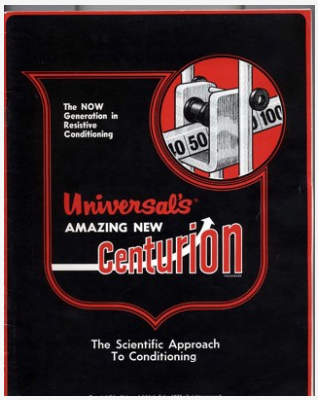
Universal's Amazing New Centurion

The first scientific exercise machine in the World.



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Below find a reprint of the 32 relevant pages of the article "Universal's Amazing New Centurion" in "Universal Centurion":

The NOW Generation in Resistive Conditioning

Universal's AMAZING NEW Centurion

TRADEMARK

The Scientific Approach To Conditioning

Introducing the new Universal® Centurion

TRADEMARK

A revolution in Conditioning Concept, Machine Design, and Exercise Efficiency

For nearly two decades, UNIVERSAL has been recognized as a leader in the field of resistive exercise and conditioning.

UNIVERSAL has greatly contributed to the physical well-being of man and has enabled millions to discover new realms of self-improvement. This success has increased the public's general acceptance of the resistive approach to conditioning.

Further reflections of UNIVERSAL's existence can be seen in the continual development of better and more effective methods of conditioning. For the most part, the new developments paralleled the changes in man's technological evolution.

Current advancements in research technology have enabled UNIVERSAL to develop a new conditioning machine which is a major breakthrough in the field of resistive training.

It is now our foremost concern that you be informed of the true significance of this unique achievement. The total impact of our accomplishment can only be understood after one has become aware of the many complexities involved in its development.

Due to the diversities in the readers' scientific backgrounds, we have attempted to explain these complexities in simple non-technical terms and illustrations, and yet, in a manner not detracting from the significance of this new conditioning achievement.

To understand the UNIVERSAL CENTURION it is necessary to understand... first (1) **The basic fundamentals of muscle performance**... and secondly (2) **How the evolution in both conditioning theory and equipment design have attempted to deal with this muscle performance.**

Now for the facts...

THE BASIC FUNDAMENTALS OF MUSCLE PERFORMANCE

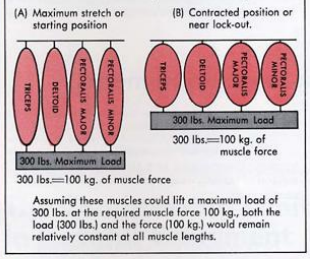
The natural changes occurring in the human lever system during all movements are primarily responsible for the different levels of muscular involvement. In order to maintain the same degree of muscular involvement throughout a movement it is necessary to accurately accommodate these changes.

The difficulty in successfully accomplishing this requirement can better be understood by examining the general effect of this natural phenomenon in a common bench press exercise.

If one could remove from the body the muscles active in a bench press movement, it would be possible to determine the actual force ranges generated by these muscles. The force ranges would vary from a light to a heavy load as a result of different levels of muscle fiber recruitment.

After determining the muscle's maximum load (or resistance) it is possible to observe that the muscles remain capable of moving this maximum load, regardless of their relative length or degree of stretch. In other words, contrary to past belief, the relative force produced by a muscle does not significantly vary due to its constantly changing length.

Illustration: The prime movers in the bench press movement (detached from body).

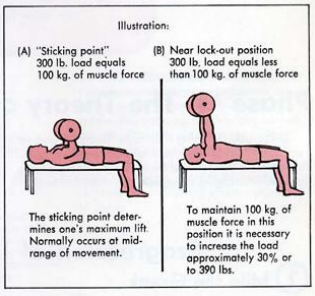


Assuming these muscles could lift a maximum load of 300 lbs. at the required muscle force 100 kg., both the load (300 lbs.) and the force (100 kg.) would remain relatively constant at all muscle lengths.

Important:

However, when these muscles are returned to the human link system some changes in muscle performance occur. The muscular force now varies at different locations throughout the range of movement while lifting the same maximum load. This variation in muscular force results from the bio-mechanical advantages and disadvantages occurring in the human lever system. When the human lever is in the position of its greatest biomechanical disadvantage, commonly referred to in weight-training as the "sticking point", maximum muscular effort is required to move the load. However, when the human lever is in the position of its greatest advantage or near lock-out position, the required muscular force is greatly reduced in order to lift the same maximum load. Therefore, the advantages and disadvantages created by the human lever system account for the differences in muscle force.

Illustration:



Conditioning Significance:

In order to insure ultimate conditioning effectiveness, it is necessary to accurately vary the resistance. The variations in resistance intensity must occur only when there are biomechanical advantages or disadvantages which either decrease or increase the required muscular efforts.

By varying the resistance accurately it is possible to maintain the same degree of muscular involvement (effort) throughout the entire range of movement.

Understanding these requirements, it is now possible to assess the various conditioning theories and equipment in order to determine their degree of conditioning effectiveness.

THE EVOLUTION OF CONDITIONING THEORIES AND EQUIPMENT DESIGN

The following conditioning theories and equipment have been assessed in accordance to their ability to provide optimum conditioning benefits. Optimum conditioning benefits can best be defined as...

> The ability to provide for maximum muscular taxation throughout the complete range of movement in such a way as to optimize human performance.

Phase #1 - The Theory of Isotonic Conditioning

Isotonic conditioning is perhaps the oldest, and yet, remains the most widely used form of resistive conditioning. This conditioning theory simply refers to any constant unchanging resistance that is applied to a moving body segment while the muscle undergoes its natural shortening on contractile process. This basic form of conditioning can be traced back to man's first real attempt at resistive training.

Progression of Isotonic Equipment

① Milo the Greek

Milo's Primitive Squat

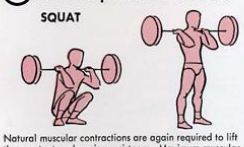
Although this was a primitive form of conditioning, natural muscular contractions were required to lift this growing calf (constant unchanging resistance). However, maximum muscular efforts are required only at the "sticking points" which normally occur at the initial starting positions and continue through the mid-range of the movement.

Milo's was the first recorded attempt at resistive training. Unknowingly, both his equipment and method of training were a primitive form of isotonic conditioning.

For centuries man continued to resort to these primitive forms of resistance. Then, with the beginning of the 1900s, the adjustable barbell was introduced as the first true advancement in functional equipment. This was to be the beginning of more rapid improvements in equipment design; however, future equipment improvements failed to change the general conditioning effects of isotonics.

② The Adjustable Barbell

SQUAT



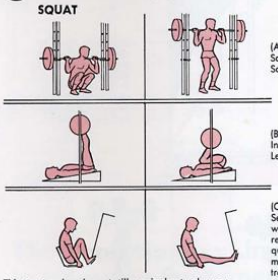
Natural muscular contractions are again required to lift the constant unchanging resistance. Maximum muscular efforts occur only at starting position through mid-ranges of motion.

The adjustable barbell provided a more accurate and simpler means of selecting resistance. However, barbells still remained a time consuming and somewhat hazardous means of conditioning.

"A common barbell hazard."

③ Structured Equipment

SQUAT



(A) Safety Squat Rack

(B) Inverted Leg Press Rack

(C) Seated Leg Press with selectorized resistance — quicker, safer and more comfortable training.

In the late 1930s and early 1940s structured resistive equipment began to appear as the first means of controlling movement, and thereby reducing the previous barbell hazards. Progress in equipment design continued to evolve around the development of easier and more comfortable means of training. Despite this progress, the general conditioning effects remained the same.

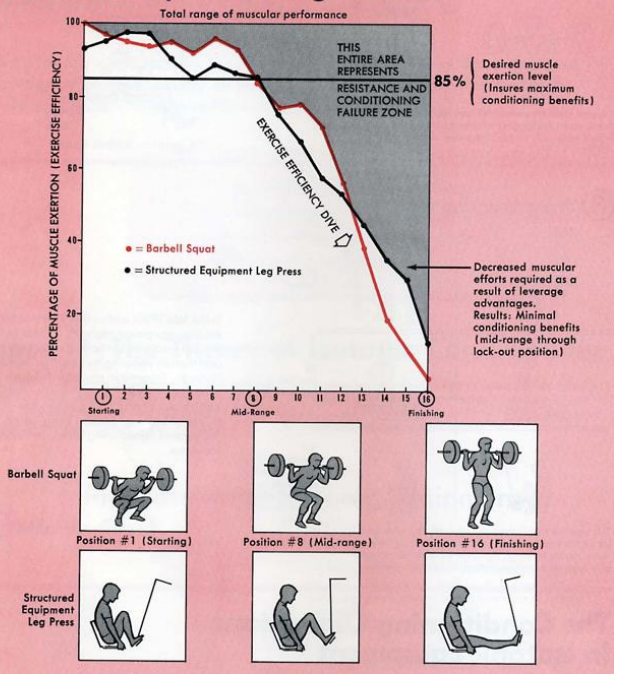
This structured equipment still required natural muscular contractions to lift the constant unchanging resistance. Again, however, maximum muscular efforts occur only at starting position through mid-ranges of motion.

The Conditioning Limitations In Isotonic Equipment

Isotonic conditioning remains beneficial for the development of new levels of strength, however, it fails to provide for optimum conditioning benefits. In isotonic conditioning the load or resistance is moved through a range of motion. This resistance remains constant throughout the motion but the muscular force is not constant because of the modifying effects of the lever system. Therefore, the muscle is working at its maximum potential during a very small range of motion, resulting in a vast waste in total muscle performance.

This conditioning deficiency can best be revealed by examining the actual muscular force curves for an isotonic squat and a leg press exercise (next page).

Muscular Force Curves for Isotonic Squat and Leg Press



These muscular force curves reveal the true muscular exertions as they occurred in the actual dynamic squatting and leg press movements from start to finish. Computerized Biomechanical Analysis was the scientific research method used to determine the actual muscular forces.

CONCLUSION

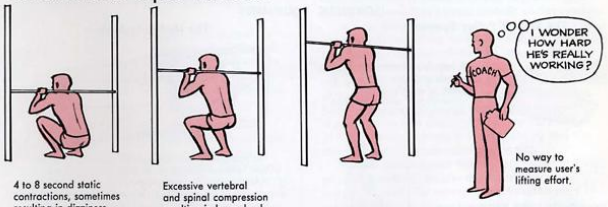
Isotonic resistance does not accommodate man's biomechanical changes as they occur throughout the range of motion, thereby, limiting maximum conditioning benefits to a small range of motion.

Phase #2 - The Theory of Isometric Conditioning

Isometric conditioning was introduced in an attempt to overcome the previous conditioning deficiencies. In general, the basic theory involves the use of static muscle contractions against a load or resistance which is immovable. Thus, the muscle attains maximum tension, however, only intermittently as the muscle length remains constant. It was theorized that a series of static contractions performed at different joint locations would develop greater strength levels by adequately accommodating man's biomechanical changes. However, despite its apparent good intentions, isometric conditioning was seldom if ever used and soon vanished in the field of conditioning.

A COMMON ISOMETRIC TRAINING STATION

The Isometric Squat Exercise



4 to 8 second static contractions, sometimes resulting in dizziness due to extreme elevation in blood pressure.

Excessive vertebral and spinal compression resulting in lower back discomfort and pain.

No way to measure user's lifting effort.

There was no way to condition every joint angle in a single movement, therefore, training usually was limited to static contractions at the starting, mid-range, and near lock-out positions.

The Conditioning Limitations In Isometric Equipment

To begin, isometric training fails to provide for optimum conditioning benefits. This failure occurs as a result of its inability to condition a muscle while undergoing movement. The inhibition of joint movement prevents the natural, ballistic motion of body segments from occurring. In highly skilled athletic movements the ballistic coordination of specific muscle groups is essential for successful performances. Although isometric training may increase muscular intensity at isolated joint angles, it eliminates essential neuromuscular integration, resulting in a loss of efficiency in the ballistic action of human muscles. More complete details on this essential conditioning principle will be covered in a following section.

Furthermore, isometric conditioning frequently causes extreme joint discomfort due to excessively high bone and joint compression. Generally, the equipment used in isometric conditioning does not provide for adequate postural support. For example, the standing isometric squat rack causes extreme force to be centered on the vertebral column causing lower back pain and discomfort. Degenerative and traumatic lesions of the spine may occur from this type of conditioning.

Another failure of isometrics is its inability to maintain important conditioning enthusiasm. Isometric training provides no meaningful method of determining self improvement nor does it stimulate complete mental concentration for the recruitment of new muscle fibers.

Considering all of these factors, isometric conditioning falls short of being the "ideal" method of conditioning for athletes.

Phase #3 - The Theory of Isokinetic Conditioning

The theory of isokinetic exercise appeared as the first practical approach toward improving general muscular performance.

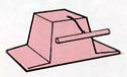
The word isokinetic simply refers to the maintenance of the same (ISO) force in a muscle throughout a complete joint movement. The muscular activity is similar in nature to that in isotonic conditioning. However, the improvement in muscular efficiency results from isokinetics' control of the exercise speed rather than the control of resistance or joint movement.

An external lifting device is used to hold the speed of body movements to a constant fixed rate regardless of the variations in muscular force. This fixed rate of movement eliminates the dissipation of muscular force or energy that normally occurs when there is acceleration in movement. The muscular force is now converted into the resistive force and remains proportionate to its actual input which varies according to the efficiency of the skeletal leverage position. Therefore, the harder one pushes the greater the resistive force. This mechanical technique of controlling the speed of movement enables greater development of muscular strength and endurance.

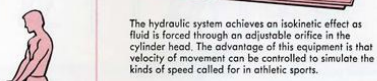
Despite this improvement in muscle taxation, isokinetics is not the perfect approach to muscular training.

ISOKINETIC EQUIPMENT

The Rope & Pulley System



A centrifugal braking device retards and controls the speed of exercise thereby automatically accommodating the muscular efforts.



The Hydraulic System

The hydraulic system achieves an isokinetic effect as fluid is forced through an adjustable orifice in the cylinder head. The advantage of this equipment is that velocity of movement can be controlled to simulate the kinds of speed called for in athletic sports.

However, this system is limited to one training speed, and there is no accurate means of determining the degree of lifting force. Also, frequent repairs are required by both the plastic pulley wheels and rope.

Gauge: measures and records the lifting force.

The Conditioning Limitations In Isokinetic Equipment

Isokinetic exercise is clearly an advanced method of conditioning, however, it still fails to provide the optimum in conditioning benefits. This imperfection is a result of isokinetic's major alteration of the natural ballistic characteristics of motion.

When exercising it is extremely important to maintain the natural ballistic characteristics of motion in order to insure the improvement and development of functional athletic strength and endurance. Muscles learn by doing and they learn to move quickly by the continuous lifting of heavy loads performed in a fast and explosive manner. Unfortunately, isokinetic exercise is restricted to slow constant speeds and therefore may eliminate the muscle's acquisition of ballistic skills. This is an extremely important training principle that must be considered in the design of all exercise equipment. More complete facts on this subject are provided in the following article "Locomotor Principles Underlying Athletic Performances."

Isokinetic exercise is further limited by its inability to maintain important training enthusiasm. Similar to isometric training, isokinetics has difficulty measuring actual strength improvements. In addition, the lack of a true resistance (dead weight) enables the user to cheat in his lifting efforts. This shortcoming has greatly reduced isokinetic's current use among weight lifters.

Finally, there is a lack of pertinent evidence to substantiate how slow the exercise speed must be in order to maximize muscular effort. For the most part, current findings have been based on mere speculation and guess work.

Locomotor Principles Underlying Athletic Performances

by Dr. Gideon Ariel

TRAIN FAST TO BE FAST... A PROVEN FACT!

Traditionally, resistive equipment manufacturers have only been concerned about the element of force. However, when the element of force is considered as a separate entity, it has little relationship to successful athletic performance.

There are basically three factors that govern the success of all human movement: force, displacement (or direction), and duration of movement. In order to provide optimum conditioning benefits, these factors must be incorporated into the equipment's design and function.

The purpose of the following information is to scientifically substantiate the need for rapid-explosive conditioning movements. Also, as a result of this evidence, one will better understand the conditioning shortcomings that exist in previous methods of training.

In all motor skills, muscular forces interact to move the body parts through the activity. The displacement of the body parts and their speed of motion are important in the coordination of the activity and are also directly related to the forces produced. However, it is only because of the control provided by the brain that the muscular forces follow any particular displacement pattern, and without these brain center controls, there would be no skilled athletic performances.

In any athletic performance, accurate coordination of the body parts and their speeds is essential for maximizing performances. This means that the generated muscular forces must occur at the right time for optimum results. For this reason, the strongest weight lifter cannot put the shot as far as the experienced shot putter. Although he possesses greater muscular force, he has not trained his brain centers to produce the correct forces at the appropriate time.

Recent neurological research has demonstrated that **the brain performs differently depending upon whether the desired motion is slow or fast.** It was found that the motor control centers reacted in one manner when slow and/or steady forces were required, but reacted quite differently when variable or quick forces were desired. Results showed that control signals from the brain are more closely related to rates of change than on force levels and for this reason the range and the speed of the exercise have important carryover implications for skilled athletic performance. **In all athletic events, intricate timing of the varying forces is a critical factor in successful performances, and, therefore, training an isolated muscle group slowly may result in poorer athletic performances.**

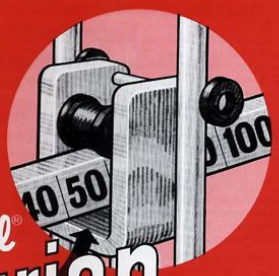
In describing the movements of an athlete, we do not normally talk of the independent contraction of hundreds of thousands of muscle fibers, but instead specify the activity: throwing, running, jumping, blocking, etc. All athletic movements result from contractions of muscles and their synergists in relatively standard patterns of coordinated activity. Therefore, research in exercise machine design should view the problem of motor control in terms of the sequencing and coordination of agonists and antagonists.

Athletic performance, whether on the football field or simply walking, requires the coordination of a number of joints. For example, in a baseball pitch 12 segments of the body work together in harmony to produce a successful throw. These muscles and the speed of the body segments are controlled by signals from the motor cortex of the brain. Human behavior in athletic performances requires activity by the automatic control system in the ballistic movements of skilled motion. These ballistic motions are fast movements which exhibit large initial accelerations and are produced by the application of a variable force. **Ballistic motion results from properly timed contractions of muscles integrating all of the joints involved in the activity. Since most athletic events are ballistic movements and since the neural control of these patterns differs from slow controlled movements, it is essential that training routines employ fast motions and multiple joint actions.**

In static training where coordination is not a factor such as in body building exercises, force, direction, and duration can be separated, but in voluntary actions such as in athletic performances the three must operate together.

Superior performance cannot occur by isolating just one of these factors and excluding the other two. Therefore, lifting repetitions should be performed as fast as possible with maximal mental concentration for recruitment of the maximum firing level of muscle fibers as required in ultimate athletic performance.

The Now Generation In Resistive Conditioning



The Universal® Centurion

TRADEMARK

Dynamic Variable Resistance available on all press stations (leg, chest, shoulder)

Phase #4 — Universal's® Theory of Dynamic Variable Resistance

Universal, recognizing the need to improve the efficiency of resistive conditioning, employed modern research and engineering technology to develop a new variable resistance system (The Centurion) designed to provide the optimum in conditioning benefits.

The Universal Centurion insures optimum conditioning benefits by varying the resistance throughout the range of motion according to the motion parameters and man's biomechanical changes. The essential difference between the Universal Centurion and other variable resistive systems, is Universal's unique ability to maximize muscular efforts while maintaining the true dynamic characteristics of motion.

Dynamics, simply refers to any movement whether it be man or machine. Human movement consists of natural variations in acceleration and deceleration within a single movement. These variations in acceleration and deceleration (inertia forces) affect the magnitude with which the muscle has to contract. Normally, the accelerations of motion produce greater muscular contractions and vice versa.

In addition to assessing man's natural pattern of movement, it is further necessary to assess the dynamic affects of the exercise machine. Optimal equipment design should maintain small inertia forces. The smaller the inertia force produced by the machine's moving parts, the greater the muscular involvement. Also, it is necessary that the mechanical inertia forces do not disrupt man's natural pattern of movement (acceleration and deceleration).

Universal was able to determine the exact degree to which these motion parameters (man and machine) affected muscular performance. These factors were then added to the variable resistance intensity to accurately accommodate man's biomechanical changes without disrupting his natural pattern of movement. In other words, one may naturally accelerate and decelerate throughout the range of movement while the resistance is adjusted to maintain the same relative degree of muscular effort. This exclusive Universal feature assures the optimum development in functional strength and speed.

The Scientific Bases Behind The Universal® CENTURION

TRADEMARK

The Universal Centurion is the first dynamic variable resistive system which fully accommodates man's resistive needs. This new resistive system is the result of scientifically determining the answers associated with human and mechanical movement.

In the previous sections, the basic prerequisites for designing exercise equipment have been generally discussed. However, because these factors provide the foundation for the new Universal Centurion they merit a more formal review.

1 MAN

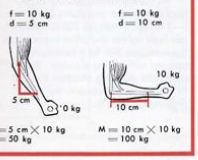
The basic tool for the performance of any movement task is the human body. When designing exercise equipment it is essential that the design conform to man's needs and not vice versa. The degree to which exercise equipment maintains man's natural pattern of movement while providing an effective over-load resistance determines the amount of improvement that can be gained in his performance of any movement. The human body is basically a system of weights (mass of body segments), levers (bones), and devices for producing force (muscles and nerves). Human movement is governed by the laws of physics which apply to any link system in motion regardless of whether the system is human or mechanical. When performing an exercise movement, the segments of the human body form a link system. This link system when in motion includes muscular forces which act on each body part; and in addition to the muscular forces, there are inertia forces which are produced by the motion itself. Due to the modifying effects of the lever system and the motion parameters (inertia forces) the muscular force does not remain constant throughout the range of movement. Therefore, in order to maintain maximum muscular efforts, it is necessary that the resistance be varied throughout the range of motion according to the motion parameters and the biomechanical changes.

The following example will illustrate the changes in muscular force that occur from different leverage positions.

MOMENTS OF FORCE

The moment of force about any point is equal to the magnitude of the force multiplied by the perpendicular distance from the action line of the force to that point.

Example: M = force × distance



By understanding this important human phenomenon, it is relatively easy to again establish that muscles work at their maximum potential during only a very small range of the total movement. Therefore, the first requirement in the design of exercise equipment is to accurately vary the resistance in order to accommodate these biomechanical changes. This can only be accomplished by scientifically assessing the exact changes in muscular force that occur at each joint angle within a complete movement.

2 THE ELEMENT OF HUMAN MOTION

HUMAN LOCOMOTION

While assessing man's biomechanical system it is equally important to simultaneously assess the effects of the motion parameters (inertia forces) on muscular performance.

Motion implies a change of place or position which involves both direction and speed. Any motion regardless if human or mechanical, occurs only when sufficient force to overcome the object's inertia is applied. Inertia may cause an object to resist being set in motion, or if moving, to resist being slowed down or stopped. The changes in inertia or fluctuations of motion produce variations in the actual resistive force which inadvertently affect the degree of muscular force. In order that the reader can clearly understand this principle, we will use an elevator in motion to illustrate how variations in resistance occur from varying the speed of movement.

Imagine yourself entering a hotel elevator. Upon entering, while the elevator remains motionless, you weigh 200 lbs., or, in other words, there is 200 lbs. of force being exerted on the floor of the elevator. When the elevator begins moving upward, the elevator starts from 0 velocity and increases in speed. From experience one may recall a sensation of being forced down or of feeling heavier as the elevator continues upward. The passenger feels himself pressing down on the floor with a force which is greater than when he and the elevator were at rest, and this phenomenon is commonly observed by most elevator riders. We can measure this sensation by having the passenger stand on a scale in the elevator while the elevator ascends at a slow speed (2 ft./sec²). Observing the dial on the scale for the 200 lb. person, it would now read 212.5 lb.!!

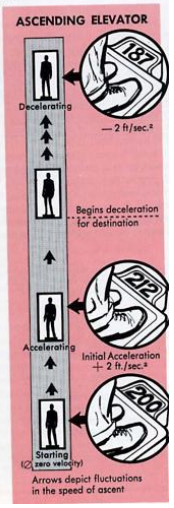
The reader can easily compute this result by using the following formula:

$$P = W + \left(\frac{W}{G}\right) \times a$$

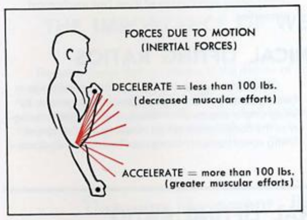
P = Apparent Weight
W = Passenger's Weight
G = Gravitational Force
a = Elevator's Acceleration

$$P = 200 + \left(\frac{200}{32}\right) \times 2$$
$$= 200 + (6.25 \times 2)$$
$$= 200 + 12.5$$
$$= 212.5$$

As the elevator approaches its final destination and slows down (—2 ft./sec²), then the 200 lb. passenger feels lighter and often experiences the sensation that he is continuing upward without the elevator. In this particular stopping situation the 200 lb. person would observe the scale reading at 187.5 lb.!



Human dynamics are concerned with man in motion and include any external implements with which he interacts. Both the object and any body part may resist changes of motion and these changes in motion are directly related to both the mass of the segment and its moment of inertia. For example, when lifting a 100 lb. barbell, it is generally assumed that the resistance applied to the body is 100 lbs. and that this barbell imparts a 100 lb. resistance throughout the complete range of motion. However, as in the case of the elevator, when the 100 lb. barbell is moving, the resistance it provides can vary from more than 100 lbs. to less than 100 lbs., depending upon the fluctuations of the motion.

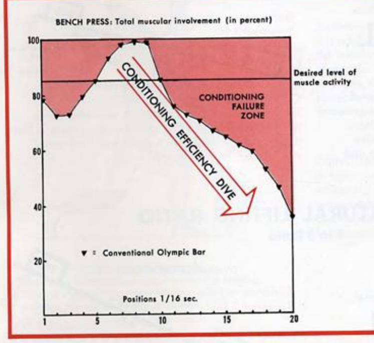


Since these inertial forces (acceleration and deceleration) affect the weight of the 100 lb. barbell, the magnitude with which the muscle has to contract is also affected. The less the inertial forces, naturally, the greater the muscular contraction and vice versa.

In order to effectively cope with the problems of inertia associated with resistive exercise equipment, it is essential to accurately identify their particular motion patterns. Since acceleration and deceleration are factors in all human movement and can be modified through mechanical means, they, therefore, must be incorporated in the design of the exercise equipment. If the exercise equipment does not vary the resistance according to these motion parameters and the biomechanical changes previously discussed, there may occur a vast waste in muscle performance.

Data provided by
Computerized Biomechanical Analysis

For example, the following force curve reveals what normally occurs when lifting near maximum resistance with a non-varying conventional Olympic bar. Data for plotting this force curve was provided by the computer output taken from the actual performance.



EXAMPLE OF COMPUTER OUTPUT FORCE DATA
AT THE ELBOW FOR AN OLYMPIC BENCH PRESS
(In Kilograms)

Pos.	Elbow Angle (Deg.)	Moment (KG-M)	Horiz Force (KG)	Vert Force (KG)	Muscle Force (KG)	Shear Force (KG)	Comp Force (KG)
1	177.6	9.196	—71.23	—232.49	209.00	—26.27	261.03
2	153.6	8.029	—113.17	—204.78	182.48	49.93	228.38
3	134.8	5.714	—102.65	—145.37	129.86	68.48	164.86
4	120.1	4.034	—81.79	—110.83	91.48	62.37	122.83
5	109.4	2.619	—56.70	—91.23	59.12	44.82	97.64
6	101.9	1.729	—38.92	—82.57	39.30	30.98	85.86
7	97.1	1.181	—27.48	—78.84	27.07	21.64	80.64
8	94.5	.861	—20.12	—77.29	19.37	15.30	78.33
9	93.5	.732	—17.13	—76.69	18.64	13.24	77.28
10	94.1	.717	—16.84	—76.24	16.30	13.03	76.93
11	95.7	.765	—17.54	—76.40	17.39	13.92	77.14
12	98.1	.806	—20.28	—77.10	20.36	16.37	78.02
13	102.2	1.065	—23.89	—78.27	24.20	19.35	79.52
14	104.7	1.195	—26.33	—79.85	27.16	21.17	81.43
15	108.3	1.347	—29.53	—82.01	30.61	23.15	84.03
16	112.6	1.604	—34.65	—85.36	36.45	26.77	88.15
17	116.9	1.792	—37.94	—88.89	40.73	25.88	92.47
18	121.6	2.239	—46.26	—93.46	50.89	35.93	100.51
19	126.6	2.683	—53.65	—103.21	60.98	37.83	110.01
20	132.2	3.169	—60.77	—112.82	78.08	40.04	121.73

The diminishing muscular efforts (positions 10-20) result from the biomechanical advantages (skeletal leverage) which is further magnified by the reduction in actual resistance that occurs in this area of movement due to the normal deceleration of motion.

3 THE ELEMENT OF MECHANICAL INERTIA

As previously discussed, many exercise machines disrupt man's natural pattern of movement. This disruption of natural movement is often times the result of adverse mechanical inertia forces. These forces affect not only the pattern of movement but also lessen the magnitude of required muscular efforts. In order to insure maximum conditioning effectiveness, it is necessary that the exercise machine maintain small inertia forces. The smaller the inertia forces produced by the machine's moving parts, the greater the muscular involvement.

There are basically two factors in equipment design that determine the relative degree of inertia. They are as follows:

1. **Mechanical balances in lifting ratios, and**
2. **The weight distribution of all moving parts (mass).**

These two factors are extremely important and canno be ignored in optimum equipment design.

The following illustrations will clearly reveal the conditioning significance of these two mechanical properties.

THE IMPORTANCE OF MECHANICAL LIFTING RATIOS

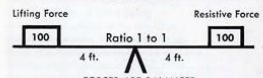
In the design of structured exercise equipment, the degree of balance between the lifting force and the resistive force determines the amount of mechanical inertia or adverse momentum. To minimize the degree of mechanical momentum, it is necessary that these forces remain equal under all dynamic conditions.

This basic engineering principle has often times been ignored in the design of exercise equipment. By using simple seesaw illustrations, one can easily recognize the conditioning effects resulting from different lifting ratios currently being used in exercise equipment

UNIVERSAL'S NATURAL LIFTING RATIO

1 to 1 Ratio

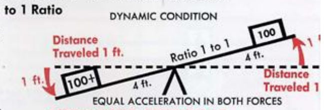
STATIC CONDITION



FORCES ARE BALANCED

This seesaw illustrates that a natural lifting ratio of 1 to 1 maintains balanced inertia forces. The resistive force equals the lifting force under static conditions. Under dynamic conditions, the lifting and resistive forces remain equally balanced in acceleration and distance traveled.

DYNAMIC CONDITION



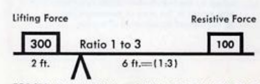
EQUAL ACCELERATION IN BOTH FORCES

CONDITIONING SIGNIFICANCE
The user must exert a constant muscular force throughout the range of movement as there is little if any potential energy build up or "runaway" mechanical momentum (inertia).

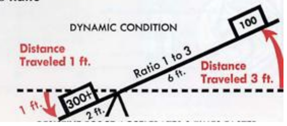
THE UNNATURAL LIFTING RATIO

1 to 3 Ratio

STATIC CONDITION



DYNAMIC CONDITION



The Unnatural Lifting Ratio (Continued)

This seesaw illustrates that the current use of a 1 to 3 lifting ratio creates adverse inertia forces. These forces reduce the amount of effective resistance. The lifting force is three times greater than the resistive force under static conditions or the initial force required to overcome inertia. Under dynamic conditions, the resistive force is accelerating three times faster (and farther) than the lifting force.

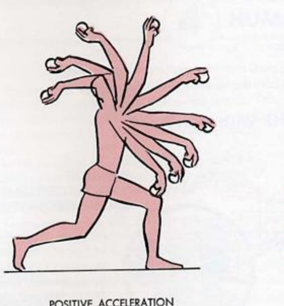
CONDITIONING SIGNIFICANCE
The heavier the resistance and the faster the movement, the greater the mechanical inertia or "runaway" momentum resulting in diminishing muscular efforts required to maintain the motion. Under these conditions, the user exerts only maximum muscular efforts to start the lift and then the mechanical parts become a "runaway" offering the user practically no resistance.

THE IMPORTANCE OF WEIGHT DISTRIBUTION (MASS)

The other factor that contributes to the degree of mechanical inertia or the "runaway" momentum is the mass or actual weight distribution of the machine's moving parts. This secondary factor may combine with the improper balances in lifting ratios to further increase the magnitude of adverse inertia forces. The amount of decrease or increase in inertia is directly proportional to the change in mass.

The following illustrations of a throwing movement using a light and heavy weighted object will clearly reveal the significance of this mechanical principle.

Throwing Movement - light weight object (baseball)



POSITIVE ACCELERATION
Little or no buildup in movement momentum (inertia). Thrower must apply constant muscular effort to maintain the acceleration of movement.

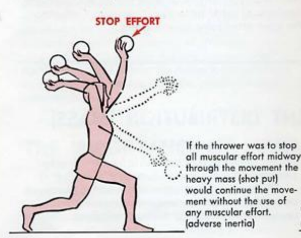
To throw a light weight object such as a baseball, it is relatively easy to start the movement or overcome the initial inertia. In addition, it is also relatively easy to stop the movement at the end of the throw. For example, due to a baseball's light weight or mass it is possible to hold on to the ball throughout the entire throwing cycle.

CONDITIONING SIGNIFICANCE
A light weight object or small mass does not significantly contribute to the degree of movement momentum. Therefore, continuous muscular efforts are required to maintain the speed of movement (acceleration).

Throwing Movement - heavy object (shot put)

Assuming one could accelerate at the same rate of speed with a heavy object (shot put), the degree of momentum would be greatly increased. In this example, due to the heavier mass it is difficult to begin the movement, however, once started the movement becomes difficult to stop.

CONDITIONING SIGNIFICANCE
The heavier the object or mass and the faster the movement the easier it is to maintain the state of motion and thereby reducing the force required to keep it moving. Also, the greater the distance, and thus the time over which an object is accelerated, the greater the velocity and, therefore, the greater the momentum.



If the thrower was to stop all muscular effort midway through the movement the heavy mass (shot put) would continue the movement without the use of any muscular effort. (adverse inertia)

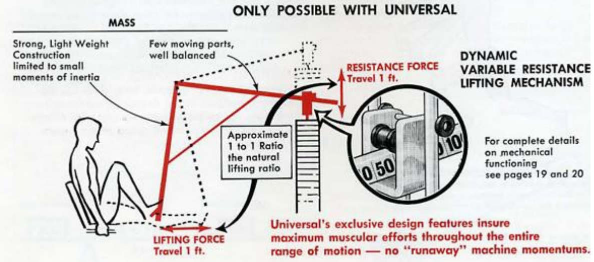
The constant build up of increasing momentum causes the shot put to become a complete "runaway", forcing it to leave the user's hand. (adverse inertia)

Universal's New Dynamic Variable System has been developed in strict accordance with these engineering principles.

Example: The Universal Variable Resistance Leg Press Station

Both the lifting ratio and the weight distribution of the moving parts maintain small inertia forces while the resistive intensity instantaneously adjusts to accommodate both the human and mechanical changes.

ONLY POSSIBLE WITH UNIVERSAL

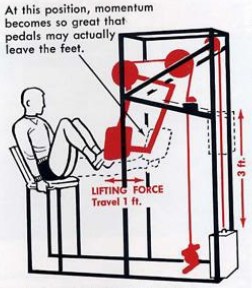


For complete details on mechanical functioning see pages 19 and 20

Universal's exclusive design features insure maximum muscular efforts throughout the entire range of motion — no "runaway" machine momentums.

Design Features To Avoid In Conditioning Equipment

The following example illustrates the mechanical and conditioning weaknesses that may occur from using a heavy moving mass and a ratio disadvantage (1 to 3).



"THE MECHANICAL FLYWHEEL"

HEAVY MOVING MASS (shown in red) and numerous mechanical parts create high moments of inertia.

RATIO DISADVANTAGE (1to 3)
The faster the lifting speed and the heavier the resistance, the greater the "runaway" Inertia

RESISTANCE FORCE travels 3 times faster and farther than the lifting force.
The greater the distance and acceleration, the greater the momentum.
The greater the mechanical momentum, the less muscular efforts or energy required to maintain motion.

These design weaknesses create adverse "runaway" inertias which become the dominant driving force, robbing the user of "normal" exercise benefits.

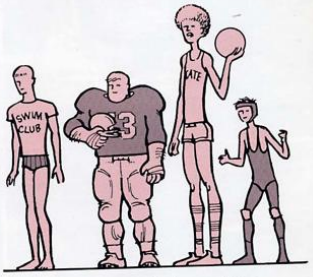
4 HUMAN FACTORS

The final prerequisite in the design of exercise equipment involves the element of human factors. This element deals primarily with the differences in body sizes as comprised by the interrelationship of body segments.

In the design of a variable resistive system, it is necessary that the fluctuations in resistance occur at the proper joint angles, regardless of the human variations in lifting stroke lengths.

To accomplish this task, the changes in resistance should be made to coincide with the mean averages in lifting stroke lengths (joint angles); and remain easily adjustable to accurately accommodate those individuals who may fall below or above the average lifting lengths.

Universal's new variable system has been calibrated to the mean averages in lifting lengths. In addition, visual read outs are provided so that any size user may easily adjust his starting position to insure the necessary increases in resistance occur exactly and precisely when needed.



Athletes come in all shapes and sizes

Computerized Biomechanical Analysis

Human movement analyzed with total precision.
The first unveiling of man's precise resistive needs as required in true dynamic movement.

ANALYSIS PROCEDURE

Sophisticated slow motion cinematography is used to capture highly complicated body movements. A camera with speeds ranging up to thousands of frames per second, becomes a recording observer of each single motor segment movement. Through careful use of this film, research scientists are able to get a full perspective on the complete movement cycle.

Complex tracing equipment is then used to digitize each segment movement and organize the data with all varying details. This digitized data is processed directly into a high speed computer.

As film has aided the human power of observation, increasing the amount of available facts, computers are required to remember and collate the facts. These modern technological "wonders" are fed vast amounts of film-bred information which they instantaneously decipher and edit into a usable form.

Independent modern computer center used by Universal.

Isolated Camera Shots of each joint segment of movement

Special Tracing Equipment digitizes each joint movemen for computer programming

The computers are programm calculate the forces of each body segment and their cont tions to the whole movement

All this research technology comes down to the final computer output

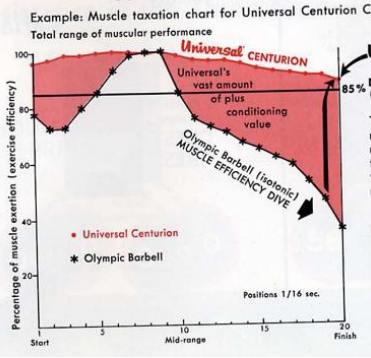
Pos.	Elbow Angle (Deg.)	Moment (KG-M)	Horiz. Force (KG)	Vert. Force (KG)	Muscle Force (KG)	Shear. Force (KG)	Comp. Force (KG)	Percent	Factor
1	147.8	6.390	–82.65	–192.78	145.23	53.25	202.88	52.6	47.4
2	133.6	4.660	–76.44	–150.03	105.01	58.14	158.03	58.1	41.9
3	122.8	3.300	–61.45	–122.80	75.00	50.11	127.86	61.4	38.6
4	113.5	1.980	–39.35	–103.67	45.00	32.39	106.05	65.1	34.9
5	106.7	1.160	–24.10	– 94.45	26.36	20.12	95.38	69.1	30.9
6	102.0	.570	–12.20	– 89.55	12.95	10.16	89.80	72.1	27.9
7	98.8	.100	–2.14	– 86.76	2.27	1.83	86.77	73.9	26.1
8	97.0	–.230	–12.74	– 87.64	12.78	13.65	87.50	75.7	24.3
9	96.1	–.490	–27.11	– 89.50	27.22	29.29	88.81	76.5	23.5
10	96.2	–.590	–38.05	– 90.85	38.33	41.20	89.46	76.5	23.5
11	96.9	–.860	–47.24	– 92.95	47.78	51.25	90.80	77.9	22.1
12	98.1	–.980	–53.55	– 95.19	54.44	58.14	92.46	80.1	19.9
13	99.7	–1.030	–55.93	– 97.19	57.22	60.94	94.13	81.3	18.8
14	101.4	–1.100	–59.33	– 99.70	61.11	64.64	96.35	84.9	15.1
15	103.5	–1.120	–59.90	–101.92	62.22	65.15	98.65	82.0	18.0
16	105.6	–1.040	–55.15	–102.31	57.78	59.90	99.60	87.5	12.5
17	107.9	–.910	–47.80	–101.60	50.56	51.83	99.60	94.9	5.1
18	110.2	–.700	–36.45	–96.68	38.89	39.36	97.55	96.0	4.0
19	112.8	–.400	–20.70	–93.19	22.22	22.16	92.86	100.0	.0
20	115.5	–.020	–1.29	–84.88	1.11	1.00	84.89	96.7	3.3
21	118.6	.450	–9.26	–89.25	19.23	7.07	89.48	96.0	4.0
22	121.9	1.050	–20.83	–96.45	23.86	16.49	97.35	94.9	5.1
23	125.9	1.750	–33.81	–105.94	44.00	25.40	108.27	88.5	11.4
24	130.6	2.590	–48.00	–119.33	56.86	34.30	123.00	82.0	18.0
25	136.1	3.540	–68.58	–134.36	81.45	41.54	142.26	81.3	18.8
26	142.7	4.880	–81.09	–158.97	118.91	46.68	171.59	78.7	21.3
27	150.6	5.810	–87.67	–181.14	132.05	41.26	196.67	73.5	26.5
28	160.3	7.237	–94.89	–215.69	164.22	26.32	233.93	67.3	32.7

For the 1st time ever... Man's True Resistive Formula

The final computer output provides the exact resistive formula required to maintain maximum muscular efforts throughout the range of movement. (Fluctuations in resistance required at each joint angle.)

NOW - examine the muscular results of this resistive formula in action

Example: Muscle taxation chart for Universal Centurion Chest Press



Universal SUPERIORITY

85 % **Desired muscle exertion level** (insures maximum conditioning benefits)

These muscular force curves reveal the true muscular exertions as they occurred in the actual movement from start to finish (dynamic conditions). Computerized Biomechanical Analysis was used to determine the actual dynamic muscular force curves.

This new, high level of muscle performance is available on all Universal Centurion Press Stations (Chest, Shoulder, Leg)

Next: the key to Universal's magic performance

Introducing the change that's guaranteed to make you

When you examine the New Universal Centurion, you will notice several important mechanical changes– **A New Variable Resistance Lifting Mechanism** and its working components.

When you exercise on the New Centurion, you will experience both a progression in resistance and muscle taxation you never before thought possible.

The thing Universal did not change was its perfected design features which have guaranteed you that "life-lasting" natural smooth lifting stroke.

The New Universal Centurion provides for superior achievement in muscular development and performance.

The original Universal was designed to give you the best in conditioning. Now, we are telling you that your conditioning just got better.

Meet Universal NEW "Experience

Universal's new variable lifting system may at first glance appear rather simple and uncomplicated, however, the scientific foun tion behind its development sets it "far apart" from all existing conditioning syster

Superior technical know-how turned resear findings into a workable lifting mechanism

Many long hours of research, on drawing boards, designing and redesigning a lifting system, then testing and retesting resulted in the mechanical duplication of man's PRECISE RESISTIVE FORMULA.

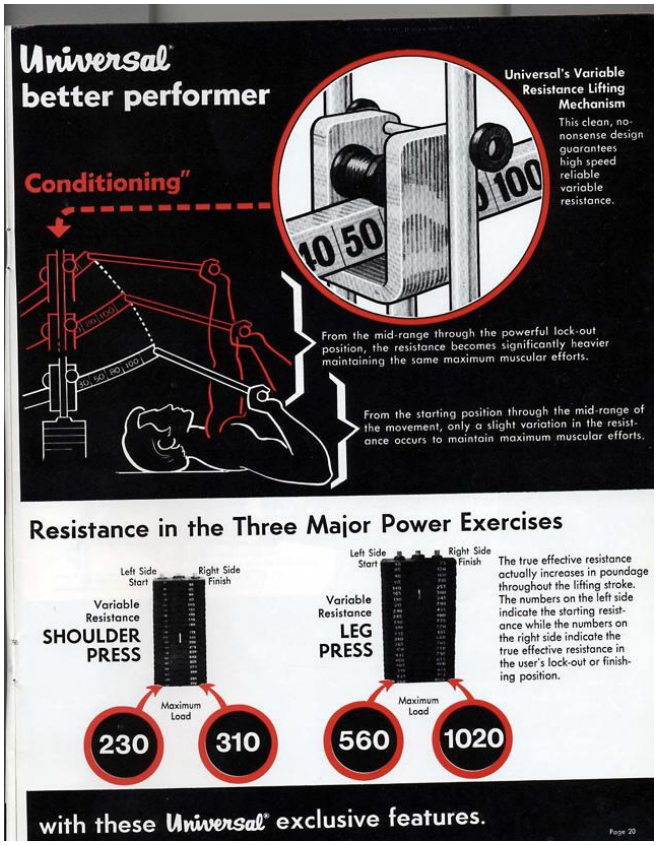
Universal's new design and performance simplicity assures "high-speed" performance reliability.

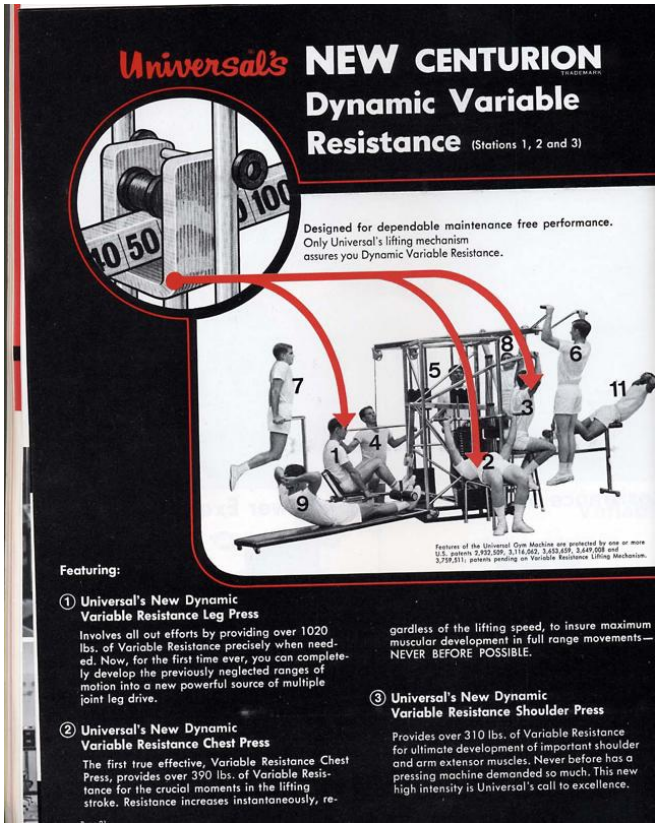
Visual Read Outs

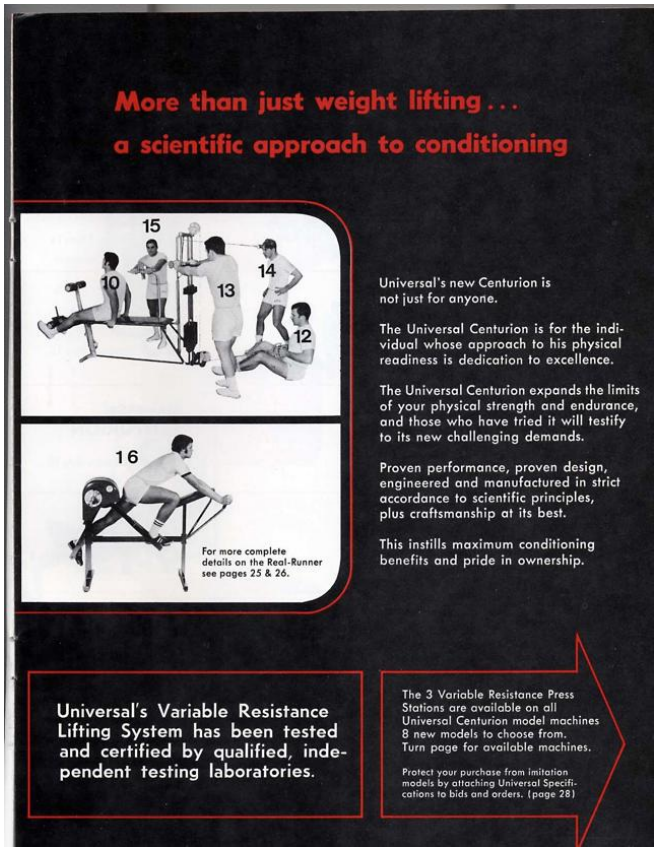
Accurately reveal the exact amount of resistive overload being lifted.

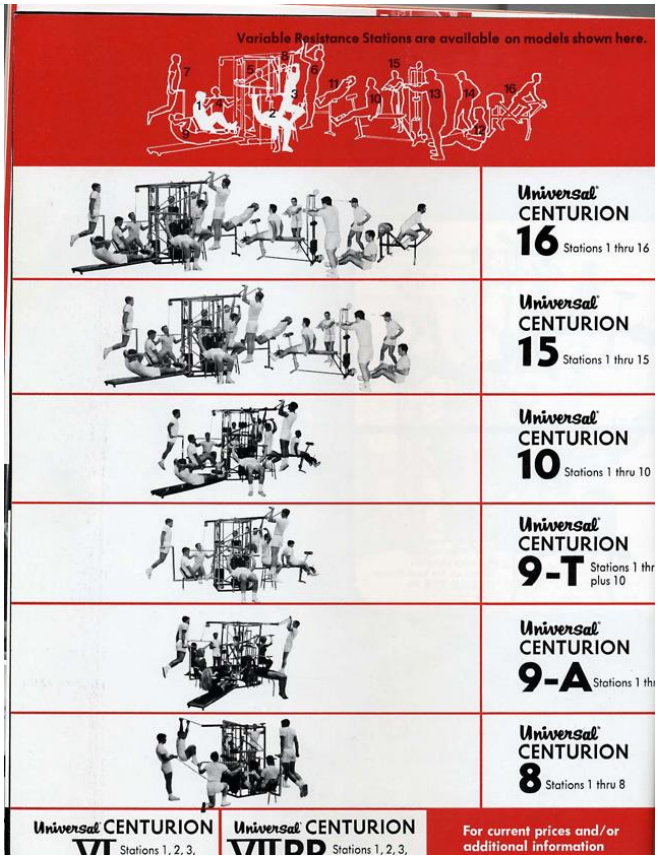
These visual read outs have been calibrated to the national mean averages in lifting stroke and are so designed that any size user can easily adjust his starting position, to insure increases in resistance occurring exactly and precisely when required.

Variab


Universal
better performer
Conditioning"
Universal's Variable Resistance Lifting Mechanism
This clean, no-nonsense design guarantees high speed reliable variable resistance.
40 50
100
From the mid-range through the powerful lock-out position, the resistance becomes significantly heavier maintaining the same maximum muscular efforts.
From the starting position through the mid-range of the movement, only a slight variation in the resistance occurs to maintain maximum muscular efforts.
Resistance in the Three Major Power Exercises
Left Side Start
Right Side Finish
Variable Resistance
SHOULDER PRESS
Maximum Load
230
310
Left Side Start
Right Side Finish
Variable Resistance
LEG PRESS
Maximum Load
560
1020
The true effective resistance actually increases in poundage throughout the lifting stroke. The numbers on the left side indicate the starting resistance while the numbers on the right side indicate the true effective resistance in the user's lock-out or finishing position.
with these Universal exclusive features.
Page 20


Universal's NEW CENTURION
Dynamic Variable Resistance (Stations 1, 2 and 3)
40 50
100
Designed for dependable maintenance free performance.
Only Universal's lifting mechanism assures you Dynamic Variable Resistance.
1
2
3
4
5
6
7
8
9
11
Features of the Universal Gym Machine are protected by one or more U.S. patents 2,932,509, 3,114,062, 3,652,659, 3,649,008 and 3,759,511; patents pending on Variable Resistance Lifting Mechanism.
Featuring:
① Universal's New Dynamic Variable Resistance Leg Press
Involves all out efforts by providing over 1020 lbs. of Variable Resistance precisely when needed. Now, for the first time ever, you can completely develop the previously neglected ranges of motion into a new powerful source of multiple joint leg drive.
② Universal's New Dynamic Variable Resistance Chest Press
The first true effective, Variable Resistance Chest Press, provides over 390 lbs. of Variable Resistance for the crucial moments in the lifting stroke. Resistance increases instantaneously, regardless of the lifting speed, to insure maximum muscular development in full range movements—NEVER BEFORE POSSIBLE.
③ Universal's New Dynamic Variable Resistance Shoulder Press
Provides over 310 lbs. of Variable Resistance for ultimate development of important shoulder and arm extensor muscles. Never before has a pressing machine demanded so much. This new high intensity is Universal's call to excellence.


More than just weight lifting . . .
a scientific approach to conditioning
15
10
13
14
12
16
For more complete details on the Real-Runner see pages 25 & 26.
Universal's new Centurion is not just for anyone.
The Universal Centurion is for the individual whose approach to his physical readiness is dedication to excellence.
The Universal Centurion expands the limits of your physical strength and endurance, and those who have tried it will testify to its new challenging demands.
Proven performance, proven design, engineered and manufactured in strict accordance to scientific principles, plus craftsmanship at its best.
This instills maximum conditioning benefits and pride in ownership.
Universal's Variable Resistance Lifting System has been tested and certified by qualified, independent testing laboratories.
The 3 Variable Resistance Press Stations are available on all Universal Centurion model machines 8 new models to choose from. Turn page for available machines.
Protect your purchase from imitation models by attaching Universal Specifications to bids and orders. (page 28)


Variable Resistance Stations are available on models shown here.
Universal CENTURION 16 Stations 1 thru 16
Universal CENTURION 15 Stations 1 thru 15
Universal CENTURION 10 Stations 1 thru 10
Universal CENTURION 9-T Stations 1 thr plus 10
Universal CENTURION 9-A Stations 1 th
Universal CENTURION 8 Stations 1 thru 8
Universal CENTURION VI Stations 1, 2, 3,
Universal CENTURION VIPP Stations 1, 2, 3,
For current prices and/or additional information

Universal's NEW ADDITION...
VARIABLE RESISTANCE SINGLE STATIONS

Variable Resistance CHEST PRESS
Provides over 390 lbs. of true effective resistance (flat exercise bench included)

Variable Resistance LEG PRESS
Provides over 1020 lbs. of true effective resistance

Variable Resistance SHOULDER PRESS
Provides over 310 lbs. of true effective resistance (heavy duty pressing stool included)

Provides extra dimension and flexibility for an expanding conditioning program.

Quality Construction and Long Lasting Durability that you expect and depend on from Universal.

Universal's® EXCLUSIVE FEATURES:

- Dynamic Variable Resistance lifting mechanism — constructed for high-speed, durable performance.
- Frame — rugged heavy duty construction (all 2" tubular steel).
- Quiet, smooth operation — Self-Lubricating Bearings.
- Safe — heavy, sturdy design will not wobble. Plus safety tip over bars.
- Visual Read-Out Scales — accurately measure percentages of Variable Resistance.
- Less moving parts — therefore less maintenance (no chains, sprockets, or unnecessary gears).
- Eye Appealing, Space Saving.

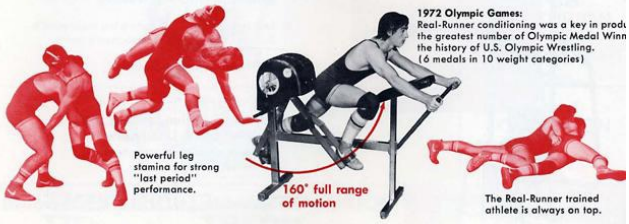
All single station features are covered under Universal's famous quality guarantee.

No conditioning program is complete without Universal's REAL RUNNER

Total Team Conditio

FOOTBALL | Real-Runner conditioning develops quick starts, rapid acceleration, and extra power!

WRESTLING | Real-Runner conditioning develops maximum lower body strength and stamina!

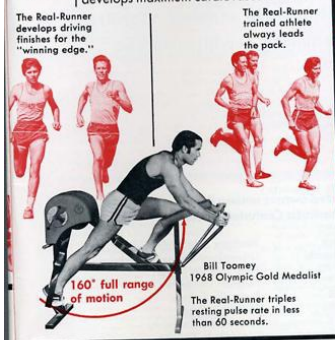


Universal's Real-Runner is without a doubt the most physically demanding and yet performance rewarding piece of equipment you can own.

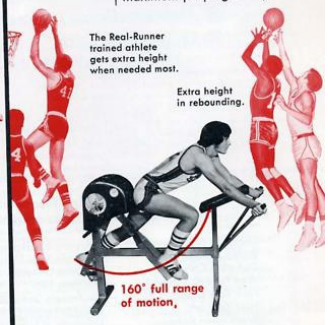
Universal's Real-Runner trains you to perform.

Guarantees Championship Performance

TRACK | Real-Runner conditioning maximizes sprinting and running performance, and develops maximum cardiovascular fitness!



BASKETBALL | The Real-Runner's multiple-joint conditioning action develops maximum jumping ability.



Examine Universal's Exclusive Running Action

① The Universal Real- Runner conditions the leg muscles as they perform their natural running functions.

② The Universal Real-Runner establishes correct neurological and fundamental running skills. User develops high knee lift action, powerful leg drive action, and proper foot flexion.

Multiple Joint Action

③ The Universal Real-Runner develops running power through ballistic muscular movements (most efficient of all movements) while eliminating tension in opposing muscles.

④ The Universal Real-Runner provides maximum leg strength development in complete full range movement. User can select from over 360 lbs. of true effective resistance which is applied directly to hip and leg muscles.

These Exclusive Universal Features develop stronger, tougher, more competitive performers.

Real-Runner available as separate purchase or included with Spartacus, Maximus MBA-RR, Centurion 16, and Centurion VII RR models.

4 BIG REASONS
why more people are choosing the NEW Universal® CENTURION TRADEMARK over all other conditioning systems.

1. **Universal's** advanced and unmatched human research.
2. **Universal's** proven engineering.
3. **Universal's** quality craftsmanship and dependability.
4. **Universal's** years of unequalled conditioning and technological know-how.

Pro-teams, Colleges, High Schools, Junior Highs, Private Individuals, Y.M.C.A.s, Health Clubs, Industry and Government Organizations are among the fast growing ranks of enthusiastic new Centurion owners.

These are only a few selected owners among the fast growing ranks of enthusiastic Centurion users.

University of Pittsburgh
Boston College
Dickerson College
West Point Academy (13)
New York Giants
New York Jets
Washington Redskins
University of Washington
San Jose City College
Texas Tech
University of Oklahoma
Oklahoma State
University of Texas
S.M.U.
University of Houston
University of Indiana
Ohio University
Purdue University
Bethel College
Rio Hondo College
Wake Forest University

University of Arkansas
Colorado State University
Princeton University (6)
Montana Tech
Vic Tanny's Gyms (3)
Chicago Health Clubs
University of Missouri
University of North Carolina
East-side Y.M.C.A.
Midway Y.M.C.A.
Concordia College
College of St. Thomas
De Anza College
Ambassador Health Clubs
Monterey Jr. College
University of Colorado
San Jose City College
John Niland, Dallas Cowboys
Jack LaLanne Health Clubs
University of Wyoming
Williamette University

Northern Colorado University
University of California, Berkeley (2)
New York Stars (WFL)
Fordham University
Porterville College
St. Paul College
New Mexico University
Glendale Jr. College
North Fork State
S. Carolina State
W. Virg. Wesleyan College
Dyersburg Comm. College
Georgia Southern University
Toronto Maple Leafs
New York Athletic Club
Ron Sellers, Miami Dolphins
Larry Czonka, Miami Dolphins
George Allen, Washington Redskins
Noland Ryan, California Angels
Long Beach State (2)
San Diego State

GENERAL SPECIFICATIONS

The Universal Centurion is designed and engineered in strict accordance to both human and mechanical scientific principles.
For your assurance of Universal's exclusive proven design and performance features—avoid any and all substitutions by ordering from these detailed specifications.

Notice: In the event, other systems may attempt to qualify as an "Equal" to the Universal Centurion, we at Universal politely request, at your convenience, the right to conduct an on-the-spot, feature by feature product comparison.

BASIC FEATURES

A. All runner guides solid 1" thick steel shafting
Not acceptable: ⅛" material or hollow tubing.

B. All Press Station weights lifted by solid 1" thick steel shafting. Not acceptable: cables, chains or non-lubricated ½" flat material.

C. Weight lifting lubrication system to be 1½" Molybdenum Disulfide impregnated Nylon built-in bearings strategically placed throughout wt. stacks; must float to insure automatic self-alignment. Not acceptable: non-lubricating, partial-lubricating, spray-on, or plastic coating systems or force-fit bearings.

VARIABLE RESISTANCE FEATURES

A. Variable lifting mechanism — solid steel lifting mechanism plus specially designed Delrin rollers with high grade lifetime lubricated bearings. (Bushings—not acceptable). Not Acceptable: chains, sharp-toothed sprockets (requiring frequent maintenance) or Counter-Balance Weight System (Causing loss of resistance when needed most.)

B. Performance — variable lifting mechanism must accurately vary the resistance to maintain the same degree of muscular efforts throughout the range of movement.
The variations in resistance must be documented by Computerized Biomechanical Analysis research and performance findings (or other qualified scientific research method).

C. Visual Performance Read-Out Scales — must be available on all variable stations. Plus: lifting system must be adjustable to provide all size users with the same degree of variable resistance.

VARIABLE RESISTANCE STATIONS

1. Variable Chest Press — the true effective resistance must vary to 390 lbs. for the average lifting stroke. Revolving handles, upholstered exercise bench, fully chromed.
2. Variable Shoulder Press — the true effective resistance must vary to 310 lbs. for the average lifting stroke. Revolving handles, low back support pressing stool, fully chromed heavy duty, thick upholstered seat.
3. Variable Leg Press — the true effective resistance must vary to 1020 lbs. for the average lifting stroke. Full 15 inch high back support seat with safety hand rails.

STANDARD RESISTANCE STATIONS

4. HIGH LAT PULLS to .... 230 lbs.
with 2½ lb. & 5 lb. increment adapters.
Self aligning, swivel, pulley system.
5. QUAD AND DEAD LIFT STATION to .... 160 lbs.
with 2½ lb. & 5 lb. increment adapters.
Includes one pair of revolving stirrup handles.
Attachment for "D" model thigh & knee machine.
6. CHINNING STATION
Separate from hip flexor station. Special bar with head and face obstacles removed. Contoured rubber hand grips included.
7. DIPPING STATION
Rugged construction accommodates all heights. Contoured rubber hand grips. Mounted on heavy rubber refrigerator glides. Fully chromed.
8. HIP FLEXOR STATION
Special tilt up rubber contoured hand grips. Adaptable to all height variations.
9. ABDOMINAL CONDITIONING STATION 3-T
Adjustable frame support, fully chromed. Padded foot roller, vertical handle, heavy duty upholstering. Vinyl covering for foot positions.
10. THIGH AND KNEE—FREE STANDING
Model 5 to .... 160 lbs.
with 2½ lb. & 5 lb. increment adapters.
(Included with SPARTACUS and GLADIATOR.)
To include 360° Swivel Pulley. "D" Model included with 9-T and H-101 (formerly Hercules) models include special adapter post to accommodate 150 lbs. of additional weights.
11. BACK HYPEREXTENSION & SWIMMERS KICK STATION
Includes broad base padded abdominal support foot roller position and rubber contoured flutter kick handle. Structure to rest on thick rubber refrigerator glides. Entirely chromed.
12. ROWING STATION to .... 160 lbs.
with 2½ lbs. & 5 lb. increment adapters. Includes multi exercise bar with revolving handles.
13. WRIST & FOREARM STATION ...... over 150 lbs.
Separate station with dial for instant resistance settings in less than 1 lb. increments. Flexion and Extension hand positions, plus separate Adductor, Abductor and Pronation, Supination hand positions.
14. NECK CONDITIONER to .... 70 lbs.
Includes padded head harness. Adjustable leverage lifting arm with 5 lb. increment adjustments.
15. HAND GRIPPER STATION .... over 150 lbs.
Resistance setting in less than 1 lb. increments Contoured hand positions. Hands function alternately in two separate positions.
16. REAL RUNNER STATION to 360 lbs. each leg.
Must be free standing, separate of Leg Press.
Not acceptable: combination station. Two striding arms attached to a heavy frame structure, 1½x1½" — 1½x2½". Wall thickness not less than .120 and ¼" on striding arms. Slip-in foot supports and stirrups. Large heavily upholstered chest pad and two rubber contoured hand grips. User must be able to extend leg against adjustable resistance and be able to freely lift his own leg forward together with weight of the striding arm. Friction mechanism to be enclosed in protective helmet. Entire frame and striding arms to be protective chrome finished.
NOT ACCEPTABLE: Counter-balance weight system.
17. SELF-LOCKING SAFETY SELECTOR KEY.
Must slide in and lock itself.
NOT ACCEPTABLE: Force-fit type.
18. WHEEL LIFT ASSEMBLY (Single Person Operative). No cylinders or oil. Includes large, 6 inch, wide base, rubber protected, easy rolling wheels.
19. GUARANTEES Original purchaser only.
LIFETIME
A. Mechanical functions of the lifting mechanism which consist of the runner guides and dry, self-lubricating weight bearings. (nylon impregnated with molybdenum disulfide)
B. Lifting Arm — Positions machine for moving by one person.
5-YEAR
A. Entire frames and bracings; against workmanship and materials.
B. Actual contact friction material used for EXTEN-SO-FLEX feature.
2-YEAR
General protective coverage on any and all other metal parts including entire pulley or wheel systems and leather or nylon head harness.
20. Coaches Training Manual, Exercise Wall Chart and initial supply of Individual Workout Cards.

Features of the Universal Gym Machine are protected by one or more U.S. patents 2,932,509, 3,116,062, 3,653,659, 3,649,008 and 3,759,511; patents pending on Variable Resistance Lifting Mechanism.

Acknowledgement

Chuck Coker, President of Universal Gym Equipment, has over 30 years of actual experience in resistive conditioning and coaching. He is largely responsible for our national school system's current use of resistive exercise equipment. His first-hand knowledge of the conditioning needs of athletes has enabled Universal to stay on top of this rapidly changing industry.

"As President of Universal Athletic Sales, I take this opportunity to personally assure you of our new Centurion's superior conditioning performance. This guarantee is a result of a total creative team effort which involved many long hours in research, on drawing boards designing and redesigning lifting systems, testing and retesting, until mechanical precision was achieved. For each person who did his unique part in the new Centurion's development, I hold a special appreciation, and especially Dr. Gideon Ariel whose valuable research contributions allowed us to explore and determine man's resistive needs. Each of us on the Universal Staff has gained a greater degree of insight and knowledge in this field from the challenging experience associated with the development of the Centurion.

The new Centurion is definitely the start of a new generation in resistive equipment. Speaking for the staff, I trust that through this publication, you have been able to focus upon the true conditioning significance of our latest accomplishment."

Chuck Coker

FOR THE RECORD

When purchasing a resistive exercise machine, the following conditioning factors must again be evaluated:

1. What is the basic need for the conditioning machine?

(Athletics, physical education, general conditioning, etc.)

In determining the basic need for the conditioning machine, it is necessary to evaluate the following two requirements!

a. Does the exercise machine condition the muscular system in a pattern of movement similar to the desired activity?

b. Can the needed strength requirements be derived from the machine?

Universal's unique versatility is capable of successfully fulfilling these requirements for any physical activity.

2. Does the exercise machine provide the exact resistance intensity capable of accommodating man's biomechanical changes? (The Human Factor)

It is essential that research data be provided to substantiate this claim. The only possible research method capable of determining man's dynamic resistive needs is Computerized Biomechanical Analysis.

Only Universal has utilized Computerized Biomechanical Analysis to obtain the necessary data to assure full-range maximum muscular efforts.

3. What physiological safety features were incorporated into the design of the exercise machine?

This consideration involves the reduction of adverse shearing forces that may occur at a particular body joint while exercising.

Universal's equipment design has successfully reduced the possible adverse effect of shearing forces. Universal has substantiated this claim by providing the actual force data.

4. What neuromuscular considerations were made in the exercise machine design?

This is an important consideration which involves the ability to train at rapid explosive dynamic movements while maintaining maximum muscular efforts throughout the entire range of movement.

Universal has successfully accomplished this essential requirement. — Progressive Dynamic Variable Resistance, a Universal exclusive.

5. What are the mechanical limitations of the exercise machine regarding its built-in inertias?

This consideration involves the possible adverse effects of the exercise machine's design, specifically the moving mass, whether it is light or heavy, and the basic lifting ratio. If sound engineering principles are not adhered to, adverse inertias can eliminate needed muscular efforts. Slow movements should not be considered as a means of reducing mechanical failures.

Universal has developed the first mechanical resistance system that provides precise resistance intensity under any conditioning speed.

6. Are there scientific training programs available for each sport?

Conditioning programs must be available for each particular sport in order that maximum athletic performance can be achieved. This requires understanding the specific physiological needs of each activity.

Universal provides comprehensive training programs for each activity.

7. Is the exercise machine void of troublesome features?

This is a major consideration that will have important impact on actual circuit training programs. This consideration involves the relative size of the exercise machine, the ability to easily select the required resistance, and the ability for the user to easily change stations.

Universal remains conducive to needed circuit training programs with easy weight selection, no awkward exercise positions, and less conditioning space required.

8. Does the cost justify the purchase?

The buyer must justify the possible spending of thousands of dollars for equipment which may not be capable of producing maximum muscular development and performance efficiency.

Universal has developed a conditioning system which insures maximum conditioning benefits while remaining at a far lower cost than other less efficient systems.

These famous names in the world of Sports and Athletics are convinced of Universal's SUPERIORITY

JACK YOUNGBLOOD
Defensive end Los Angeles Rams 1st team All-Pro, 1974

"The Universal is fantastic for developing strength and, most important, maintaining it through the competitive season."

BILL TOOMEY
Olympic Gold Medalist. Former Decathlon World record holder. Winner Helms World Trophy Award.

"Universal enabled me to fully develop the physical qualities necessary in achieving maximum performance results."

GEORGE ALLEN
Head coach Washington Redskins 3 time Pro Coach of the Year.

"After reviewing various new machine brands, I have no doubt, the Universal Centurion is the most superior."

NOLAN RYAN
Major League strike out re holder. California Angels

"Universal's new Centurion are the greatest. It is truly lieveable how this new adde tance intensity develops new of strength and endurance."

BOYD EPLEY
Nationally recognized weight training coach and trainer. Univ. of Nebraska

"I highly recommend the Universal Centurion for any athletic program regardless of the sport or sex. I would be happy to discuss the value of the machine with you anytime."
Call 402 472-3116

JOHN McKAY
Head Football Coach USC.
1974 National Football Champions

'Proper physical conditioning of footb players is absolutely essential in order to play the major schedule our team h each year.
Our Universal Gym Machines are an e part of the conditioning program."

MICKI KING
1972 Olympic Gold Medalist (3-meter springboard) 10 national AAU diving titles.

"I've found the new Universal Centurion, designed especially for women, to be a long overdue revolution for the conditioning of females. Strength, flexibility, firmness, endurance, and tone can be easily achieved with the new Universal Centurion."

BILL FARRELL
Coach of USA 1972 Olympic Free Style Wrestling Team. (6 medals in 10 weight categories). New York Athletic Club National Champion since 1970.

"For years I have used the Universal Gym Machines for the conditioning of my wrestlers. The new Universal Centurion is simply fantastic for developing new levels of achievement in both strength and stamina."

DAVE MAGGARD
Athletic director Univ. of California. 1968 Olympian. Head track coach-USA vs USSR Member of US Olympic Committee Track &

"During the time in which I trained for the Olympics, I used the Universal Gym Machi extensively. I continue to use the new Uni Centurion to stay in shape and have found ing compares to its new resistive feature."

Universal® GYM EQUIPMENT
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TELEPHONE: (209) 251-4251

LOCAL DISTRIBUTOR