Dr. Bird still had military access to the U.S. Air Force medical facilities which he had traditionally employed to evaluate his clinical concepts. This would greatly facilitate compliance with the then immature FDA Medical Device act dictates.

By early 1980, Dr. Bird had completed a novel time cycled Military Transport Respirator (TXP®). This led to the further prototyping of a percussive means of ventilating the lung based upon Bernoullian and Newtonian fluid dynamics.

While Dr. Bird had the general technology required for a high frequency percussive ventilation of the lung, he still had not resolved the “Achilles heel” of the concept in terms of obtunding the pulmonary airway stretch receptors.

There remained two unsolved required components to possibly resolve the “stretch reflex” handicap. One was to create a pneumatically servoed valve that would near instantaneously completely open and close at frequencies of over 1000 cycles per minute. The completion of the differential cartridge in itself was a major breakthrough in fluidic technology.

The other challenge was to create a combination pneumatically servoed injector exhalation valve that would near instantaneously open and close to form a “flow interrupter” in combination with the fluidically servoed valve.

After petitioning the FDA for a device exemption (IDE), Dr. Bird established the (family owned) Percussionaire® Corporation to later market the perceived line of Intrapulmonary Percussive Ventilatory devices and their accessories.
By 1981, the fourth generation prototyping of a percussive design concept was being totally conducted at the Forrest M. Bird (dba) Bird Space Technology research facilities in Idaho. In lieu of a combination injector exhalation valve Dr. Bird was employing a gated venturi to continue his research. This limited the cyclic frequency to about 200 cycles per minute without creating a design mandated inadvertent PEEP. With a functioning Percussionator design, Dr. Bird petitioned the U S FDA for an Investigational Device Exemption (IDE). This initially covered Dr. Bird’s projected Therapeutic Intrapulmonary Pulmonary Ventilation (IPV®) concepts.

By 1982, prototype Intrapulmonary Percussive Ventilation (IPV®) devices, along with a critical care version called Volumetric Diffusive Respiration (VDR®), were being investigated on animals within the Air Force’s Willford Hall medical facilities. By late 1982, prototype devices were used on terminal patients with certain promising outcomes. As could be expected with such a diverse conceptual undertaking, there were many irritating “voids” to resolve. Gradually, a new investigative aeromedical “state of the art” was being created with considerable favorable clinical results.

Dr. Bird continued to search for a common injector exhalation valve that would cycle at rates of 1000 cycles per minute with a sub clinical inadvertent PEEP.

The percussive oscillatory wave format of the original IPV® venturi with a distal gate, limiting percussive oscillation to about 150 cycles per minute.

After well over two years of research, Dr. Bird conceived the logic for a reciprocating injector exhalation valve he would call a Phasitron®. It would take another year to perfect the venturi geometry and diaphragmatic servoing to obtund the Hering Breur reflex.
By early 1982, prototype Intrapulmonary Percussive Ventilation (IPV®) devices along with a critical care version called Volumetric Diffusive Respiration (VDR®) were being investigated on animals within the Air Force medical facilities. By late 1982, prototype devices were being used on terminal patients with certain promising outcomes.
As could be expected with such a diverse conceptual undertaking, there were many irritating issues to resolve. Gradually, a new investigative “state of the art” was emerging, with considerable favorable clinical results.

By 1984 the FDA clinical studies were underway in over thirty diverse medical facilities to obtain required clinical data for FDA submission. The differential flow timing cartridges and the Phasitron® (injector exhalation valves) were all being made by hand without the ability to clone functions without potential random failures.

By 1988 the original VDR-1/2 matrix device was re-designed to facilitate operational reliability and operational ease. This model was designated as the VDR-4. Production tooling had been completed with a high degree of manufacturing cloning ease.

Modules extracted from the multi cartridge VDR® matrix device would provide for four families of percussive ventilatory devices including:

THE FAMILY OF MILITARY TRANSPORTER® TXP® VENTILATORS.

THE FAMILY OF INTRAPULMONARY PERCUSSIVE VENTILATION (IPV®) CARDIOPULMONARY THERAPY DEVICES.

THE FAMILY OF VOLUMETRIC DIFFUSIVE VENTILATION (VDR®) FOR HIGH FREQUENCY PERCUSSIVE VENTILATION (HFPV™)

THE OSCILLATRON VENTILATOR FOR HIGH FREQUENCY PERCUSSIVE OSCILLATORY VENTILATION (HFPOV™).

NOTES: