Appendix 14 – The Computerized Exercise Machine System

Chapter 14: The Ariel Computerized Exercise Machine System

By Gideon Ariel Ph.D. - The Inventor

I have discussed previously my association with the Universal Gym Exercise Company. I was involved with them for about 8 years and helped to design the most advanced exercise system of the time. However, the designs were for equipment constructed of metal with cams to provide resistance that varied throughout the exercise movement. This was an appropriate type of exercise equipment for a gym, school, or athletic setting which could be used by many people continuously all day long. Many of the people who trained on this type of equipment were young and, frequently, insensitive or uncaring about the wear and tear on the systems. For this reason, the equipment had to be rugged and able to sustain the stress and abuse of the exercising public. The Universal Gym equipment was designed specifically for this marketplace and the type of exercise users who, in general, were indelicate when working out on the equipment. (See Appendix 1).

For its time and place in the world of exercise, the Universal Gym equipment, which employed the dynamic variable resistance (DVR) system, was the best training device available. However, there were some limitations even for this advanced system. For one thing, the cam provided only a fixed pattern of adjustment. However, if you wanted to change the form of the exercise, you were unable to make any alteration. You could not swap different cam shapes into and out of the equipment if you wanted to follow a different movement path. Another limitation was the inability to accelerate at the end of the exercise movement. You could not because of the rigid and inflexibility in the hardware. If you wanted an isometric contraction at the midpoint of the exercise, it was impossible for the cam to provide this option.

The Universal Gym Equipment with DVR (Dynamic Variable Resistance)

The Universal DVR machines were fantastic in the 1970s and are still providing superb exercise into the 21st Century. But I was sure that could be better and smarter machines which could provide improved exercise benefits. I had not found any but in my mind, I was confident that I could create something that would fill the void. I concluded that I would have to invent something. Ever the optimist and with dogged determination, I pondered and considered a number of ideas that might work.

One possibility would be to use air in closed cylinders to provide resistance. However, there were problems with using air: (1) the amount of pressure could not be regulated or calibrated; (2) the system would have to be pressurized at all times; (3) pressurizing the system which would require electrical connections; and (4) air can only be compressed. What if there were leaks in the cylinders or the pressurized lines which delivered the air? What would happen during an electrical failure? How would you provide for each movement direction? Since air cannot be stretched, there would have be two cylinders for an exercise such as a bicep extension-flexion exercise.

I reconsidered another proven system to provide exercise that provided increased and decreased forces throughout the exercise movement. These were "stretchy" devices like the ones I had developed during my brief time at Indiana University in Bloomington. When I was a student and the assistant track coach at Indiana

University, I had taken several different lengths of surgical tubing from the medical school, attached handles at one end and fixed the other end to the wall. These simple tubes were unbelievably fantastic for three dimensional joint movements and the more the tube was stretched, the greater the resistance to the muscle. In addition, they were light and easily portable. Unfortunately, they could not be calibrated so the person exercising had no idea how much force he or she was exerting.

Surgical Tubing as Exercise Device (I first came with this idea in 1968)

One day during my regular exercise routine, I was raising and lowering a barbell in a bicep curl. It was very easy to lift the weight at the beginning of the exercise when my arm was down with the barbell in my hand. However, as I bent my elbow the weight was increasing more difficult to lift until after I had passed the halfway point with my elbow at ninety degrees. As I continued the curl, the weight again seemed easier to lift as the hand and weight approached my shoulder. The same problem occurred in reverse as I lowered the barbell.

I concluded that what I really needed was a little magic "genie" to add and remove weight from a bar, such as the barbell, while the exercise was in progress. I imagined that there was a little magic "genie" who could add weights incrementally when it was easy for me and remove weights when I struggled to raise the bar. In other words, the "genie" could add or remove some of the load during the exercise so that the load adjustments would be fine-tuned to the person performing the exercise. My "eureka" moment occurred as I realized that I needed the exercise device to adjust to the person rather than the person having to adjust to the equipment.

These thoughts whirled around in my head. I had long ago recognized the limitations of traditional equipment. I had perceived a way to improve on exercising. Now I had to find a way to make the equipment smart enough to adapt to the individual. This would take more time and brainpower to solve. I had to find a solution to adjust to the continuous changes between levers (bones) and the load so that exercise is optimized, as well as a method for regulating and recording these adjustments. I needed to invent a system with a brain.

At that time, all of the existing resistive training equipment were merely "tools" which lacked intelligence. The equipment was "unaware" that a subject was performing an exercise on it. The human brain can sense touch, see objects in motion, determine smells, tastes, and sounds and act according to the sensory inputs. No exercise hardware could function like a human because none had "brains". How could I give an exercise device this "thinking" capability?

My initial thinking led me to the consideration of the human body's use of closed loop feedback and sensory capabilities. This neurological and muscular system provides people with the ability to execute large and fine motor skills. Much of the control was at a subconscious level such as breathing, walking across the room, and chewing food. Other tasks necessitated great cerebral attention such as running down a runway for the pole vault in track and field or manipulating the dials on an electronic device. These capabilities did not exist on any fitness training equipment.