepts in his fourth generation Intrapulmonary Percussive Ventilation (IPV®) Percussionators®.

Dr. Bird has claimed to be a self styled Conceptual Technologist in aeromedicine. With effective dual medical and physical understandings he was able to project both clinical and physical logic into all of his concepts. Clinically, the Bird Mark 7 Respirator was just the beginning of a continuing series of novel mechanical cardiopulmonary ventilatory devices. Dr. Bird has remained with his analog fluidic logic based upon the fact that the mammalian ventilatory and circulatory systems are analog.

Dr. Bird has followed the cradle to the grave advances in cardiorespiratory medicine, advancing with the clinical state of the art. His “classical” generation of clinical researchers, as revealed in this historical resource compendium, were the true pathfinders in advancing mechanical cardiopulmonary ventilatory concepts to the present state of the art. When one peruses the classical literature and compares the data of yesterday to that of today, one can realize that certain of today’s published revelations are “reviews of the reviews” based upon the “classical” foundation developed by the first generation of cardiorespiratory investigators.

Dr. Bird’s aeromedical airborne research center pioneered modern day intensive care transport.

By 1980 Dr. Bird had conceived his “intrapulmonary percussive ventilation” concept which allowed the internal percussion of the pulmonary structures. This required certain expanded definitions.
DEFINITIONS AS THEY MAY RELATE TO THE PERCUSSIVE
DIFFUSIVE/CONVECTIVE
MECHANICAL VENTILATION OF THE PULMONARY STRUCTURES

CONTINUOUS MECHANICAL VENTILATION (CMV)- A mechanically programmed intrapulmonary tidal volume delivery based upon a scheduled volume with a selected cyclic delivery rate.

CONVECTIVE TIDAL VOLUME DELIVERIES- The delivery into the pulmonary structures of programmed volumes of a respiratory gas (measured in cubic centimeters) that exceed the anatomical dead space, favoring the wash out of carbon dioxide.

DEMAND CONSTANT POSITIVE AIRWAY PRESSURE (DEMAND-CPAP)- A pneumatically energized flow accelerator that is servoed by physiological proximal airway pressure change. A certain minimal proximal airway pressure is selected (such as 5 cm H2O) for maintenance during the spontaneous physiological expiratory phase, which additionally provides a mechanically programmed inspiratory flow acceleration to accommodate physiological inspiratory demand to reduce the work of spontaneous breathing. DEMAND-CPAP is a form of Inspiratory Pressure Support.

DIFFUSIVE SUB TIDAL VOLUME DELIVERY- The mechanical programming of repetitive intrapulmonary Percussive Volume Deliveries (measured in milliliters and/or cubic centimeters) that are less than the patient's anatomical dead space. Higher Frequency SUB TIDAL VOLUME deliveries favor diffusive activities within the pulmonary structures, enhancing oxygen uptake.

DIGITAL FREQUENCY MONITORING- A COMPONENT OF VDR MONITORING, pulsatile frequencies generated by a VDR device, can be presented in a traditional LED format.

DYNAMIC FUNCTIONAL RESIDENTIAL CAPACITY (D/FRC)- The average amount of gas remaining within the Pulmonary Structures during Oscillatory Equilibrium, when the Elastomeric and Frictional Forces within the Lungs are in Equilibrium with the Pulsatile Sub Tidal Volume Delivery Pressures, without further increase in Lung Volumes. (D/FRC) is resultant from either an Inspiratory or Expiratory Oscillatory Equilibrium.

EFFECTIVE ALVEOLAR VENTILATION- The amount of physiological tidal exchange delivered into peripheral pulmonary structures during effective intrapulmonary diffusion and perfusion.

EXPIRATORY INTERVAL- A COMPONENT OF VENTILATORY PROGRAMMING, describing the scheduled time at a selected baseline between repetitive Inspiratory Oscillatory Intervals.
FAILSAFE SENSITIVITY- VDR HIGH PRESSURE FAILSAFE SECURITY PROVISION, guarding against an internal ventilator failure and/or an obstructed Phasitron delivery tubing. Whenever the Phasitron delivery pressures exceed the selected pressure rise for approximately two (2) seconds, an aural alarm is sounded concomitant with a regulated drop in patient delivery pressures. The Failsafe Sensitivity selection determines the sustained pressure required (within programmable limits) within the patient servoing circuit to provoke a pressure rise alarming.

FUNCTIONAL RESIDUAL CAPACITY- The amount of gas remaining within the Pulmonary Structures at the end of Passive Exhalation, when the Elastomeric Forces within the Lung are in Equilibrium with Ambient Pressures.

GROSS TIDAL VOLUME- A COMPONENT OF VDR PROGRAMMING, relating to a passive convective intrapulmonary gas exchange, realized during the programmed Expiratory Interval, when Percussively elevated Lung Volumes, are decreased to the programmed Baseline.

HIGH FREQUENCY PULMONARY VENTILATION (HFPV)- A loose definition of methods employed in attempting to create a greater diffusive (mechanical mixing) component during intrapulmonary ventilation than would normally be expected with conventional mechanical lung ventilation (CMV).

"i/e" PULSE RATIO- A COMPONENT OF VDR PROGRAMMING, expressing the pulsatile (sub tidal volume) flow/no flow relationships in milliseconds. Valve open -flow time/valve closed -no flow time.

INTEGRATED MANOMETER- A COMPONENT OF VDR MONITORING, whereby a rotary switch allows the selection of a highly dampened integrated proximal airway pressure. The manometric mechanism is calibrated with a time constant well beyond repetitive (cyclic) programming. Information is clinically significant in determining the efficacy of the selected program in terms of "mean functional pressures" as they reflect upon blood gases and cardiac output.

INTERMITTENT MANDATORY VENTILATION (IMV)- A mechanical ventilatory program scheduled to deliver a certain number of controlled tidal volumes per minute while allowing the patient to breathe spontaneously with a reduced work of breathing provided by mechanical pressure support, etc.

INTRAPULMONARY PERCUSSION- A method of delivering repetitive high velocity bursts (sub tidal volumes) of respiratory gases into the proximal physiological airway, with precise pneumatic control over pressure/flow/volume relationships for maximum bilateral intrapulmonary distribution while impaction forces are maintained below "stretch receptor" threshold and barotraumatic potentials.
INTRAPULMONARY PERCUSSIVE VENTILATION (IPV expanded)- A cyclic method of controlled percussive intrapulmonary (sub tidal) breath stacking, increasing the existing Functional Residual Capacity of the pulmonary structures to a selected level (pulsatile equilibrium) at which point repetitive sub tidal volume delivery does not further increase lung volumes. Each percussive inspiratory interval (timed in seconds) is associated with percussive, diffuse intrapulmonary gas mixing concomitant with aerosol delivery; followed by passive exhalation of a Gross Tidal Volume to a selected baseline.

INTRAPULMONARY PERCUSSIVE VENTILATION (IPV)- A mechanical means of introducing (aerosol laden) successive sub tidal intrapulmonary breath stacking, reaching a controlled percussive Apneustic Plateau within the pulmonary structures, for the purpose of endobronchial secretion mobilization and the resolution of associated atelectasis.

JET INSUFFLATOR (VENTILATOR)- A mechanical device usually consisting of a Solenoid Valve, with control over valve opening and closing ratios, as well as over the flowrate of pulsatile gas delivery into the physiological airways through an uncuffed indwelling airway catheter (with a tip located) immediately above the Carina.

MANOMETRIC DAMPENING- A COMPONENT OF VDR MONITORING, A method of dampening the needle of a manometer looking at proximal airway pressure change during VDR programming. A standard calibration provides the clinician with a "mean pressure interpretation" of the phasic pressure alterations at the physiological proximal airway.

MECHANICAL PULSE GENERATOR (FLOW INTERRUPTER)- A pneumatically energized, diaphragm controlled, differential flow valve for the controlled cyclic interruption of a pressure/flow regulated respiratory gas.

MINUTE VENTILATION- The amount of mechanically delivered respiratory gas (measured in liters) cyclically delivered into the pulmonary structures each minute.

OSCILLATORY APNEUSTIC PLATEAU- is resultant from an Oscillatory Inspiratory Equilibrium, after the Inspiratory Increase in Lung Volume has been satisfied, and the lung is being ventilated by Percussive Sub Tidal Volume deliveries through an Inspiratory Pressure Wedge; without a further increase in Lung Volume.

OSCILLATORY DEMAND CONSTANT POSITIVE AIRWAY PRESSURE (OD-CPAP)- A COMPONENT OF VDR PROGRAMMING, allowing the selection of an Oscillatory Expiratory Baseline while maintaining a Positive End Expiratory Pressure with an Inspiratory Flow Acceleration to assist a Spontaneous Inspiratory Effort.
PERCUSSION/BASELINE RATIO (P/B RATIO)- A COMPONENT OF VDR PROGRAMMING, expressing the ratio of the PERCUSSIVE sub tidal (inspiratory) interval in relation to the time at BASELINE (expiratory) interval. A method of describing the VDR CONVECTIVE I/E RATIO.

PHASING RATE- A COMPONENT OF VDR PROGRAMMING, describing the number of cyclic inspiratory/expiratory intervals per minute counted as Convective Returns to a programmed Expiratory Baseline.

PHYSIOLOGICAL DEAD SPACE- A pulmonary unit that is void of cyclic gas exchange, diffusion across the alveolar membranes, perfusion of the pulmonary capillaries and/or any combination thereof.

POSITIVE DISPLACEMENT OSCILLATOR VENTILATOR- A mechanical piston type device with a reciprocating relatively fixed stroke, causing (to and fro positive and sub ambient) displacements of a respiratory gas into and out of a mechanical breathing circuit. A biased proximal airway inflow and outflow is often employed to control the circulation of respiratory gases.

PRESSURE LIMITED VENTILATION- A peak inspiratory pressure limit (measured in cm H2O) established to limit the maximum delivery pressure within the pulmonary structures during the mechanical ventilation of the lung.

PRESSURE RISE AND FALL ALARMING- VDR HIGH and LOW PRESSURE FAILSAFE SECURITY PROVISIONS, available systems to monitor and alarm on a rapid or sustained proximal airway pressure rise. A battery operated HI/LO SIG-ALERT selectable time related pressure drop can provoke an alarm as well as a pressure rise above a programmed value. Additionally, a Wave Form Monitor (MONITRON®) can perform a similar task with programming accomplished on a CRT.

PROXIMAL AIRWAY PRESSURE- A sampling point adjacent to the physiological airway where mechanical and/or physiologically altered pressures are recorded. Proximal airway pressure alterations provide the pulmonary (proximal/distal) pressure gradients for potential intrapulmonary inflow and outflow.

PROXIMAL AIRWAY WAVE FORM ANALYSIS- A COMPONENT OF VDR MONITORING, whereby proximal airway pressures are directed against a transducer with sufficient speed capacities to relate the rapid pressure changes associated with VDR/IPV scheduling. Therefore, a means for presenting Proximal Airway Pressure changes on a cathode ray tube (CRT) are enhanced. Desirable pressure scales and sweep speeds can be selected, allowing the Clinician to program and interpret Proximal Airway Pressure potentials as they may affect physiological parameters. Additionally, proximal airway pressure tracings can be documented on strip chart recorders.

PULSATILE AMPLITUDE and/or PULSATILE FLOWRATE- A COMPONENT OF VDR PROGRAMMING, describing the (proximal airway) pressure rise during selected sub tidal volume deliveries, secondary to the programmed flowrate of respiratory gases, delivered from the orifice of the Phasitron.
PULSE (PERCUSSIVE) FREQUENCY- A COMPONENT OF VDR PROGRAMMING, describing the number of Pulsatile Sub Tidal Volume deliveries per minute.

VDR "I/E" RATIO- A COMPONENT OF VDR PROGRAMMING, describing the ratio between the length of time (in seconds) that sub tidal volumes are intrapulmonarily delivered (OSCILLATORY INSPIRATORY INTERVAL) to the length of time a scheduled interruption at baseline (EXPIRATORY INTERVAL) is programmed. Oscillatory Inspiratory interval/expiratory interval.

VDR/IPV PERCUSSIONATOR/VENTILATOR- A mechanical device capable of delivering sequential percussive bursts (sub tidal volumes) of a selected respiratory gas, with flow generated at the proximal physiological airway for delivery into the pulmonary structures, through a mechanical/physiological interface (combination injector exhalation valve) called a Phasitron. A Sinusoidal Pressure change pattern can be programmed.

VOLUME LIMITED VENTILATION- A selected volume (measured in milliliters) programmed for intrapulmonary delivery under a preselected pressure limit, whereby the mechanical ventilator will cycle on either the selected volume and/or pressure limit, based upon which limit is first reached.

VOLUMETRIC DIFFUSIVE RESPIRATION (VDR expanded)- A cyclic method of precisely controlling the intrapulmonary delivery of successive (aggregate) sub tidal volumes to a selected equilibrium (increase in lung volume) ultimately reaching an Oscillatory Apneustic Plateau (Oscillatory Equilibrium), followed by the passive exhalation of a gross tidal volume down to a programmed static and/or pulsatile baseline.

VOLUMETRIC DIFFUSIVE RESPIRATION (VDR)- A Sinusoidal Wave Form applied against the physiological proximal airway to more independently (mechanically) control PaO2, PaCO2 and Cardiac Output.

NOTES: