Why Centrifugal Force Is Actually Inertia .

As indicated in Chapter One, the focus of this entire work is on Inertia in its most common function, the generation of Centrifugal Force. The Inertial-Pneumatic Electric Power Concept proposes that it is a free natural gravity neutralizer in space and is a free natural fluid pressurizer, among other things, in man-made rotating machines. It further proposes that centrifugal force is generated within the boundaries of all rotating man-made machines without effect on the energy that establishes and/or sustains the rotation. It further proposes that centrifugal force is a true source of energy when it is applied to the appropriate energy conversion system. Natural confirmation of these proposals is apparent in the stabilized and perpetual nature of all orbital systems, natural and man-made, through out the universe. Once an orbital system has been established, precise equilibrium between gravity and centrifugal force sustains the system in a precise circular, or nearly circular, path of motion described in space perpetually. The only obvious energy in each system is the forward kinetic energy of the orbiting body but that energy, at any given instant, is tangentially directed and the only way that it can be extracted and applied is by tangentially directed opposition to the orbiting body's forward motion. It is equally obvious that when this occurs, such as application of rocket reverse thrust opposition by Shuttle Craft crews when return to earth is desired, the orbit rapidly decays. The obvious conclusion is that all orbital systems are sustained only if the forward kinetic, or inertial, energy of the orbiting body remains constant.

It should be equally obvious to the reader that neutralizing or overcoming the effects of earth gravity requires the expenditure of work and energy, regardless of how it is accomplished. Getting out of

bed, standing up or lifting any object requires work and the expenditure of human body muscular energy. Trucks and autos expend more fossil fuel energy climbing hills, when earth gravity opposes forward motion,and much less such energy as they move down hill , with earth gravity assisting forward motion. Aircraft expend enormous amounts of excess fossil fuel energy taking off from the airport runway and climbing into their cruise path elevation. In the cruise mode, energy consumption is significantly reduced but continues at a lower , but constant, level since earth gravity is merely being neutralized. Launch rockets expend enormous amounts of rocket fuel energy placing a Shuttle Craft into its orbital path, much of it toward lifting unburned fuel and fuel disposable containers at lift-off. Once it is in orbit, however, no further injection of rocket fuel energy into the system is required. Suddenly, earth gravity's relentless effect is mysteriously and completely neutralized, perpetually.

This raises an important question. If the forward motion kinetic, or inertial, energy of the Shuttle Craft remains constant because there is no resistance to forward motion, and no further rocket fuel energy is being injected into the orbital system, where is the earth gravity neutralizing energy coming from? The answer to this question should become apparent to the reader as the evidence, the data, the solutions and conclusions,presented on following pages of Chapter Two, are carefully and thoughtfully examined.

Addressing the above question will involve certain very important and very fundamental laws of physics, primarily laws concerning bodies of matter in motion, and fundamental definitions and equations. They are listed below as transferred from the pages of Machinery's Handbook, 19th edition, but they may also may be found in numerous other technical

publications. Quote:

1) A FORCE may be defined simply as a push or a pull. The push or pull may result from contact between bodies or from a force, such as magnetism or gravitation, in which no direct contact takes places.

2) MATTER is any substance that occupies space. Gases, liquids, solids, electrons, atoms, molecules, etc., all fit this definition.

3) INERTIA is that property of matter which causes it to resist any change in its motion or state of rest.

4) MASS is a measure of the Inertia of a body!!! Unquote.

Author's Note: This definition of MASS is very important to conclusions drawn, on subsequent pages of this chapter, concerning the generation of Centrifugal Force and Inertia's function in the process. It is interpreted to mean that when a force is applied to a body of matter to accelerate or decelerate that body's motion, it is actually being applied to the INERTIA of the body as it resists such acceleration or deceleration and the MASS of the inertia is identical to the mass of the body itself.

Again quoting from the pages of Machinery's Handbook, 19th Edition:

Sir Isaac Newton's Laws of Motion may be stated as follows:

FIRST LAW: Every body continues in a state of rest or in uniform motion in a straight line until it is compelled by a force to change its state of rest or motion.

SECOND LAW: Change of motion is proportional to the force applied, and takes place along the straight line in which the force acts. The "force applied" represents the resultant of all the forces acting on the body.

This law is sometimes worded: An unbalanced force acting on a body causes an acceleration of the body in the direction of the force and of magnitude proportional to the force and inversely proportional to the mass of the body. Stated as a formula, (R) =(M a) where (R) is the resultant of all the forces acting on the body, (M) is the mass of the body , (mass = weight (W) divided by acceleration due to gravity (g)), and (a) is the acceleration of the body resulting from application of force (R).

THIRD LAW: To every action there is always an equal and opposite reaction, or , in other words, if a force acts to change the state of motion of a body, the body offers a resistance equal and directly opposite to the force. (Author's Note: Actually the body's inertia offers the resistance,)

Newton's SECOND LAW may be used to calculate linear and angular accelerations of a body produced by unbalanced forces and torques acting on the body. However, it is necessary first to use the methods described under "Composition and Resolution of Forces" to determine the magnitude of all forces acting on the body. Then for a body moving with pure translation, $(R) = (M\,a) = \left(\frac{W\,a}{g}\right)$ where (R) is the resultant force in pounds acting on a body weighing (W) pounds, (g) is the gravitational constant, usually taken as 32.16 ft/sec^2 (or feet per second per second) approximately, and (a) is the resulting acceleration in ft/sec^2 of the body due to (R) and in the same direction as (R). (Unquote.)

Author's Note: The above equation, emerging from Newton's SECOND LAW, is considered by most authorities as the most fundamental in all physics. On subsequent pages it will usually be written as $\left(F = m\,a = \frac{W\,a}{g}\right)$, since there usually is only one force involved, with (F) representing that force.

The equation ($Vf = \sqrt{2\ a\ S}$), also from the pages of Machinery's Handbook, will have significant involvement as well, wherein (Vf) is the final velocity in feet per second, (a) is the rate of acceleration in feet per second per second and (S) is the distance moved in feet. In subsequent applications of this equation, (L) will be substituted for (S).

One of the reasons for the apparent confusion and misconceptions among the contemporary intelligentia, concerning precisely what centrifugal force is , how it is generated and the functions of inertia in the process may be the vagueness, the variations and the general inadequacy of published descriptions of this natural function. Listed on following pages are several such descriptions along with references and author's comments.

It appears that all of the published descriptions are ultimately based on fundamental assumptions, established and sustained for three hundred years or more, somewhat along these lines of reasoning. The action is initiated by the restraining agent as it exerts the centripetal force radially inward toward the center and against the orbiting or rotating body and thereby constantly accelerates the body, or its inertial image of identical mass , from natural straight line tangential path to forced circular path of motion. Apparently there is a further assumption that inertia is involved in the process in two separate and distinct functions, 1) the first function tends to sustain the body's forward motion orbital velocity at its operational constant uniform level and thereby sustains the critical time period (t) at its appropriate level and 2) the second function inertia initiates the reaction in this scenario by constantly exerting an equal and opposite centrifugal force radially outward. The fundamental ($a = v^2/r$) and ($F = m\ v^2/r$) evolved from these assumptions which, in turn, were converted in other terms for convenience.

During the final years of the concept development period, in attempts to gain further enlightenment concerning derivation of these long established fundamental equations, it was discovered that acceleration of the orbiting body, or its inertial image of identical mass, from any given point on the natural tangential path of motion to an appropriate point on the orbital circle through an appropriate segment of an involute curve, erected to that segment of the orbital circle, in an appropriate segment of the critical time period (t), consistantly required an accelerating force of precisely the same value as that emerging from application of the long established ($F = m v^2 / r$) or one of its derivatives ($F = .000028416 W r N^2$).

This was a surprising development because it strongly suggested that an alternate equation derivation format might be possible. When the initial point on the natural tangent was at its outer end and a complete involute curve erected to the complete orbital circle terminated at the circle's end point, it appeared to be impossible for the restraining agent to execute an acceleration of body mass, or that of its inertial image, through such a path of motion. This, in turn, suggested that perhaps the long established assumption, concerning the order of action to reaction, may have been reversed and that it is actually second function body inertia that initiate the action as it acts radially outward in constant resistance to the constant change in direction of body motion from tangent to circle. This being the case, the successful restraining agent must react with an equal and opposite force so as to totally block second function inertia's effort. This being the case, would second function inertia accelerate an inertial image of the body from circle to tangent, presumably through an involute curve path, to define the magnitude of its effort? Eventually, a precise answer to this question was developed and the author comments reflect the results.

FIRST DESCRIPTION: From Machinery's Handbook, 19th Edition:

CENTRIFUGAL FORCE: When a body rotates about any axis other than one at its center of mass, it exerts an outward radial force upon the axis or any arm or cord from the axis which restrains it from moving in a straight, (tangential), line. In the following formulas:

F = centrifugal force in pounds.

W = weight of revolving body in pounds.

v = velocity at radius R of body in feet per second.

R = perpendicular distance from axis of rotation to center of mass, or for practical use, to center of gravity of revolving body, in feet.

Note: If a body rotates about its own center of mass, R equals zero and v equals zero. This means that the resultant of the centrifugal forces of all the elements of the body is equal to zero or, in other words, no centrifugal force is exerted on the axis of rotation. The centrifugal force of any part or element of such a body is found by the equations given below where R is the radius to the center of gravity of the part or element. In case of a flywheel rim, the mean radius of the rim meets practical requirements, as this is the radius to center of gravity of a thin radial section.

$$F = \frac{W v^2}{g R} = \frac{W v^2}{32.16 R} = \frac{4 W R pi^2 n^2}{60 \times 60 g} = \frac{W R n^2}{2933} = \underline{0.000341 W R n^2}$$

If (n) is the number of revolutions per second instead of per minute, then $F = \underline{1.227 W R n^2}$.

Calculating Centrifugal Force:

In the ordinary formula for centrifugal force, $F = 0.000341 W R n^2$. The mean radius R of the flywheel or pulley rim is given in feet. For small dimensions, it is more convenient to have the formula in the form: $\underline{F = 0.000028416 W r n^2}$, in which F = centrifugal force in pounds, W =

weight of rim in pounds, r = mean radius of rim in inches, n = number of revolutions per minute. (Unquote and end of FIRST DESCRIPTION).

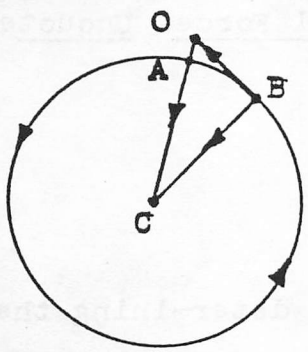
Author's Comment On FIRST DESCRIPTION:

This description is totally inadequate for determining the origin of Centrifugal Force and Inertia's involvement in the process. Inertia is not even mentioned nor is Centripetal Force or the derivation of the equations for determining the value of Centrifugal Force. However, it must be remembered that Machinery's Handbook is,and has been for a very long time, the primary technical reference for practicing engineers, machinists and maintenance personnel and this description adequately provides the means to determine the bursting stress on rotating elements of machinery. In the twenty-seven years of the author's engineering experience, reference to this natural function was rare and usually occurred in reference to stress analysis only.

(End of author's comment on FIRST DESCRIPTION.)

SECOND DESCRIPTION: From " Modern Physics" by Charles E. Dull, 1939 Edition,A High School Level Textbook.

Curvilinear Motion and Centrifugal Force.



Ball B tries to follow path B O. String pulls it toward center.

Fig. 211. The ball tends to break the string and follow the path B O.

176. How is curvilinear motion produced? From Newton's first law we learned that a body which has aquired velocity continues to move in a straight line. If a second force acts upon the moving body at right angles to its path, it will be deflected from its rectilinear line, and its motion will become curvilinear. To illustrate, we may tie one end of a string

to a ball. Holding the other end firmly, we may swing the ball in a circle about the hand as a center. The pull of the hand upon the cord deflects the ball away from its rectilinear path and toward the center. (See Fig. 211) As the ball moves along the circumference from B to A, the pull toward the center has deflected it a distance equal to A O. The constant pull that deflects a body from its rectilinear path and compels it to move along a curve, is called Centripetal Force. (Centrum center, Petere , to seek)

177. What is Centrifugal Force? (Centrum , center, Fugere, to flee from). If the revolving body of Fig. 211 did not have inertia, it would be pulled to the center. If the earth in revolving around the sun did not have inertia, it would fall into the sun. The reaction due to the inertia of the moving ball offers resistance to the centripetal pull and tends to break the string. If the string breaks, the ball immediately begins to move in a straight line along a tangent to the curved path. The resistance that a body offers to deflection from a straight line is commonly known as Centrifugal Force. Some physicists object to the use of the term " force " as applied to the tendency a body offers to resist being deflected from its path, but beginners find it easier to think of such reaction as Centrifugal Force. Unquote.

End of SECOND DESCRIPTION.

Author's Comment on SECOND DESCRIPTION:

While this description is totally inadequate also, for determining the origin of Centrifugal Force and Inertia's involvement in the process, it does have certain redeeming features. It does involve the terms " Centripetal " and " Centrifugal " and provides a unique explanation of their derivation from the Latin words " centrum " , " petere " and

" fugere ". It also mentions Inertia but fails to explain precisely how it is involved. Also its reference to the path of motion as "curvilinear" rather than " circular " while technically correct, could be misleading and confusing to some. It also refers to the " pull of the hand toward the center". This is considered, by the author, to be an inaccurate and misleading statement. When a ball is tied to a string and swung in a circle with the hand at the center, the hand is actually performing two functions, 1) It is maintaining the center of rotation at a point in space in opposition to the pull of centrifugal force on the string, which is functioning as the restraining agent and forcing the ball to move through a circular path in space and, 2) By moving the fingers holding the string in a small circle around the center, the hand is applying a tangentially directed force laterally across the string in the direction of rotation, which establishes and maintains the rate of rotation and, more importantly , the critical time factor (t), the time in seconds for one revolution, as it overcomes the resistance to rotation offered by friction, wind resistance and gravity.

Also the statement that " If the revolving body of Fig. 211 did not have inertia, it would be pulled to the center." is considered, by the author, to be inaccurate and very misleading. Corrected it would read "If the revolving body of Fig. 211 did not have inertia, there would be no pull on the string because there would be no resistance by the ball's inertia to the constant change in direction of the ball's forward motion through the circular path described in space". Under no circumstances would the body be"pulled to the center". Neither the body or its inertia will ever move to a position inside the circular path.

The later statement " If the earth, in revolving around the sun, did not have inertia, it would fall into the sun." is a true and accurate

one. The difference is that the hand is holding one end of the string at a fixed point in space and thereby forcing the body to rotate about that point but never pulls or attracts the body to a position inside the circular path,as explained above. On the other hand , the sun's gravity does the same thing,in that it does maintain a fixed point in space as the center of rotation. However, its gravitational attraction toward its center of gravity is constant and perpetual and it would, indeed, cause the earth to cross the nearly circular orbital path and plunge into its fiery surface , if it could. But the fact is that it does not have the power to do so because the earth's orbital velocity and its orbital radius provide the conditions whereby Inertia exerts precisely one "G" of centrifugal force away from the sun which totally neutralizes the one "G" of centripetal force exerted by the sun's gravity toward the sun.

End of author's comment on the SECOND DESCRIPTION.

THIRD DESCRIPTION: From " Elementary Mechanics", 1930 Edition.
An International Correspondence School Textbook.

Centrifugal Force

27. Suppose that a body is forced to move in a circle, being held perhaps by a string to a central point or guided by a circular ring. If it were not for this constraint, the motion starting from any point **A** , Fig. 8 , would be in the straight line **AX**;

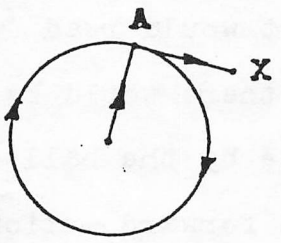


Fig. 8

the string or guide deflects the motion. Such a deflection can, however, be due only to a force, which is the tension in the string or the pressure of the ring on the body. This force is called the centripetal force and acts toward the center of motion. Like any other force it produces an acceleration (a). Since there is always

action and reaction, there is a force equal and opposite to the centripetal force, which is called centrifugal force, which acts away from the center of motion. There is a common impression that centrifugal force is a force pulling the body away from the center about which it moves, and if it were not for the cord or other restraining agent the body would fly out radially from the center; this notion is wholly incorrect. The body, if left to itself, would, in obedience to Newton's first law, move in a straight line, and it is the deflection or centripetal force that pulls it out of the straight line. Let the restraint be removed , that is, cut the string in Fig. 8, and the body will move in a tangent to the circle, the line AX in the figure. So far as the body is concerned, there is no centrifugal force that might cause it to move radially outward. The centrifugal force acts on the restraining agent, and not on the body.

28. Assuming the velocity of the body around the circle to be uniform, the acceleration toward the center is also uniform and is just sufficient to keep the body moving in a circle. Representing the velocity of the body along its circular path by (v) and the radius of the circle by (r), it can be proved by the principle of limits or by the calculus that the acceleration (a) of the body toward the center is equal to ($\frac{v^2}{r}$) , or ($a = \frac{v^2}{r}$) . Since force = mass x acceleration, let $F_c = \frac{m\,v^2}{r} = \frac{W\,v^2}{g\,r}$ (1). This formula may be expressed more conveniently as follows: Let F_c = centrifugal force ,in pounds; W = total weight of body, in pounds; r = radius, usually taken as distance between center of motion and center of gravity of body, in feet; N = number of revolutions of body per minute. In formula (1), (v) is in feet per second; since the circumference of a circle having a radius (r) is (2 pi r), the distance traveled by the body in one minute is

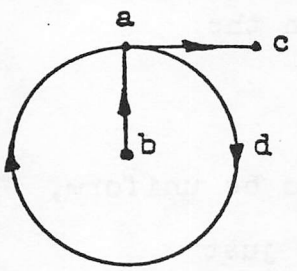
(2 pi r N) and in one second is ($\frac{2 \text{ pi r N}}{60}$) , which is the velocity (v). Substituting this value of (v), and (32.16) for (g), in formula (1), $Fc = \left(\frac{2 \text{ pi r N}}{60} \right)^2 \times \frac{W}{32.16}$ or $Fc = .00034 \text{ W r N}^2$ (2).

Unquote " Elementary Mechanics". End of THIRD DESCRIPTION.

Author's Comment on the THIRD DESCRIPTION:

This description is totally inadequate to fully explain the origin of centrifugal force and Inertia's involvement in the process. For one thing it fails to even mention Inertia , let alone explain how it is involved. End of Author's Comment on the Third Description.

FOURTH DESCRIPTION: From World Book Encyclopedia , 1952 Edition.



Centrifugal Force

The diagram illustrates a stone (a) tied to a string (ab). When the stone (a) revolves around (b), it is traveling toward (c), but the string is pulling the stone toward (d). Therefore the stone follows the path of the circle.

Centrifugal Force is the force that pulls a moving body outward when it is moving in a circle. For example,if a bucket of water is swung rapidly in a circle over your head, the water will not fall out,even when the bucket is upside down, if the bucket is swinging fast enough. Centrifugal forces push the water outward toward the bottom of the bucket even more strongly than gravity pulls the water downward. Another example of centrifugal force is the way automobile tires fling mud against the fenders when the automobile is moving fast. Highways are slanted at curves, or banked , because centrifugal

force would turn an automobile over if it were driven around a flat curve at high speed. Centrifugal force is caused by the tendency of all moving bodies to keep moving in the direction they are started in. When you throw a baseball , for example , it would travel forever in the direction you throw it if there were no other forces, such as gravity, to stop it. This tendency to keep moving in the same direction is called inertia. When a stone is tied to a string and swung in a circle, the string is what makes the stone travel in a circle. The stone constantly tries to move in a straight line. In the illustration, the stone (a) tends to move to (c). But the string between (a) and (b) pulls the stone in the direction of (d). But when the stone's direction is changed slightly it tends to move in a straight direction again, and is again pulled toward (d). The inertia of the stone pulls outward against the string at every point along the circle. There are an infinite number of points on a circle, so the stone pulls outward at an infinite number of points, or continuously, as long as it is swung in a circle.

A mathematical equation has been worked out which can tell us how great any centrifugal force is, if we know certain other things. We must know how fast the object is traveling when it is swung, and we must know the length of the radius of the circle in which the object is moving. We must also know the mass of the object. The speed of the object is multiplied by itself, or squared , and divided by the radius. For example , a stone moving 10 feet per second on a five foot rope would give us 10 times 10 , or 100 , which divided by 5 , is 20. Twenty is then multiplied by the weight of the stone. If this is 4 pounds, we now have 80. Eighty is divided by 32.2 which is the rate at which a falling object increases its speed. The speed of a falling object increases 32.2 feet per second every second. So eighty is now divided by 32.2

which gives a little more than 2.45. The centrifugal force is then about 2½ pounds. Centrifugal force is used in many ways in industry in instruments called Centrifuges.

Unquote World Book Encyclopedia, 1952 Edition.

End of the FOURTH DESCRIPTION.

Author's Comment on the FOURTH DESCRIPTION.

Obviously, the FOURTH DESCRIPTION was written so that lower grade school children could understand it. That was the general theme of this issue of World Book, but its inclusion in Chapter Two of this work is important in the sense that it is a perfect example of some of the misconceptions that children of this age are being exposed to. They have great faith that whatever they read in a reputable encyclopedia is the absolute and complete truth. Unfortunately, this is not always so. Take, for example, the statement in the FOURTH DESCRIPTION , quote , " Another example of centrifugal force is the way automobile tires fling mud against the fenders when the automobile is moving fast." Unquote.

This is another one of those half truths that a child may carry in his or her memory bank through the remainder of life. Certainly, centrifugal force is involved in this familiar occurence of the moving automobile but why not tell them the whole truth, that it only breaks the adhesion between mud and tire. Once the adhesion is broken , centrifugal force ceases to exist in this situation, and the mud slinging against the fenders is performed by the forward inertia and kinetic energy of the rapidly moving mud, along a tangent to the tire outer surface. Remember, when the mud and tire are rotating together, their tangentially directed

forward inertia and kinetic energy, in the direction of rotation, perform but one function, that of sustaining the rotational velocity and the critical time factor (t), the time in seconds for one revolution of tire and mud.

Simultaneously, the inertia of the mud is also exerting a radially outward force against the adhesion between mud and tire, in resistance to the adhesion's function as restraining agent, of forcing the mud to move in a circular path in space, along with the tire. Eventually, this force exceeds the strength of the adhesion and the bond between tire and mud is broken.

At that instant, centrifugal force ceases to exist in this situation, and the inertia of the mud assumes its natural path of motion, a tangent to its former circular path, in accordance with Newton's first law, at the same forward velocity it possessed in the circle. The energy of its forward motion, which is usually referred to as kinetic energy, is actually inertial energy, since it is the mud's inertia that causes it to move along the tangent at that constant velocity, again in accordance with Newton's first law. The fender of the automobile happens to lie directly across the mud's tangential path of motion and eventually, actually in a fraction of a second, mud and fender come into contact with one another. The mud's inertia fiercely resists the interruption of its constant forward motion and it expends its inertial, or kinetic, energy in an instant, as the atoms of mud are splattered against the surface of the fender. Perhaps this is too complex for lower grade children to understand but it is the whole truth concerning the functions of inertia, centrifugal force and kinetic energy in the slinging of mud from tire to fender.

Another flaw in the FOURTH DESCRIPTION is that it too speaks of the string " pulling " the stone from its natural straight line tangential path into the circular path. Actually the string is not pulling the stone from tangent to circle. Rather, it is resisting the inertia of the stone in its constant effort to move from circle to tangent, where it naturally wants to be, in accordance with Newton's first law. The pulling is exerted by the stone's inertia and in a direction outward from the center and along a radius to the circular path of motion, which maintains a constant tension on the string , because the inner end of the string is anchored at a specific point in space, the center of rotation. The stone's inertia constantly pulls radially outward on the outer end of the string. This is confirmed in the FOURTH DESCRIPTION by the statement that " The inertia of the stone pulls outward at an infinite number of points, or continuously, as long as it is swung in a circle."

However, it also emphasizes another weakness in all published descriptions and definitions of the generation and maintenance of centrifugal force, and this Fourth Description is no exception, their failure to clearly and decisively describe the two separate and distinctive functions of inertia in the process. Its first function is, of course, the generation of radially outward directed centrifugal force. The second distinct and separate function of inertia is to exert its full maximum effect toward sustaining the rotational, or orbital, velocity and the critical time factor (t) constant at the specified system operational level. It is this second vital function of inertia that defines the perpetual characteristic of all orbital systems as they function in the perfect vacuum of outer space, which offers zero resistance to forward motion.

The final flaw in the FOURTH DESCRIPTION is the fact that it fails to accurately describe the true functions of the string as the Restraining Agent. First, it perpetually tends to precisely sustain the center of rotation at its appropriate operational position in space. Second , it perpetually tends to precisely sustain the length of the radius from center of rotation to the center of gravity of the orbiting or rotating body. Third, as long as it can successfully sustain the above two factors, it can successfully resist the radially outward force exerted against the body by second function inertia. However, this is understandable since it is quite apparent that its author was unaware.

End of Author's Comment on the Fourth Description.

FIFTH DESCRIPTION: From World Book Encyclopedia , 1987 Edition.

Centripetal Force is the force that compels a body to move in a circular path. According to the law of inertia, in the absence of forces, an object moves in a straight line at a constant speed. An outside force must act on an object to make it move in a curved path. When you whirl a stone around on a string, you must pull on the string to keep the stone from flying off on a straight line. The force the string applies to the object is the Centripetal Force. The word Centripetal is from two latin words meaning " to seek the center ". Centripetal force acts in other ways. For example, a speeding automobile tends to move in a straight line. Centripetal force must act on the car to make it travel around a curve. This force comes from the friction between the tires and the pavement. If the pavement is wet or icy , this friction force is reduced. The car may then skid off the road because there is not enough centripetal force to keep it moving in a curved path. You can use the following formula to calculate the centripetal force to make

an object travel in a circular path: $F = \frac{m v^2}{r}$. Multiply the object's mass (m) by the square of its velocity , (the velocity multiplied by itself), (v^2) , and divide the product by the radius of the circle in which the object moves, (r) . In the metric system the centripetal force is given in newtons when the object's mass is expressed in kilograms, the velocity in meters per second and the radius in meters. Unquote World Book Encyclopedia, 1987 Edition.

End of FIFTH DESCRIPTION.

Author's Comment on the FIFTH DESCRIPTION.

Inertia is mentioned in this description but its precise and true dual function is not addressed. This description also makes the same misleading statement as many others when it states that " When you whirl a stone around on a string you must pull on the string to keep the stone from flying off on a straight line." The truth of the matter is that when you whirl a stone around on a string , you must grip the inner end of the string firmly while exerting a holding force so as to maintain the inner end at a specific point in space as the center of rotation. The pull is , in fact, exerted radially outward by centrifugal force, which is not mentioned in this description , at the outer end of the string. The FIFTH DESCRIPTION appears to be the most incomplete and inadequate description and definition of the generation of centrifugal force,and inertia's vital dual functions in the process, that has been presented thus far. The second example which states that the centripetal force is exerted by friction between tires and pavement is a true statement but it does, in fact , belie the belief that the centripetal force is a pull toward the center other than when gravity is the restraining agent. Friction can never be anything but a holding force at an interface of substances.

End of Author's Comment on the FIFTH DESCRIPTION.

SIXTH DESCRIPTION: From Encyclopedia Americana, 1988 Edition.

CENTRIPETAL and CENTRIFUGAL FORCE: According to Newton's first law of motion, a body in motion will continue to move in a straight line unless it is acted upon by a force. Thus, when a body travels in a circular path, a force is necessary to hold it in that path, such as the force of gravity on the satellite of a star or the force exerted by a man's hand when he whirls a ball at the end of a string. This force, which causes an orbiting body to continually swerve toward the center of its orbit is called Centripetal (center seeking) force. According to Newton's third law of motion when two bodies interact, the forces that they exert on each other are equal but opposite in direction. Thus, corresponding to the centripetal force exerted (through the string) by the man's hand on the whirling ball, there is an opposite Centrifugal (center fleeing) force. Centrifugal force and centripetal force are not distinct forces that could conceivably exist seperately. Instead they are two aspects of a single phenomenon. Centrifugal force should not be confused with the apparent force - actually an example of the so-called coriolis force - by which fluids in a " centrifugal " pump are " impelled"radially by a rotor. This apparent force is a convenient postulate, which makes it appear that motion follows the same rules in an accelerated frame of reference (the rotor) as it follows in an unaccelerated one. Unquote Encyclopedia Americana , 1988 Edition.

End of the SIXTH DESCRIPTION.

Author's Comment on the SIXTH DESCRIPTION.

While this description is inadequate because it too fails to fully

describe the true dual functions of Inertia in reference to Centrifugal Force and , in fact , does not even mention Inertia, it does not make the mistake of describing the centripetal force as a pull by the man's hand on the string but correctly states that it is a holding force that is applied by the hand. It would have been more enlightening, however, had it added that the hand is , most importantly, holding the inner end of the string at a fixed point in space as the fixed center of rotation for the circular path of motion described in space by the ball's center of gravity and that the restraining agent, the string, is doing exactly what it is supposed to do , restraining the ball from its constant effort to move from the orbital circle back to its natural straight line tangential path of motion under the impetus of its inertia.

Just prior to that , however, it states " Thus when a body travels in a circular path , a force is necessary to hold it in that path, such as the force of gravity on the satellite of a star, etc. " The fact of the matter is that in an orbital system , such as that described, gravity is the Restraining Agent and this is the only circumstance in which the centripetal force actually and constantly exerts a pulling force, by and through the restraining agent, on the orbiting body , toward the center of rotation. The statement would have been more enlightening and more representative of the whole truth if it had cited the precise equilibrium between gravity and inertia as the true element sustaining the orbital path. This is typical,however, of statements by physicists and astronomers that all orbital systems are held together by gravity, a half truth, but then they fail to explain what prevents them from collapsing in on themselves, the other half of the whole truth.

There is another unique feature of the SIXTH DESCRIPTION in that it mentions the so-called " centrifugal pump " as being a misnomer and the

author is in complete agreement with this position. Fluid pressure, in such a pump, developed by centrifugal force, is normally very insignificant for several reasons. 1) Rotational velocity is relatively low and 2) fluid mass is relatively high and radius to center of gravity is relatively short but 3) fluid flow rate through the pump is relatively high in reference to the rotational velocity of the fluid mass within the pump. This means that the radial advance per revolution of a fluid particle, as it progresses from pump inlet to pump outlet, is relatively high. Its path of motion, relative to both space and the pump housing, is spiral in configuration and such a large radial advance per spiral revolution produces very low level efficiency in fluid pressurization by centrifugal force. This description appears to be in agreement with the author's contention that this type of pump would be more appropriately identified as a " kinetic energy " pump, since the primary function of the impellor is to accelerate the tangential velocity of fluid particles from zero at the inlet to maximum at the outlet and thereby impart tangentially directed kinetic , or inertial, energy to the moving fluid particles which is converted to fluid pressure as they are jammed into the semi-restrictive fluid conductor at the pump's outlet. End of Author's Comment on the SIXTH DESCRIPTION.

SEVENTH and FINAL DESCRIPTION: From " Mathematical Principles of Natural Philosphy" - Sir Isaac Newton (1642 - 1727) As Translated in the 1930's

(Final Published Description)

(Author's Note: This work is considered to be one of the greatest single contributions in the history of science.)

From SECTION ONE - DEFINITION V:

A Centripetal Force is That by Which Bodies Are Drawn or Impelled, or Any Way Tend, Towards a Point, As to a Center.

Of this sort is gravity, by which bodies tend to the center of the earth; magnetism, by which iron tends to the loadstone ; and that force, whatever it is, by which the planets are continuously drawn aside from the rectilinear motions, which otherwise they would pursue, and made to revolve in curvilinear orbits. A stone, whirled about in a sling, endeavors to recede from the hand that turns it; and by that endeavor, distends the sling, and that with so much the greater force, as it is revolved with the greater velocity, and as soon as it is let go, flys away. That force which opposes itself to this endeavor, and by which the sling continually draws back the stone towards the hand, and retains it in its orbit, because it is directed to the hand as the center of the orbit, I call the centripetal force. And the same thing is to be understood of all bodies, revolved in any orbits. They all endeavor to recede from the centers of their orbits; and were it not for the opposition of a contrary force which restrains them to, and detains them in their orbits, which I therefor call centripetal, would fly off in right lines, with an uniform motion.

A projectile, if it was not for the force of gravity, would not deviate towards the earth,but would go off from it in a right line, and that with an uniform motion, if the resistance of the air was taken away. It is by its gravity that it is drawn aside continually from its rectilinear course and made to deviate towards the earth, more or less, according to the force of its gravity, and the velocity of its motion. The less its gravity is, or the quantity of its matter, or the greater the velocity with which it is projected, the less will it deviate from a rectilinear course. and the farther it will go.

If a leaden ball, projected from the top of a mountain by the force of gunpowder, with a given velocity, in a direction parallel to the horizon, is carried in a curved line to the distance of two miles before it falls to the ground; the same, if the resistance of the air were taken away, with a double or decuple velocity, would fly twice or ten times as far. And by increasing the velocity , we at pleasure increase the distance to which it might be projected, and diminish the curvature of the line which it might describe, till at last it should fall at the distance of 10, 30, or 90 degrees, or might even go quite around the earth before it falls, or lastly, so that it might never fall to the earth, but go forwards into celestial spaces, and proceed in its motion in infinitum. And after the same manner that a projectile, by force of gravity, may be made to revolve in an orbit, and go round the whole earth, the moon also, either by the force of gravity, if it is endued with gravity, or by any other force, that impels it towards the earth, may be continually drawn aside towards the earth, out of the rectilinear way which by its inate force it would pursue; and would be made to revolve in the orbit which it now describes; nor could the moon without some such force be retained in its orbit.

If this force was too small, it would not sufficiently turn the moon out of a rectilinear course; if it was too great, it would turn it too much, and draw down the moon from its orbit towards the earth. It is necessary that the force be of a just quantity , and it belongs to the mathematicians to find the force that may serve exactly to retain a body in a given orbit with a given velocity; and vice versa, to determine the curvilinear way into which a body projected from a given velocity , may be made to deviate from its natural rectilinear way, by means of a given force. The quantity of any centripetal force may be considered as of three kinds; absolute, accelerative, and motive.

DEFINITION VI

The ABSOLUTE quantity of a centripetal force is the measure of the same, proportional to the efficacy of the cause that propagates it from the center, through the spaces round about. Thus the magnetic force is greater in one loadstone and less in another, according to their sizes and strength of intensity.

DEFINITION VII

The ACCELERATIVE quantity of a centripetal force is the measure of the same, proportional to the velocity which it generates in a given time. Thus the force of the same loadstone is greater at a less distance,and less at a greater distance; also the force of gravity is greater in valleys, less on tops of exceeding high mountains; and yet less (as shall hereafter be shown), at greater distances from the body of the earth; but at equal distances, it is the same everywhere; because (taking away, or allowing for, the resistance of the air), it equally accelerates all falling bodies whether heavy or light, great or small.

DEFINITION VIII

The MOTIVE quantity of a centripetal force is the measure of the same, proportional to the motion which it generates in a given time.
Thus the weight is greater in a greater body, less in a less body; and, in the same body, it is greater near to the earth, and less at remoter distances. This sort of quantity is the centripetency, or propension of the whole body towards the centre , or, as I may say, its weight; and it is always known by the quantity of an equal and contrary force just sufficient to hinder the descent of the body.

End of Quote from " Mathematical Principles of Natural Philosphy" -

By Sir Isaac Newton - (1642 - 1727).

End of SEVENTH and FINAL DESCRIPTION. (Final Published Description)

Author's Comment on the SEVENTH DESCRIPTION.

In selecting a pertinent portion of Sir Isaac Newton's great work for the SEVENTH DESCRIPTION, this work has sought enlightenment from the pioneer and most respected of all authorities concerning the fundamental physics involved when matter is in motion, especially curvilinear or circular motion, and this is important because all bodies of matter, throughout the entire universe, are in such motion, in reference to space or other bodies. Far be it from this humble work to question any of the great master's deductions, or conclusions, since they are the true and infinitely adequate base on which all pertinent contemporary knowledge is based. Surely, it has not escaped the reader's attention that in this small portion of his great work, Sir Isaac laid down the firm foundation for contemporary space programs.

However, it appears that the SEVENTH DESCRIPTION is more significant for what it does not reveal than for what it does reveal. It certainly offers specific instructions on how to put a satellite into orbit and it addresses, in great detail, the radially inward centripetal forces that comprise one half of the equilibrium, that so precisely stabilizes all natural orbital systems through perpetuity, but fails to specifically identify, by name, the radially outward force that comprises the other half. However, it does acknowledge that such a force is there when it states, under DEFINITION VIII, that "-it is always known by the quantity of an equal and contrary force just sufficient to hinder the descent of the body."

It fails to mention inertia but speaks only of forward velocity as the key factor in the generation of the force comprising the other half of

orbital equilibrium and it does clearly confirm that precise equilibrium between these forces is an absolute necessity but leaves to mathematicians the task of determining their values. It seems apparent, or at least probable, that this failure to fully address, in specific detail, the precise function of radially outward directed inertia, in a clear distinction from the inertia of forward motion, in the generation of centrifugal force, that has led to such wide-spread contemporary misconception concerning this natural phenomenon. So many ignore the pertinency of the resolution of forces, the ninety degree relationship of tangent to radius, and the force and distance limitations of kinetic energy, when they adhere to the misconception that tangentially directed forward inertial or kinetic energy, which can deliver the required constant force for only a very limited distance, can somehow deliver the radially outward directed centrifugal force constantly through perpetuity.

The SEVENTH DESCRIPTION strongly suggests that the revered Newton has left it to those who have followed in his giant footsteps to clearly and precisely define the true functions of inertia in this very common natural process,which are absolutely vital to our very existance, not just a possible solution to contemporary problems. If published definitions and descriptions to date are a true indication, then such followers have certainly not given this task the concentrated attention that it justly deserves. Perhaps this is because the needs that have prevailed in the interim have not demanded it of them.

End of Author's Comment on the SEVENTH DESCRIPTION.

Perhaps the reader can appreciate this work's position that the apparent enormous potential of the proposed Inertial-Pneumatic Electric

Power System does present a contemporary need which demands that this vital subject matter be comprehensively addressed in a totally honest manner so that the whole truth,concerning the vital dual functions of inertia when a body of matter is forced to move through a circular path described in space, may be precisely and clearly defined.

Since the inception of the Inertial-Pneumatic Electric Power Concept in 1968, the author has been painfully aware of the horrendous obstacles to persuading the contemporary intelligentsia that it was not what they call " perpetual motion ", meaning a machine or system that generates its own energy source. The truth of the matter is that this concept does not generate its own energy source. It merely provides the appropriate conditions for its energy source to exist, naturally. It then effectively utilizes it as a free natural pneumatic compressor based on the same fundamental physics that permits every orbital system in the universe to utilize it as a free natural gravity neutralizer.

However,because of the mysterious and wide-spread belief that centrifugal force is somehow derived from the energy that initiates and/or sustains rotation, this explanation has not been acceptable to the contemporary intelligentsia to whom it has been offered . The foundation for this misconception appears to lie in the apparent lack of published concensus on a precise,fully comprehensive and readily understood definition of the role of inertia in the generation of centrifugal force. Thus, the author was faced with the formidable task of developing such a definition, through research and development. The surprising result is offered on subsequent pages of this Chapter Two.

Research of many available published definitions left several significant unanswered questions:

1) Most of the published definitions state that the restraining agent exerts the centripetal force radially inward against the orbiting or rotating body that produces an acceleration of the body toward the center of rotation. How is this possible when there is never any motion by the body or the restraining agent radially inward once the system operational mode has been established? How is this compatible to the fundamental fact of physics that no force can accelerate any body of matter without moving in the direction of acceleration?

2) Why is it that published descriptions so seldom even mention inertia and none, to the knowledge of this work, ever mention the two separate and distinct functions of inertia , the one perpetually resisting change in forward orbital or rotational velocity and the other perpetually resisting change in direction of forward motion?

3) If first function inertia,that resists change in forward velocity, tends to sustain orbital or rotational velocity and the critical time period (t),only,at their specified operational level perpetually, then does it not logically follow that second function inertia, that resists change in direction of forward motion, tends to sustain centrifugal force, only,at its specified operational level perpetually because first function inertia,at any given instant, is tangentially directed while second function inertia, at any given instant,is radially outward directed and this perpetual 90^{o} relationship precludes one from ever effecting the other, in accordance with the composition and resolution of forces?

4) By authentic definition , a body of matter's mass is the measure of the body's inertia. This being true, is it not perpetually characteristic of inertia's functional behavior to assume an imaginary body of its own, a perfect image of the real body in mass and configuration,even though

without the substance of the real body, with which it can describe, and/or assume, imaginary paths of motion and relative positions in space, in strict accordance with its own inate tendencies,without regard to the boundaries of the real body, and manifest such action by exerting force against the real body,of magnitude and direction appropriate to the accomplishment of its functional purposes as if it was acting on the real body?

5) As indicated earlier in this chapter,research has clearly demonstrated to this work that values for centrifugal force and even the derivation of authenic equations that define values of centrifugal force can evolve from acceleration of an orbiting or rotating body's inertial image, such as suggested in question 4 above, through the length of an imaginary path of motion,described in space,which is effectively a complete involute curve erected to a complete imaginary orbital or rotational circle,within the critical orbital or rotational time period (t). Whether acceleration is from an imaginary point in space back to an imaginary point on the orbital circle or from such point to the imaginary point in space at the outer end of the imaginary involute curve path of motion, the result is precisely the same. However, since second function inertia resists radially outward the constant change in direction of the orbiting body,wrought by the restraining agent as it relentlessly forces the body to assume infinite consecutive positions on the imaginary orbital circle, is it not most logical to assume that acceleration of image from point on circle to point in space through the imaginary involute curve path is most compatible to the natural behavior of second function inertia?

6) This being the case, why does second function inertia select an involute curve path of motion through which to apply its accelerating force

Attempts to solve for the answers to these questions begin by using the example so frequently used in published descriptions and definitions. In Figure 1, a lead ball weighing .215 pound, is swung on a string AO through the circular path of motion AC , described in space by the ball's center of gravity, in a clockwise direction. The beginning point, on the circular path of motion described in space, of each revolution of the ball at its center of gravity, is the point A . The radius r of the circle AC from the center O to the center of gravity of the ball is 8.000 inches. The time for one revolution of the ball through the circle AC is .500 second, the number of revolutions per minute is 120, and its rotational, or tangential , velocity is 8.378 feet per second. The critical time period (t) is, of course, also .500 second and will be referred to frequently on subsequent pages. The circumference of the circle AC is 2 pi r or two times 3.1416 times 8.000 or 50.266 inches, or 4.189 feet.

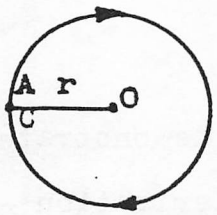


Figure 1

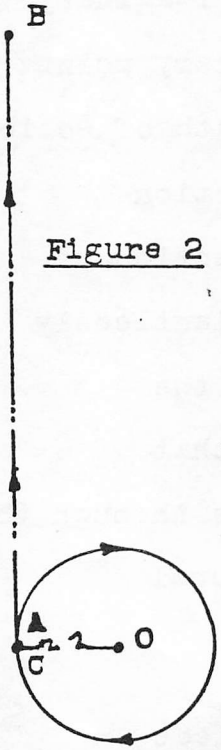


Figure 2

In Figure 2 left, in accordance with Newton's first law of motion, if the string AO should suddenly break at any given instant and the ball was no longer restrained and could follow the inate tendencies of its inertia, it would begin at the point A in space , and on the circle AC, and its center of gravity would describe a straight line path of motion AB in space, which is a true tangent to the circle AC, at the same uniform velocity of 8.378 feet per second that it moved through the circle AC. Therefor, at the end of the critical time period (t), it would arrive at the point B in space, a tangential distance from point A of 50.266 inches, or 4.189 feet. Obviously, if each revolution of the ball

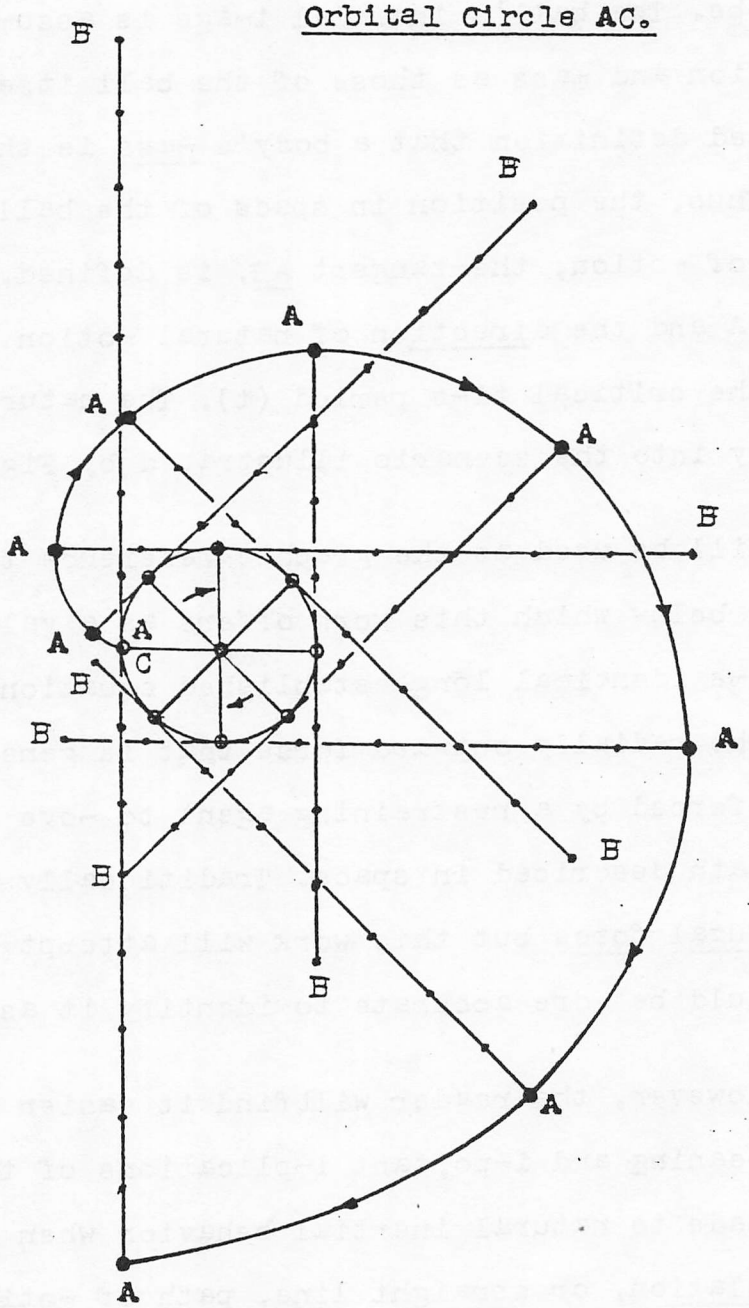
about the center O began at the point A , the ball's inertial image would want to be at the point B at the end of the critical time period (t), not at the point C where the restraining agent , the string, forces the ball itself to be. The ball's inertial image is assumed to possess the same configuration and mass as those of the ball itself, in accordance with the accepted definition that a body's mass is the measure of that body's inertia. Thus, the position in space of the ball's natural straight line path of motion, the tangent AB, is defined. Its base is anchored at the point A and the direction of natural motion is from point A to point B within the critical time period (t). The natural tangent AB enters importantly into the scenario illustrated by Figure 3 on page 58.

Figure 3 will be used as the graphic reference to illustrate the hypothesis below which this work offers as a valid alternate derivative for the same identical long-established equations for defining the value of the radially outward force that is generated as a body of matter is forced by a restraining agent to move through an imaginary circular path described in space. Traditionally it has been identified as centrifugal force but this work will attempt to demonstrate that it perhaps would be more accurate to identify it as inertial force.

Perhaps, however, the reader will find it easier to fully comprehend the true meaning and important implications of the hypothesis if reference is first made to natural inertial behavior when a body of matter is in a pure translation, or straight line, path of motion and the velocity of its forward motion is suddenly changed. For example, a 3,000 pound automobile, moving along a straight line path, which may not be precisely straight nor pure translation but about as close to it as actual practice will permit, at 60 miles per hour, or 88 feet per second, will have accumulated a potential kinetic , or inertial, energy of $m v^2/2$ or $Wv^2/2g$.

Figure 3

Illustrating How Second Function Inertia Perpetually Adjusts The Position Of Its Natural Tangent Path To The Position Of The Orbiting Body On The Orbital Circle AC.

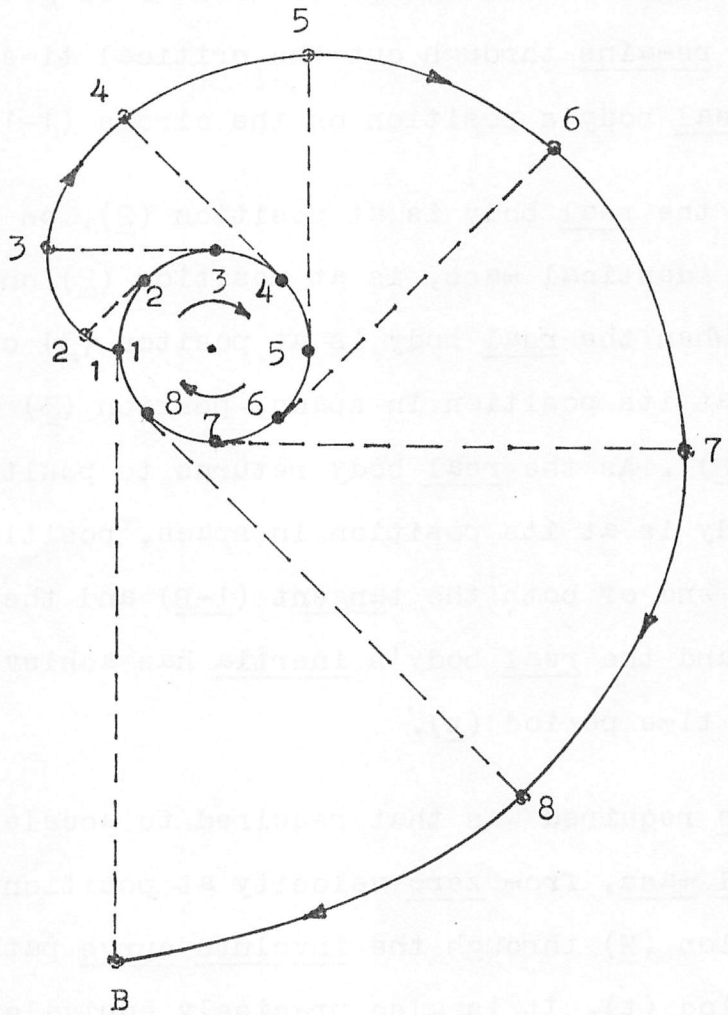


The Starting Point A Is Typical At An Infinite Number Of Points On The Orbital Circle AC Thereby Illustrating The Perpetual Performances Of Inertia's First And Second Functions.

Figure 3 A

An alternate explanation of why the Inertial Image of the Body, at its center of gravity, describes an Involute Curve path of motion, in space, in the Critical Time Period (t). Refer to Page 58 B .

Note, in Figure 3A below, how second function inertia constantly strives to convert the actual circular path of motion back to tangential path.



The starting point (1) is typical at an infinite number of points, on the Orbital Circle (1-1) , thereby illustrating the perpetual performance of Inertia's First and Second functions.

Referring to Figure 3 A on page 58 A , beginning at the point (1) on the orbital circle (1-1) , it is the objective of the body's Inertia to place the Image body , of identical mass , at the outer end of a Tangent , (1-B) , to circle (1-1) whose length is precisely equivalent to the circumference of circle (1-1), in the critical time period (t), the time for one orbit. The body's Inertia begins its effort by affixing the image body to the outer end of the imaginary straight line tangential path of image motion through the center of gravity of the real body , where it remains through out the critical time period (t), regardless of the real body's position on the circle (1-1).

Thus, as the real body is at position (2), on circle (1-1), the image body, of identical mass, is at position (2) on the involute curve path, (1-B). When the real body is at positon (3) on circle (1-1) , image body is at its position in space, positon (3) on the involute curve path (1-B) . As the real body returns to position (1) on circle (1-1), image body is at its position in space, position (B) which is the terminal end of both the tangent (1-B) and the involute curve path , (1-B) , and the real body's inertia has achieved its objective , in the critical time period (t).

The force required was that required to accelerate the image body, of identical mass, from zero velocity at position (1) to maximum velocity at position (B) through the involute curve path (1-B), in the critical time period (t). It is also precisely equivalent to the force value (F) derived from the equation ($F = .000028416\ WrN^2$) , in which W = the weight,in pounds, of the real body , r = the radius of circle (1-1) , in inches, and N = the RPM of the real body through circle (1-1).

Thus its potential energy,(Ek), is equal to 3,000 times 88 times 88 divided by 2 and divided again by 32.16 or 361,194 foot-pounds. Suddenly, without warning, it strikes an immovable tree trunk and is decelerated from 88 feet per second to zero feet per second velocity in a deceleration distance of 3 feet and in a deceleration time period of .0681818 second. The impact force, (Fi) is equal to (Ek),in foot-pounds, divided by the deceleration distance of 3 feet or 361,194 divided by 3 or 120,398 pounds. This enormous force of impact has wrapped the auto's body around the tree such that the tree trunk has penetrated to a depth of three feet into its structural components.

Note, in this scenario, that the speeding auto's inertia initiated the action as it pressed the auto against the tree trunk with a force of over sixty tons and the tree trunk initiated the reaction with an equal and opposite force, through its enormous strength which provided its capacity to maintain its precise static position in space with a holding force that was well within the limits of its tensile strength. There was no acceleration of the auto back in the direction from whence it came.

The 120,398 pound impact force (Fi) was derived from the auto's inertia instantaneously counter-acting this sudden deceleration by providing an acceleration force to the auto equivalent to that required to accelerate the auto, or its inertial image, both of the same mass, from zero feet per second velocity at the point of stoppage back up to its initial velocity of 88 feet per second at a point three feet beyond the point of stoppage at the end of the .0681818 second time period, which is exactly where the auto would have been at that point in time had it proceeded uninterrupted at its uniform velocity of 88 feet per second. While this was inertia's counter-action to change in forward motion, it counter-acts to change in motion direction with precisely

the same vigor and instantaneousness, as will be explained and illustrated by the role of second function inertia in the scenario of Figure 3.

But first, the rate (a) of auto image acceleration is equal to (Vf), which is image final velocity, squared and then divided by 2 and divided again by (L), which is the acceleration distance in feet. Thus acceleration rate (a) is equal to 88 times 88 , then divided by 2 and divided again by 3 all of which is equal to 1,290.667 feet per second per second. Then the image accelerating force, (Fa), is equal to (W), which is the image's weight in pounds, that being identical to that of the auto, times (a) and then divided by (g) or 3,000 times 1290.667 and then divided by 32.16 or 120,398 pounds. Note that the image accelerating force (Fa) is precisely the same as the auto's impact force (Fi) !

Now, referring again to Figure 3 on page 58, the lead ball on a string, referred to earlier and illustrated by Figures 1 and 2 , is at the starting point A on the orbital circle AC and is about to resume clockwise rotation at the uniform forward velocity of 8.378 feet per second but for an instant action has been frozen at the starting point A , it being typical continuously at an infinite number of starting points on the circle AC , and at the point in time , (t) minus (zero) , (t) being the critical time period required for one revolution of the lead ball, or in this case , .500 second.

Identically located at point A is the beginning of natural tangential path AB which is perpendicular to a radius of circle AC intersecting at the point A and its ending located in space at point B. Also identically located at point A is the ball's inertial image of identical mass , perpetually affixed to the beginning end of tangential path AB. The circle AC has been divided into eight equal segments, each representing 45° of

lead ball rotation and one eighth of the critical time period (t) or in this case .0625 second, and one eighth of the circumference of circle AC or in this case 6.283 inches. Natural tangential path AB has also been divided into eight equal segments and, since it is identical in length, each of its segments is also 6.283 inches long.

The instant that lead ball rotation resumes , the circle AC and the tangent AB tend to separate which immediately initiates a perpetual struggle between the restraining agent, the string, and second function inertia. The string, as long as it can maintain sufficient strength, perpetually forces the lead ball to move through the circular path AC while second function inertia perpetually struggles to keep the lead ball moving through the natural tangential path AB. The string being strong enough to prevent second function inertia from moving the ball from circle to tangent, it solves its problem by maneuvering the tangent perpetually so that it passes through the ball center of gravity , is perpendicular to the radius intersecting its center of gravity and the ball has passed through precisely the same portion of the tangent as it has of circle in the identical portion of critical time period (t).

Second function inertia accomplishes this remarkable feat by applying sufficient force radially outward against the lead ball equivalent to that required to accelerate its image of identical mass through the imaginary involute curve path of motion AA from zero velocity at A on the circle to maximum velocity at A on the path's outer end during the critical time period (t). The curved path configuration and direction of image passage through it is defined by the dual influence of first and second function inertias combined. With the image perpetually affixed to the starting end of the tangent as it is perpetually adjusted to appropriate position in space, its center of gravity must, of necessity,

describe an imaginary involute curve path of motion in space as illustrated in Figure 3.

From the perspective of inertia, it has the perpetual natural responsibility, in accordance with the enormous capacity the Creator has given it, to respond instantly and correctly to any and every change of motion , whether in velocity or direction , in any and every body of matter in the universe, from the largest galaxie to the tiny atom, with what ever is required to sustain the status quo. So governing the whirling lead ball scenario, illustrated by Figure 3, is all in the day's work but nevertheless it is executed with the same incredible 100% efficiency.

As lead ball rotation resumes from the stop-action situation at point A on the imaginary orbital circle, inertia encounters no difficulty executing its response to change in forward velocity since human muscle energy is neutralizing wind resistance, friction and the adverse effects of earth gravity. Therefor no tangentially directed stabilizing force is required of it.

However, executing its response to lead ball change in direction, as the string forces it to assume a new position on the orbital circle, requires immediate and decisive application of radially outward directed force of just sufficient magnitude against the mass of the lead ball. Of course the string is strong enough to prevent any radially outward motion of the real lead ball but it has no control over inertia's inate ability to govern motion of the lead ball's image of identical mass. Hence, inertia is free to constantly adjust the image's position in space while it remains perpetually affixed to the base of the imaginary tangential path and it instinctively knows precisely how much force is perpetually required to execute that function.

The success of inertia's execution of its resistance to change in direction function is clearly illustrated in Figure 3 on page 58. Note that as the real lead ball has completed 45° of rotation through the orbital circle AC and has moved through 6.283 inches of its circumference, inertia has moved the lead ball's image to the first position A on the involute curve path AA , has changed the posture in space of tangential path AB from vertical to 45° clockwise rotation and has advanced the real lead ball's position on the path AB from its beginning end to a position 6.283 inches from the beginning end. In addition it has sustained AB's tangential status by sustaining its 90° directional relationship to an orbital radius to the real ball's center of gravity.

As the real ball has completed 90° of rotation through the orbital circle AC and has moved through 12.566 inches of its circumference in .125 second, inertia has moved the lead ball's image to the second position A on the involute curve path AA , has changed the posture inspace of tangential path AB from vertical to 90° clockwise rotation, thereby sustaining its tangential status, and advanced the real ball's position on the path to a point 12.566 inches from its beginning end.

This sequence of space position adjustments is typical of that at an infinite number of positions as the string forces the real lead ball to assume the next forward position on the orbital circle AC, continuously and perpetually as long as rotation continues. Each new position is also a new starting point "A" as well and triggers a new scenario identical to that of Figure 3. Thus there is perpetually a dense mixture of such scenarios about the orbital circle AC.

As the real ball has completed 360° of rotation through the complete orbital circle AC in .500 second, the critical time period (t), inertia

has moved the lead ball's image to the final position A at the outer terminal in space of the involute curve path AA, has changed the posture in space of tangential path AB from vertical above point A to 360° clockwise rotation and a vertical position below point A , thereby sustaining its tangential status, and advanced the real ball's position on the path to its terminal point B , 50.266 inches from its beginning point A.

Notice how efficiently inertia plans and executes its two separate and distinct functions when a body of matter is forced to move through a circular path described in space. By far, the most of its first function executions are effortless because they occur naturally in orbital systems in the perfect vacuum of outer space which offers zero resistance to forward motion and therefor has no power to change forward motion velocity. By far, the most of its second function executions are incredibly enormous and perpetual efforts as it is required to accelerate inertial images of incredible mass through the typical involute curve path AA of Figure 3. The relatively few first function executions that occur in man-made rotating machines can be effortless as well if provision is made to neutralize the inevitable impediments to forward motion that are the inate characteristic of all such machines.

Perhaps by this time the reader is thinking that the author has assembled a fascinating account of natural functions and activities but does it really have valid foundation in scientific fact? After all, this is a total departure from prior descriptions and accounts that we have been exposed to. It has, indeed , as you will perceive as the solution for the radially outward force against the real lead ball of the Figure 3 scenario unfolds via two entirely different formats, the first newly introduced by this work, the second long established by the scientific

and educational communities. The reader must then decide which of the two is truly valid and most precisely and comprehensively unravels the existing mysteries of the matter in circular motion scenario.

The radially outward directed force (Fi) applied by second function inertia to the lead ball of Figure 3 on page 58 is identified in this first solution format as the inertial force, which initiates the action in the scenario of Figure 3. The equal and opposite force (Fr) applied by the restraining agent, the string, to the real lead ball is identified as the restraining force which initiates the reaction in the scenario of Figure 3, as it successfully restrains and perpetually prevents any motion resulting from the application of (Fi), by virtue of its adequate strength to sustain, perpetually, the radius from center of rotation to the real lead ball's center of gravity at its specified operational length while perpetually anchored to the center of rotation at a fixed point or axial centerline in space. By the same virtues, the string confines the forward motion direction of the rotating real lead ball to that of the orbital circle AC.

Referring again to Figure 3 on page 58, the length L of the involute curve path AA is authentically expressed by the equation ($L = \frac{2\ pi^2}{12} r$), in which L is the length of AA in feet, pi is the constant 3.1416 and r is the radius of the circle AC in inches. Thus the length of AA is equal to $\frac{2 \times 3.1416 \times 3.1416 \times 8.000}{12}$ or 13.160 feet . The critical time period (t) is the time in seconds required for one revolution of the real lead ball about the center of rotation but it is also the time period in which second function inertia must accelerate the lead ball image of identical mass through the length of path AA from zero velocity at A on circle AC to maximum velocity at A on AA's terminal outer end. In this case, critical time period (t) is .500 second.

Then the average velocity Va of passage through path AA by the lead ball's image of identical mass is equal to $\frac{13.160}{.500}$ or 26.320 feet per second. The final velocity Vf of image passage is equal to 2 x 26.320 or 52.640 feet per second. Then the rate a at which the image is accelerated is equal to $\frac{Vf^2}{2\,L}$ or $\frac{52.640 \times 52.640}{2 \times 13.160}$ or 105.280 feet per second per second.

Then the inertial force Fi and the restraining force Fr are each equal to $\frac{W\,a}{g}$ or $\frac{.215 \times 105.280}{32.16}$ or .704 pound.

In this second solution format, the radially inward directed force Fcp, applied by the restraining agent, the string , to the real lead ball, is identified as the centripetal force , which initiates the action in the scenario of Figure 3, in accordance with long established tradition. The equal and opposite force, Fcr , applied radially outward against the real lead ball, is identified as the centrifugal force , which initiates the reaction in the scenario of Figure 3, as it successfully prevents any radially directed motion resulting from the application of Fcp. In other respects , the restraining agent, the string, serves identical purposes in this second solution format as it does in the first above. However, it must be remembered that traditional definition also states that force Fcp produces an acceleration toward the center but never, to the knowledge of this work, has offered a public explanation of how this can occur without motion toward the center.

In any event, the acceleration rate a , supposedly of the real lead ball of Figure 3 toward the center, produced by Fcp , has been traditionally determined, by application of the calculus and the principle of limits, to be v^2/r and the acceleration force applied by Fcp has been determined to be $m\,v^2/r$ or $W\,v^2/g\,r$. Derivatives of

these fundamental equations have traditionally evolved for the convenience of applications. Among them is this example which evolved for the convenience of application to rotating machines of small dimensions: $Fcr = .000028416\ W\ r\ N^2$ and it is applied in this second solution format.

Thus Fcp and Fcr $= .000028416 \times .215 \times 8.000 \times 120 \times 120$

$= .704$ pound

How is it that the sequence and the multiple equations of the first solution format produced the same identical value for the radially outward force, against the real lead ball of Figure 3, as that produced by the second solution format which applied only one equation, .704 pound?

Perhaps the following algebraic conversion sequence will provide a reasonable answer to that question. The equations of the first solution format are converted below in terms of W , r and N .

Thus $L = \frac{2\ pi^2\ r}{12} = \frac{2 \times 3.1416 \times 3.1416 \times r}{12} = 1.6449417\ r$ feet.

The critical time period $(t) = \frac{60}{N}$ second.

Average velocity $Va = \frac{L}{t} = \frac{1.6449417\ r}{\frac{60}{N}} = \frac{1.6449417\ r\ N}{60}$

$= .0274156\ r\ N$ feet per second.

Final velocity $Vf = 2 \times Va = 2 \times .0274156\ r\ N$

$= .0548312\ r\ N$ feet per second.

The acceleration rate $a = \frac{Vf^2}{2\ L} = \frac{(\ .0548312\ r\ N\ )^2}{2 \times 1.6449417\ r}$

$= .0009138\ r\ N^2$ feet per second per second.

Then inertial force Fi and restraining force Fr

$= \frac{W\ a}{g} = \frac{.0009138\ W\ r\ N^2}{32.16} = .000028414\ W\ r\ N^2$ pounds.

Obviously the only difference produced by this alternate derivation vs. that produced by traditional derivation is the two one-billionths difference in the nine place decimal constant, .000028416 vs. .000028414 which is approximately a seven one-thousands of one per cent and very acceptable margin of error.

Why has this work flown in the face of tradition and expended this very considerable effort to develop the alternate definition and derivation? Primarily , to develop, to the very best of this work's ability , the truth, the whole truth and nothing but the truth regarding the fundamental physics involved when a body of matter is forced to move through a circular path and document it in such a manner that it can be readily understood by the reader with a background in fundamental physics at no higher level than the maximum obtainable from traditional high school curriculum.

This work is offering to the reading public a concept of enormous importance, as a gift, but is totally dependent for acceptance on the reader's full comprehension of the vital functions of inertia in this natural scenario since inertia is the concept's source of energy as a free natural fluid pressurizer just as it serves as a free natural gravity neutralizer in outer space.

This work sincerely hopes that the documentary evidence presented in this chapter two has helped the reader to understand why inertial-peumatic compression ,as utilized in this concept, is free and where the energy for such pneumatic compression comes from. It further hopes that it has helped to eliminate much of the wide-spread misconception that such energy is derived from that which establishes and/or sustains rotation.

To the best of available knowledge, the alternate derivation and definition is original with this work but perhaps the reader has knowledge,or access to knowledge , beyond the scope of this work, as to whether or not it has been developed and published by others and/or taught in our schools,colleges and universities and if not, why not. At this writing there is no evidence available to this work to appropriately answer that question but in the absence of evidence to the contrary , it must assume that it has not.

The valid conclusion can now be drawn that that radially outward directed force,traditionally identified as the centrifugal force and re-identified by this work as the inertial force because of the undeniable proof that it is clearly a function of inertia, is derived from the constant and perpetual effort of inertia's second function to sustain the orbiting or rotating body's appropriate position on its imaginary straight line tangential path of motion simultaneously with the body's forced motion through an imaginary circular path of motion,described in space, under the relentless control of the restraining agent, which does not accelerate the body toward the center of rotation but rather perpetually forces the body to continually assume a new forward position on the imaginary circular path of motion and thereby constantly changes the direction of the body's forward motion.

The inertial, or kinetic, energy of the orbital or rotational forward motion of the body , all though continually changing its direction, comprises but one of the two forces that define the inertial image's involute curve path of motion and tends to sustain the uniformity of that forward motion but contributes nothing to the acceleration of the inertial image through the involute curve path of motion because of the tangential direction in which it is exerted. Therefor, it contributes nothing to the

to the generation of the centrifugal,or inertial, force which is,of course, identical to the image acceleration force, other than its tendency to sustain orbital or rotational velocity and the critical time period (t) at their specified uniform operational levels.
In both natural and man-made orbital systems in space, this single contribution is totally sufficient in itself because of the zero resistance to forward motion in the perfect vacuum of outer space, and provides the vital element of all such orbital systems that permits them to be perpetually self-sufficient and self-sustaining, once their operational mode has been established.

The involute curve based definition and description of the centrifugal, or inertial,force and the role of inertia in the process of its generation and sustenence, suggests another hypothesis that may help to clarify this natural function even more. It proposes that a field of inertial influence which also may be rightfully identified as a field of inertial energy, in recognition of its capacity to do work, such as gravity neutralization in space and fluid pressurization in man-made rotating machines,probably extends well out into space outside the boundaries of the orbital or rotational system and those of the orbiting or rotating body itself. The outer boundaries of the field are probably clearly defined and that definition may occur in the first orbit or revolution.

In Figure 3 on page 58, the involute curve inertial image path of motion is shown as a single line. This is only for the convenience of mathematical solution, since in such solutions the mass,or weight , of the orbiting or rotating body is assumed to be concentrated at its center of gravity. The single line involute curve path of motion is that of the inertial image's center of gravity, The entire mass starts at a point and ends at a point during each orbit or revolution.

It seems to be a safe assumption that in the true and complete natural perspective, each molecule,and perhaps even each atom,of the orbiting or rotating body would have its own inertial image involute curve path of motion from its own point A on its own orbital circle to its own point A at path outer extremity, described in space by its own center of gravity. The almost infinite number of molecules and atoms in any orbiting or rotating body suggests that the number of orbital or rotational circles would be almost infinite and that the involute curve paths would be almost infinite in number as well emanating from an infinite number of points A. Another contributer to inertial field density is the fact that point A in Figure 3 is but typical of an infinite number of points on any orbital circle. What that suggests is that as the restraining agent forces the orbiting or rotating body to assume a new forward position on an orbital circle, the entire sequence of the Figure 3 scenario is initiated anew and since the number of newly assumed positions are infinite the net effect is continuous and perpetual with very dense over-lapping of all the elements of the Figure 3 configuration. This further suggests that inertial influence and energy within the boundaries of each field would be equally effective everywhere within those boundaries. How,then, would those boundaries be defined?

In Figure 4 on Page 72 , the angles of the right triangle ABO are the same regardless of the size of the orbital or rotational circle, since the base AO of the right triangle ABO is always identical to the radius of the orbital or rotational circle.

The altitude leg AB of the right triangle ABO is also the natural tangential path of the inertial image of the orbiting or rotating body. Its length is defined by the distance the unrestrained body would move in the critical time period (t), which is identical to the circumference

of the orbital or rotational circle AC , since the uniform velocity of forward motion is identical in both. Therefor the length of the altitude leg AB is always 2 pi r , or 6.2832 r .

The angle OAB is always 90° , since AO is a radius of the orbital or rotational circle AC and AB is always a tangent to circle AC. Thus, the triangle ABO is always a right triangle , since a tangent to a circle is always 90° to a radius of that circle.

The tangent of the angle ABO is always the side opposite over the side adjacent, in authentic trigonometric terms, therefor it is always AO over AB and therefor is always r over 2 pi r , which is actually 1 over 2 x 3.1416 or 1 over 6.2832 , since the (r)s cancel out . Then the tangent of the angle ABO is always $\frac{1}{6.2832}$ or .1591545 or .15915 to five places. Reference to a table of natural trigonometric functions defines the value of angle ABO as always being 9° 2' 34", that is, nine degrees , two minutes and thirty-four seconds, regardless of the value of r and AO.

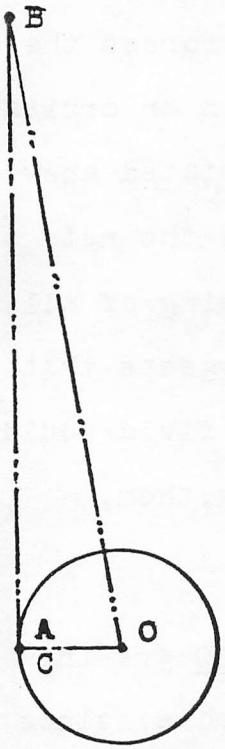


Figure 4

The hypotenuse OB of the right triangle ABO is always defined in a similar manner, since the sine of the angle ABO is always the side opposite over the hypotenuse or AO over OB and OB equals AO over the sine of ABO which equals r over the sine of 9° 2' 34" or r over .15717 . Thus, $OB = \frac{r}{.15717}$ regardless of the value of r .

However, OB is also the radial distance from the center of rotation of the orbiting or rotating body to the extremity of the field of inertial influence around that center. Therefor, if the orbiting or rotating body under analysis is an atom at the extreme circumferential surface

of a much larger orbiting or rotating body, the extreme circumferential boundary of the field of inertial influence about the orbital or rotational center of the larger body can be clearly defined by

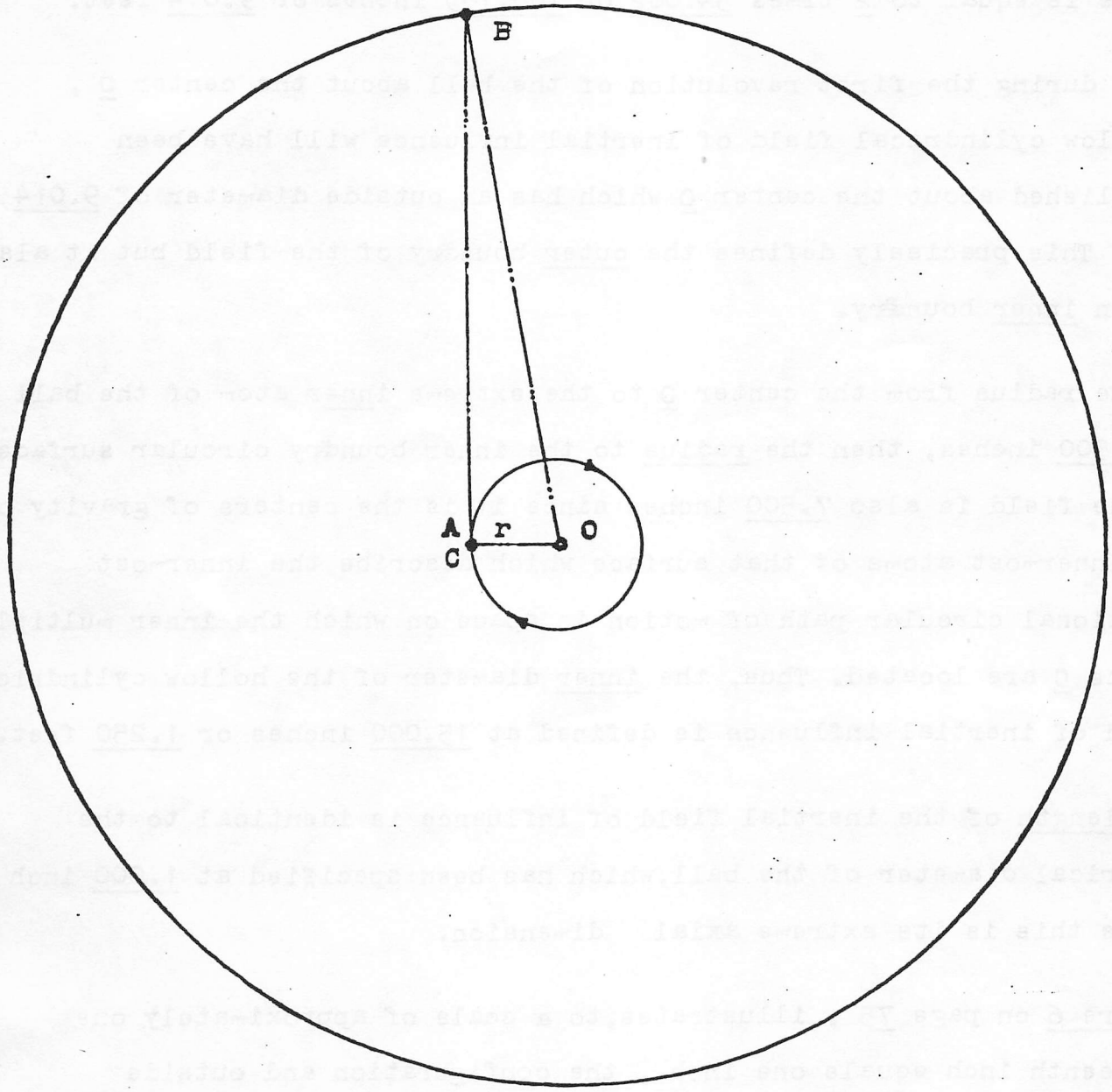


Figure 5

describing a circle on the radius OB, which is $\frac{r}{.15717}$ in length. In Figure 5 above , such a circle has been described through the point B . Referring to the lead ball on a string example, referred to on previous pages, if r is the radius from center of rotation to the center of gravity of the extreme atom of the rotating ball and has a value of

8.500 inches, then OB , as the radius of the circumferential boundary of the inertial field of influence about the rotational center O , is equal to $\frac{8.500}{.15717}$ or 54.082 inches and the diameter of the boundary circle is equal to 2 times 54.082 or 108.163 inches or 9.014 feet.

Thus, during the first revolution of the ball about the center O , a hollow cylindrical field of inertial influence will have been established about the center O which has an outside diameter of 9.014 feet. This precisely defines the outer boundary of the field but it also has an inner boundary.

If the radius from the center O to the extreme inner atom of the ball is 7.500 inches, then the radius to the inner boundary circular surface of the field is also 7.500 inches since it is the centers of gravity of the innermost atoms of that surface which describe the innermost rotational circular path of motion in space on which the inner multiple points C are located. Thus, the inner diameter of the hollow cylindrical field of inertial influence is defined at 15.000 inches or 1.250 feet.

The length of the inertial field of influence is identical to the spherical diameter of the ball, which has been specified at 1.000 inch , since this is its extreme axial dimension.

Figure 6 on page 75 , illustrates, to a scale of approximately one sixteenth inch equals one inch , the configuration and outside dimensions of the field of inertial influence around the rotational center O of the rotating ball referred to above. The outer cylindrical circle (1) , which has an extreme diameter of 108.163 inches or 9.014 feet, would be comprised of billions of fixed ending points (B) out in space where billions of lead ball atoms' inertial images end their forced journey through billions of involute curve paths of motion (3)

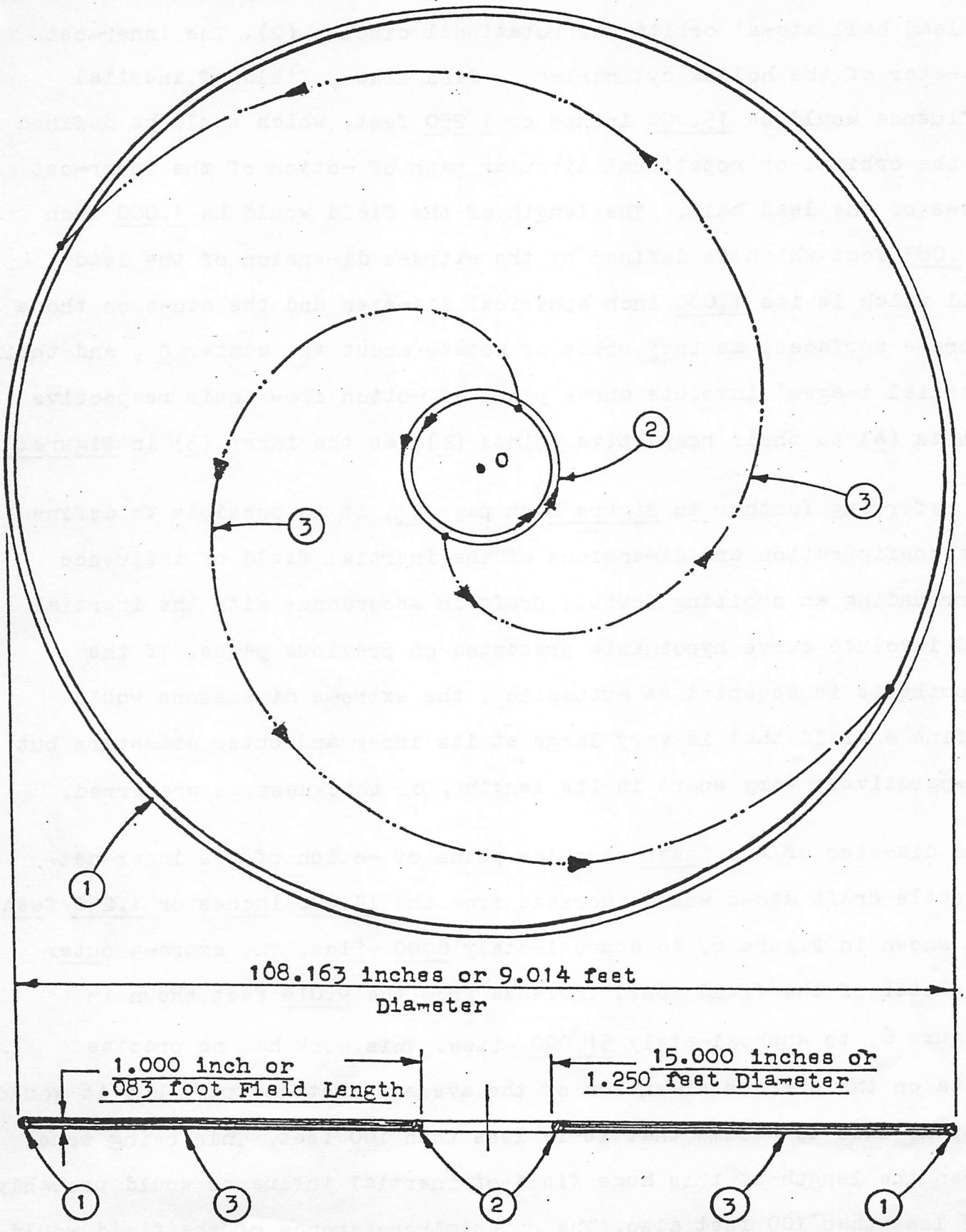

O
1
2
3
3
108.163 inches or 9.014 feet
Diameter
1.000 inch or
.083 foot Field Length
15.000 inches or
1.250 feet Diameter
1
3
2
3
1

Figure 6

from the respective billions of points (A) on their respective billions of lead ball atoms' orbital or rotational circles (2). The innermost diameter of the hollow cylindrical , disc like , field of inertial influence would be 15.000 inches or 1.250 feet, which would be defined by the orbital or rotational circular path of motion of the innermost atoms of the lead ball. The length of the field would be 1.000 inch or .083 foot which is defined by the extreme dimension of the lead ball which is its 1.000 inch spherical diameter and the atoms on those extreme surfaces, as they orbit or rotate about the center O , and their inertial images' involute curve paths of motion from their respective points (A) to their respective points (B), as the inner (3) in Figure 6".

By referring further to Figure 6 on page 75, it is possible to define the configuration and dimensions of the inertial field of influence surrounding an orbiting Shuttle Craft in accordance with the inertial and involute curve hypothesis presented on previous pages. If the hypothesis is accepted as authentic , the extreme dimensions would define a field that is very large at its inner and outer diameters but comparatively very short in its length , or thickness,as preferred.

The diameter of the inner circular paths of motion of the innermost Shuttle Craft atoms would increase from the 15.000 inches or 1.250 feet, as shown in Figure 6, to approximately 8000 miles. The extreme outer diameter of the field would increase from the 9.014 feet,shown in Figure 6, to approximately 51,000 miles. This work has no precise data on the extreme dimension of the average Shuttle Craft but it would appear safe to assume that it is less than 100 feet. This being true, then the length of this huge field of inertial influence would probably be less than 100 feet also. The outer circumference of the field would

be approximately 160,000 miles and the innermost circumference would be approximately 25,000 miles.

Since gravity is the restraining agent in all orbital systems through out the entire universe , including all Shuttle Craft systems, and it is in precise equilibrium at the orbital circle with similar fields of inertial influence surrounding all such systems, it would appear to be prudent to compare their respective characteristics at these interfaces of fields of influence.

Referring again to Figure 6 on page 75, the lines of force of earth's gravitational field , looking at the upper side exterior view, would act inward toward center O along an inifinite number of spherical radial lines which extend outward in all directions from center O. They would extend beyond the 51,000 mile outer diameter of the inertial field on into infinity with gradually diminishing strength. In the upper view, the lines of force of the inertial field would act outward, with uniform strength, away from center O . However, the length of the lines would be confined to the radial distance from the 8000 mile diameter inner circle to the 51,000 mile diameter outer extremity of the Shuttle Craft inertial field , which would be approximately 21,500 miles, maximum, but they would be infinite in number.

However, looking at the lower edge view section of the disc-like field, it becomes apparent that the only effective lines of force of either field are those within the 100 feet ,or less, length or thickness of this inertial field. The length of the inertial lines remains at approximately 21,500 miles maximum but the gravitational lines would be shortened to approximately 4000 miles for those acting on the atoms of the Shuttle Craft and its contents,continually through out all of its orbits about the earth's center of gravity . The

interface of equilibrium occurs at the centers of gravity of the Shuttle Craft atoms and those of its contents.

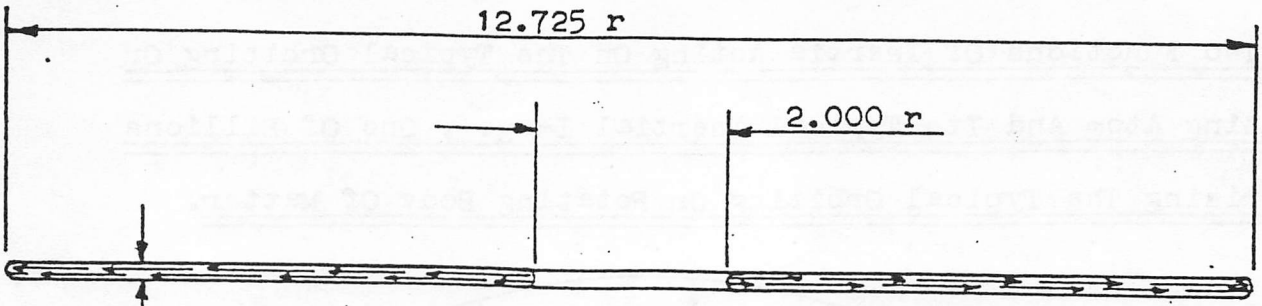
This Shuttle Craft example of interface between inertial and gravitational fields of influence in an orbital system would be typical for all orbital systems, with dimensional adjustments, whether it be that of the most distant galaxies, of those within the solar system , of those within man-made rotating machines or of those within the tiny but mighty atom, wherever there is interface between restraining agent and inertial field of influence.

This work wishes to emphasize that it sincerely believes that all of the inertial lines of force ,within the boundaries of the energy and influence field, effect only the body from which they emanate and nothing else, unlike gravitational lines of force which attract all bodies of matter radially inward toward the body from which they emanate.

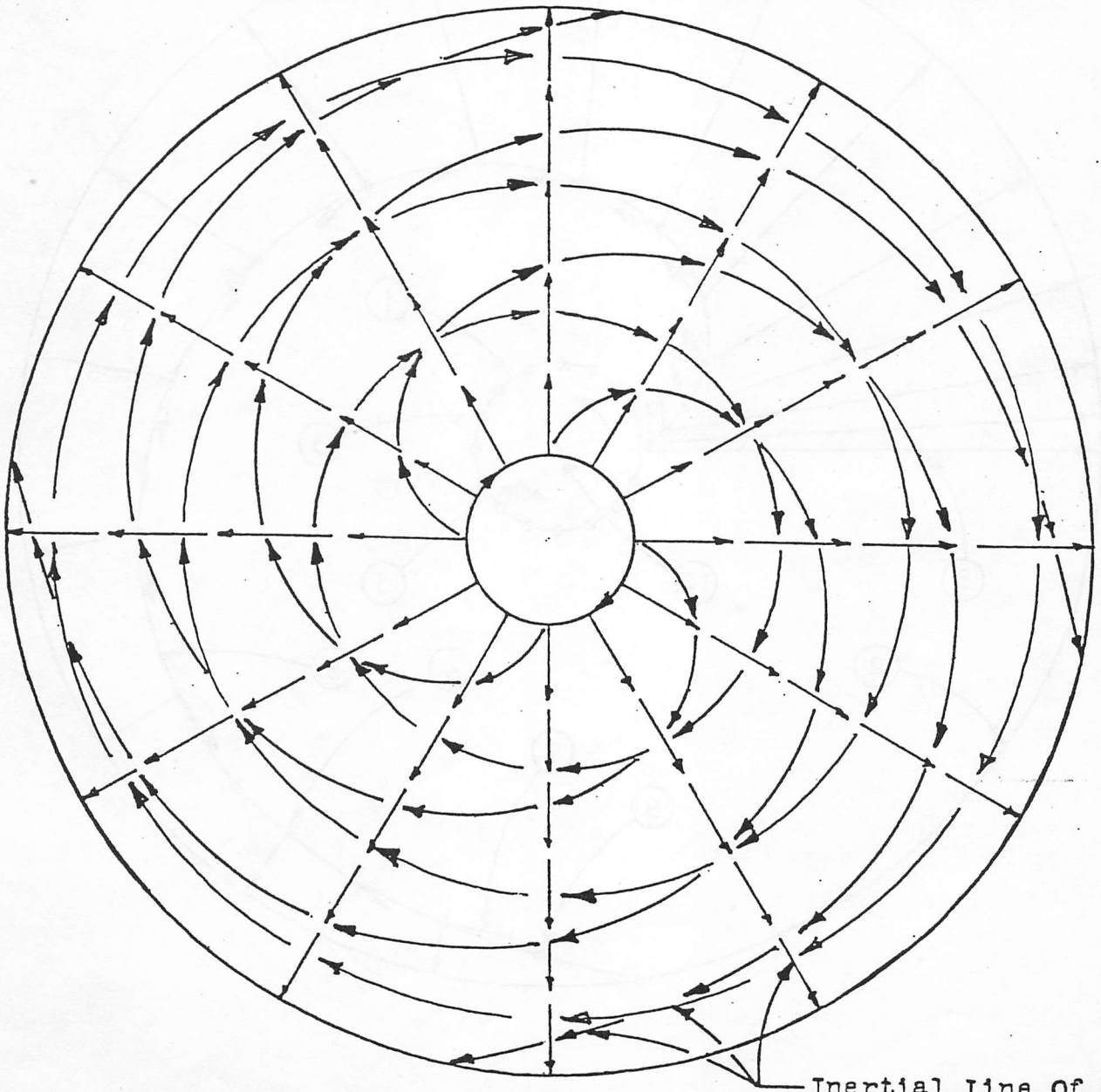
Figure 7 on page 79, illustrates the dimensions of any and all fields of inertial energy and influence enveloping any and all orbital or rotational circles in terms of the orbital or rotational radius r from the center of rotation to the center of gravity of the orbiting or rotating body of matter. Note that the field's inside diameter is two times r simply because the field's inside diameter is identical to that of the inner most orbital or rotational circle.

Note also that the outside diameter of any inertial field of energy and influence is always 12.725 times the radius r because it is always defined by dividing the orbital circle diameter, which is 2 r, by .15717. Thus 2 divided by .15717 is equal to 12.725. Perhaps it would be well to remind the reader that .15717 is the sine of 9° 2' 34" which , in turn, is the constant angle ABO of the right triangle OBA in Figure 4 on page 72

The Orbital Field Of Inertial Influence.



Maximum Thickness = Maximum Orbiting Body Dimension.



Inertial Line Of Force Typical Billions Of Places.

Figure 7

Figure 8

The Two Functions Of Inertia Acting On The Typical Orbiting Or Rotating Atom And Its Typical Inertial Image , One Of Billions Comprising The Typical Orbiting Or Rotating Body Of Matter.

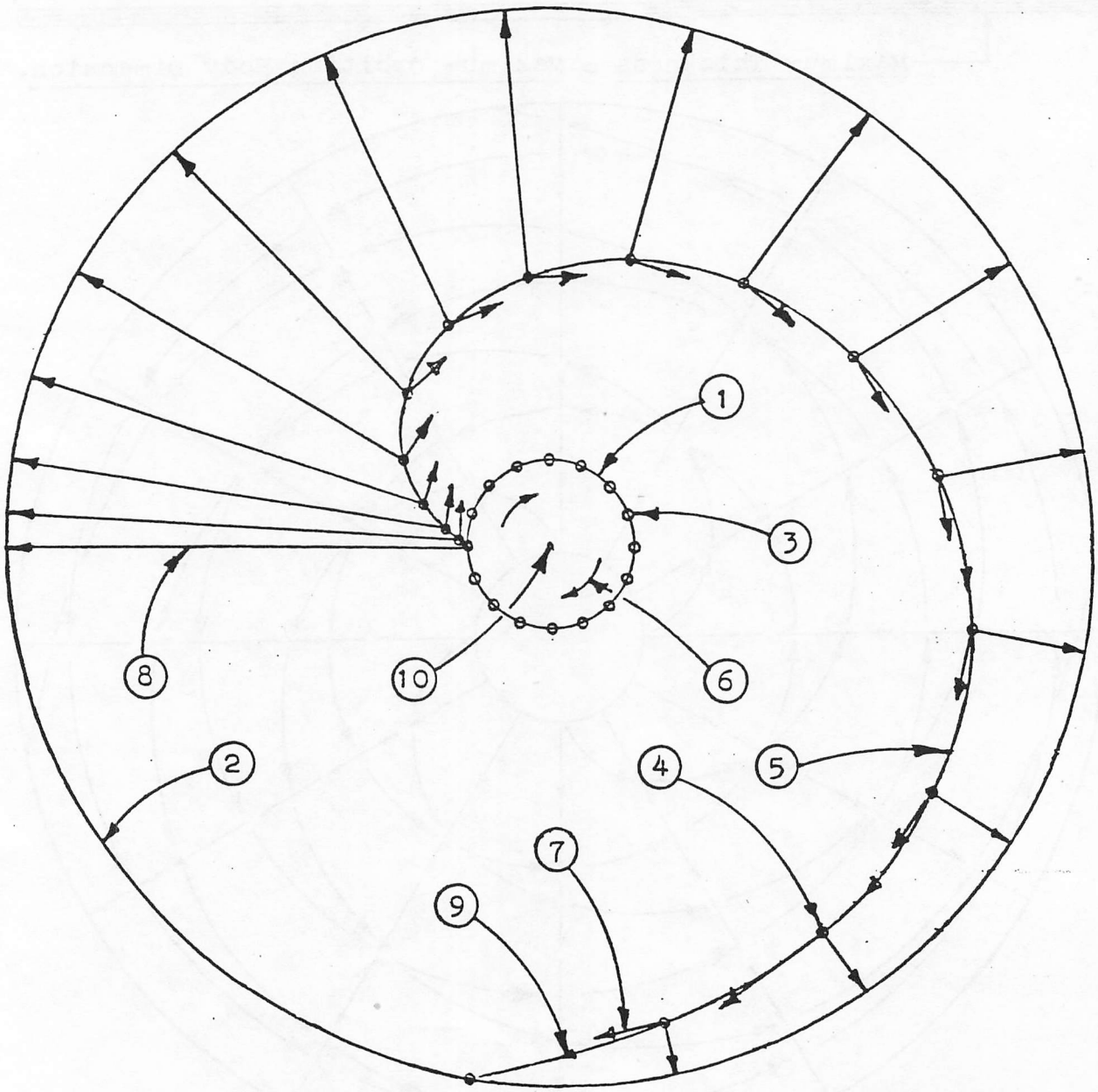
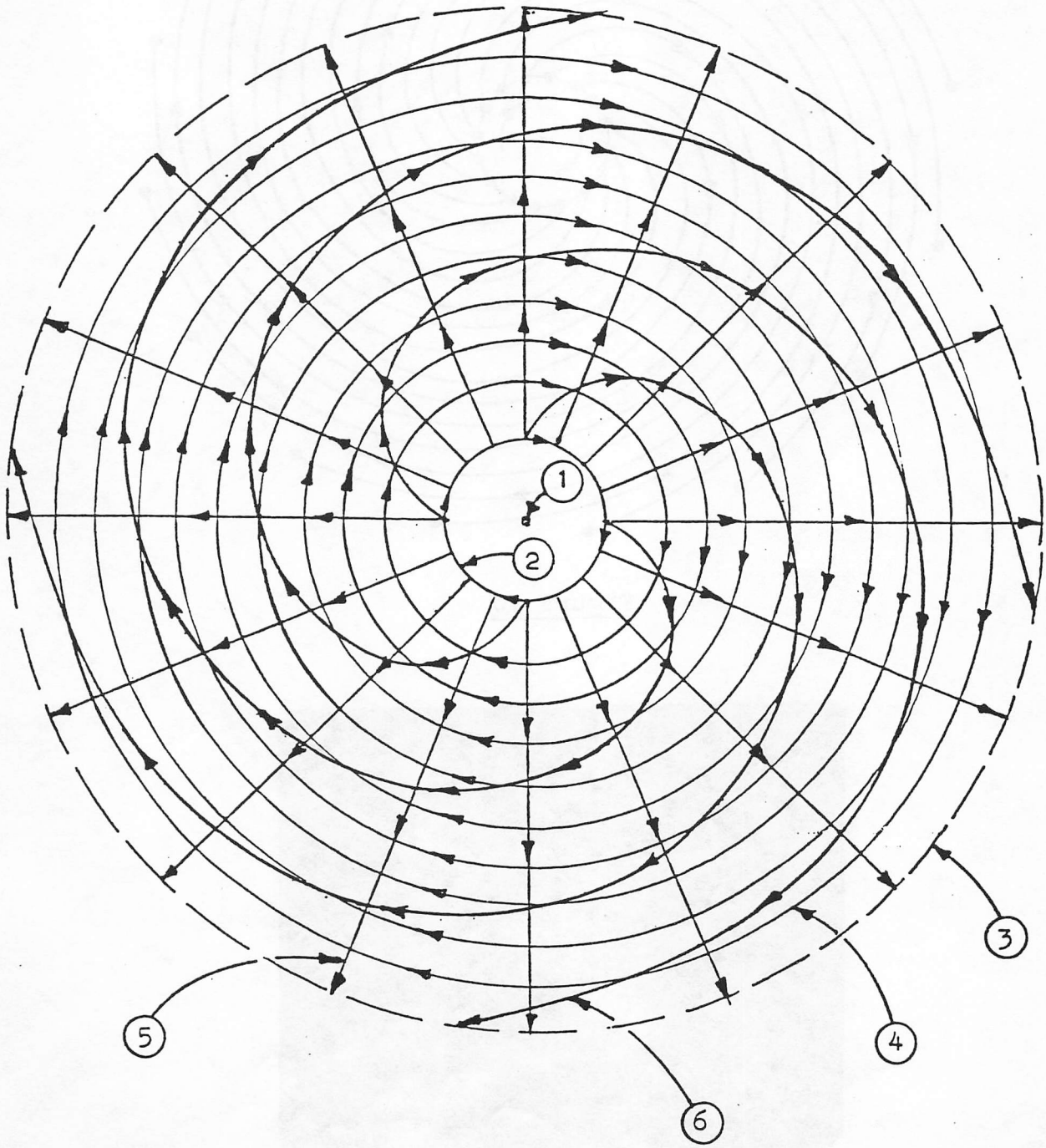


Figure 9

First And Second Function Inertial Lines Of Force And Resultant Lines Of Inertial Force Within The Inertial Field Of Influence Between Its Inner And Outer Boundaries.



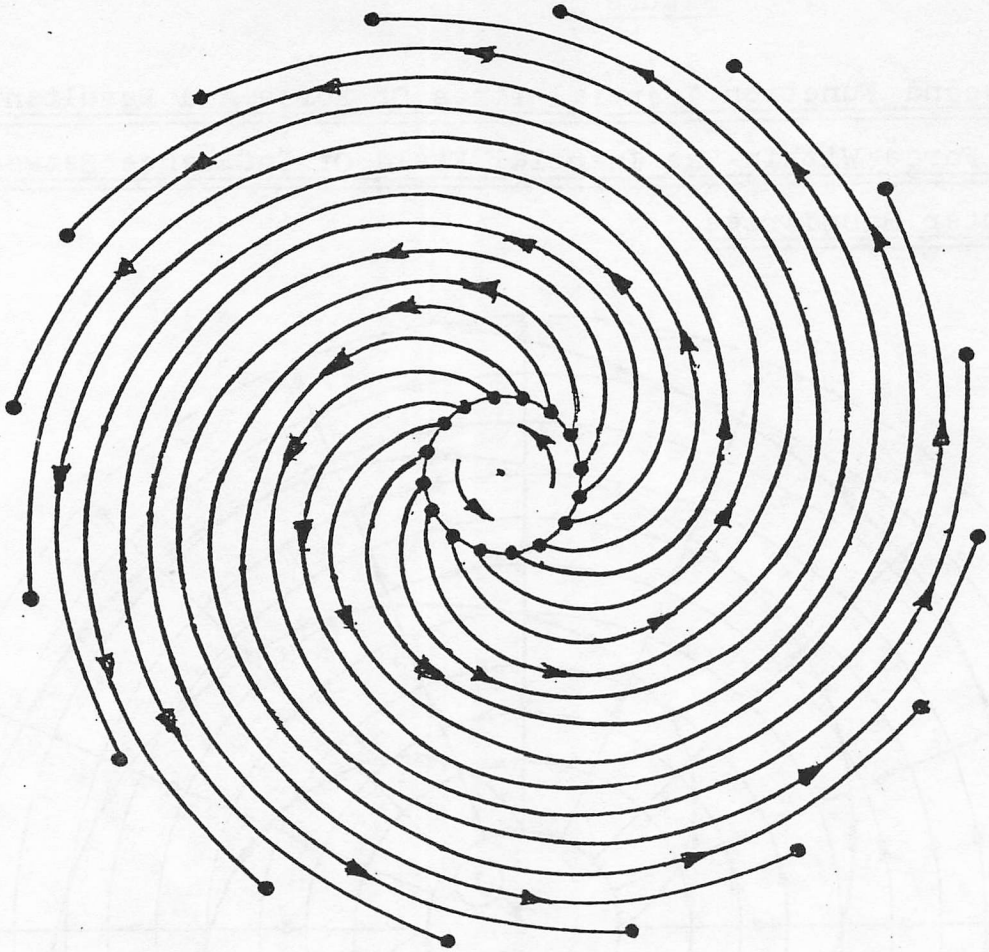


Figure 10

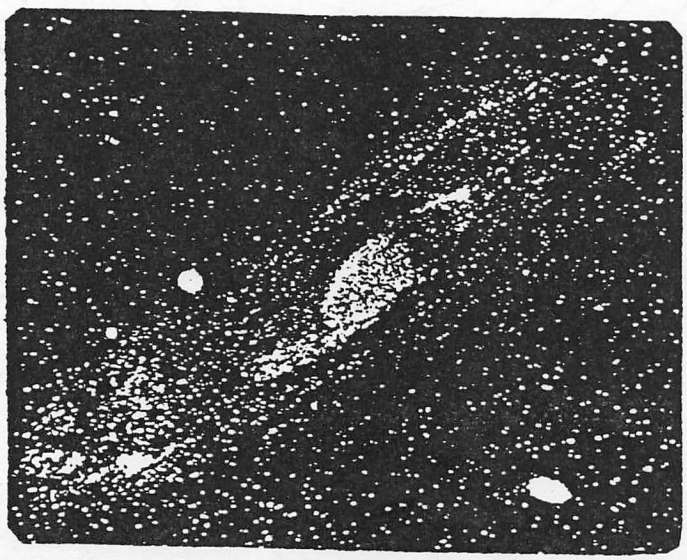
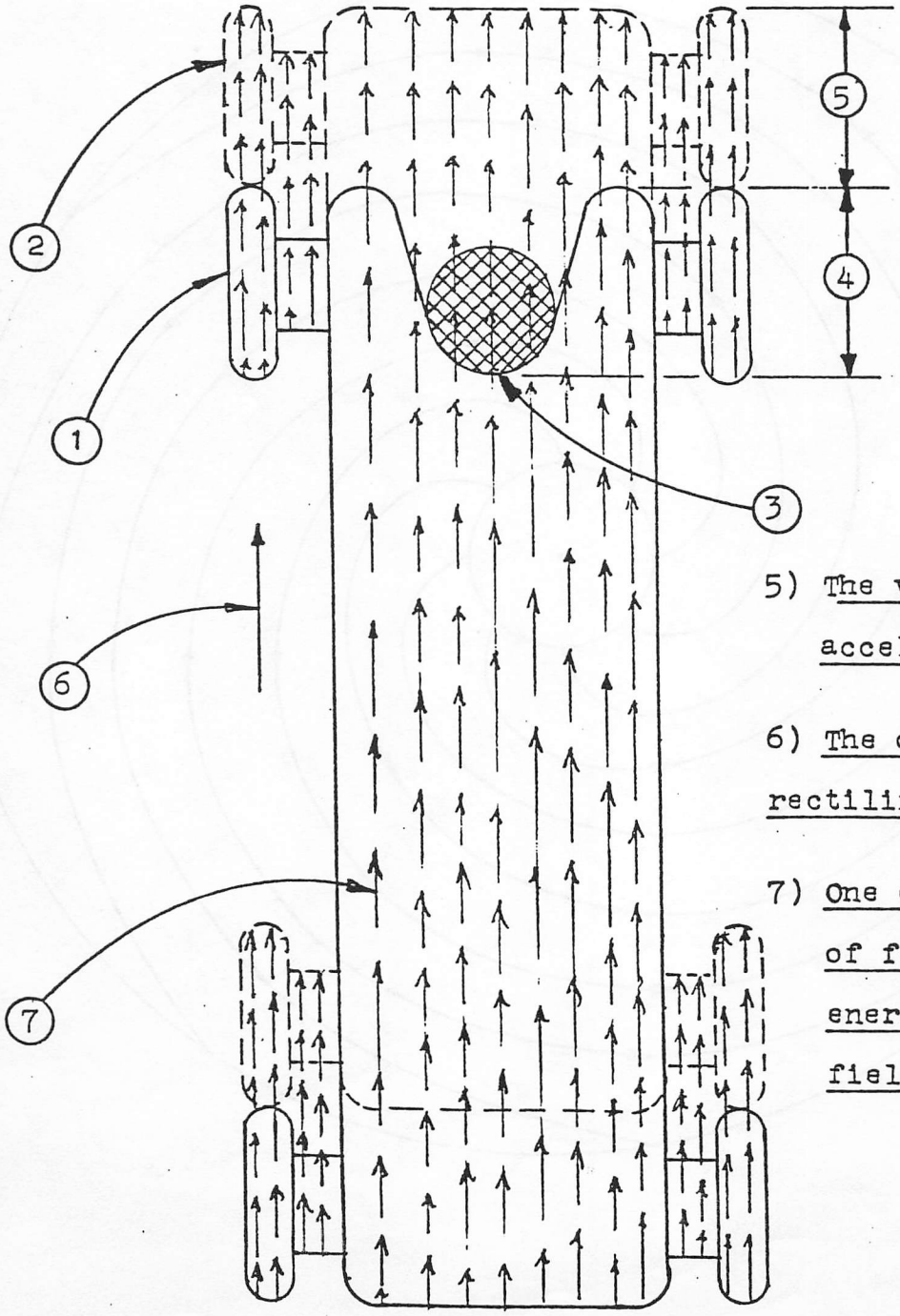


Figure 11

Figure 12

Schematic Diagram, Inertia In The Vehicle Vs. Tree Trunk Scenario On Pages 57, 59 And 60.

LEGEND: 1) The real vehicle. 2) The vehicle inertial image.
3) The immovable tree trunk. 4) The real vehicle deceleration distance.



5) The vehicle image acceleration distance.

6) The direction of vehicle rectilinear forward motion.

7) One of millions of lines of force in the inertial energy and influence field.

Figure 13

Schematic Diagram Of The Perpetual Pattern Of Inertial Image Accelerated Motion From Orbital Circle To The Perimeter Of Inertial Energy And Influence Field. Eight Paths Are Typical Millions Of Places.

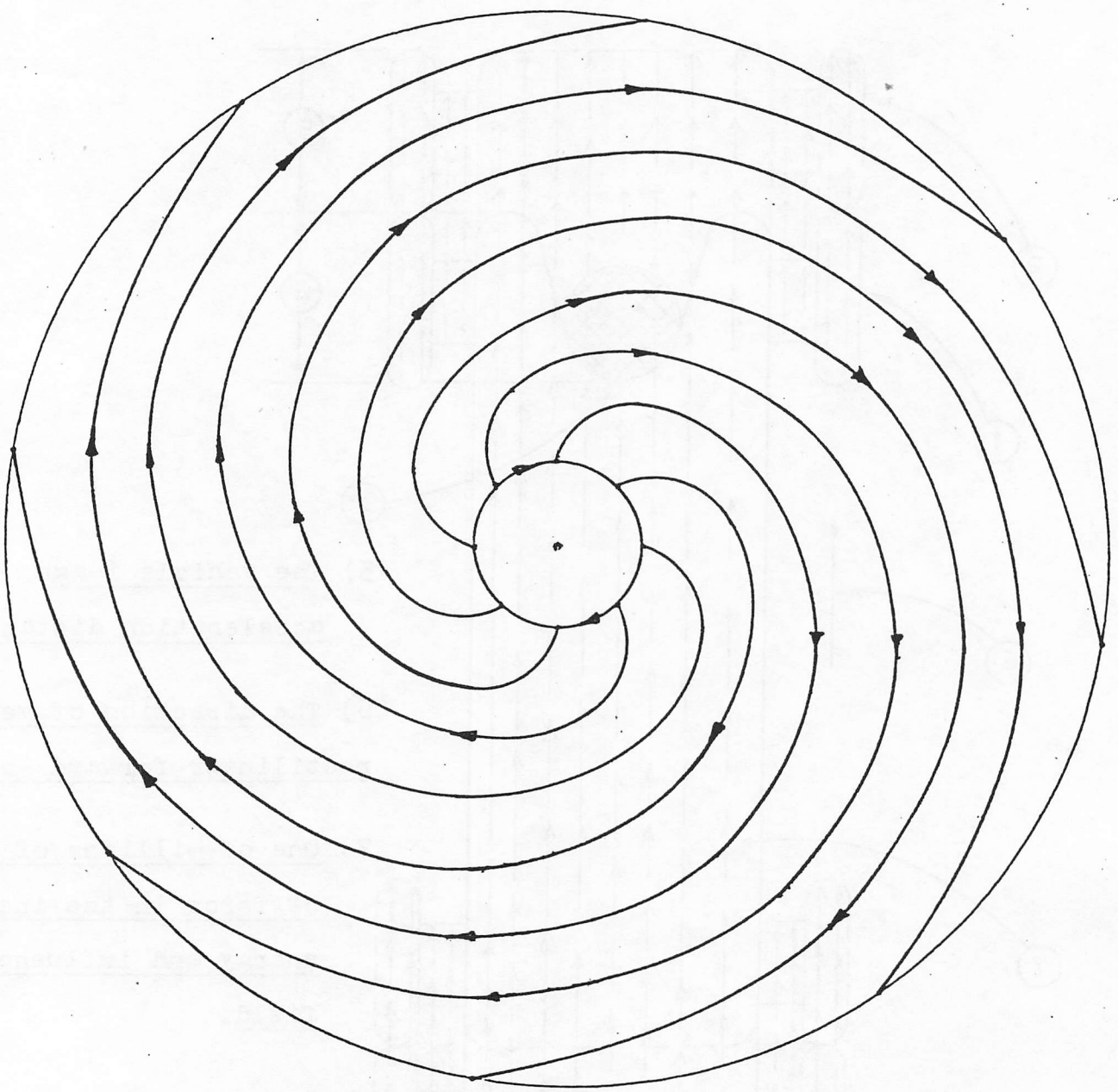


Figure 14

Schematic Diagram Of The Perpetual Pattern Of Natural Tangential Paths Of Motion In Their Respective Orbital Starting Positions. Eight Paths Shown Are Typical Millions Of Places From Orbital Circle To Inertial Energy And Influence Field Perimeter.

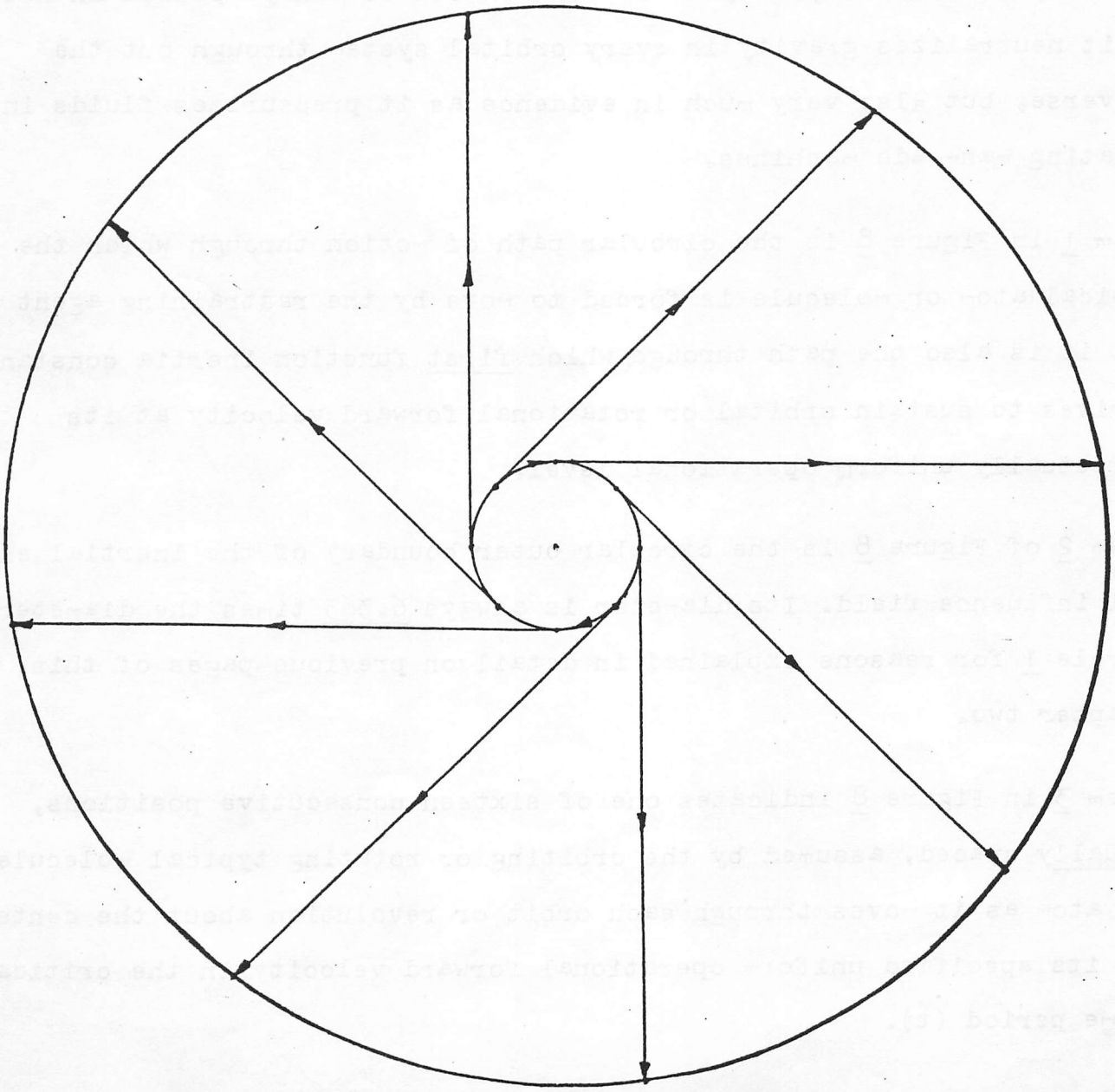


Figure 8 on page 80 illustrates the two functions of inertia that act on the typical atom or molecule of a typical orbiting or rotating body of matter and on the inertial image of such an atom or molecule as it is accelerated through a typical involute curve path of motion from the orbital circle to the circle defining the outer boundary of a typical inertial energy and influence field. The reader is reminded that such a field may be correctly identified as an energy field because it has the very definite capacity to do work , most commonly applied in nature as it neutralizes gravity in every orbital system through out the universe, but also very much in evidence as it pressurizes fluids in rotating man-made machines.

Item 1 in Figure 8 is the circular path of motion through which the typical atom or molecule is forced to move by the restraining agent but it is also the path through, which first function inertia constantly strives to sustain orbital or rotational forward velocity at its perpetually uniform operational level.

Item 2 of Figure 8 is the circular outer boundary of the inertial energy and influence field. Its diameter is always 6.363 times the diameter of circle 1 for reasons explained in detail on previous pages of this chapter two.

Item 3 in Figure 8 indicates one of sixteen consecutive positions, equally spaced, assumed by the orbiting or rotating typical molecule or atom as it moves through each orbit or revolution about the center at its specified uniform operational forward velocity in the critical time period (t).

Item 4 in Figure 8 indicates one of sixteen unequally spaced consecutive positions assumed by the inertial image of the typical molecule or atom

as it is accelerated from zero feet per second velocity at the orbital or rotational circle to maximum feet per second velocity at the outer extremity of its involute curve path at a point on the outer circumference of the inertial energy and influence field within the critical time period (t).

Item 5 in Figure 8 is the imaginary involute curve path of motion through which the image is accelerated by second function inertia as a result of its perpetual effort to sustain the appropriate repositioning of the imaginary tangential path of motion in respect to the imaginary orbital circle and the orbiting or rotating molecule or atom orbital position on that circle, while the image is perpetually affixed to the base of the imaginary tangential path of motion.

Item 6 in Figure 8 indicates clockwise motion of the typical molecule or atom through the orbital imaginary circular path described in space.

Item 7 in Figure 8 is one of millions of tangentially directed first function inertial lines of force which exert their directional effect on inertial images while they are being accelerated through their respective involute curve paths of motion.

Item 8 in Figure 8 is one of millions of second function inertial and radially outward directed lines of force within the boundaries of the inertial energy and influence field that act on both the real orbiting typical molecule or atom and on their images as they are being accelerated through their respective involute curve paths of motion. It is the combined effect of first function inertia's tangentially directed and second function radially outward directed that produces the image accelerating force which is applied along the length of the involute curve path. The strength of second function inertial lines of force

is defined by by the force required to accelerate the image of identical mass through the length of the involute curve path from zero velocity to maximum velocity within the critical time period (t).

Item 9 in Figure 8 idicates the direction in which the image of identical mass is accelerated through the involute curve path of motion.

Item 10 in Figure 8 indicates the center of orbital rotation, the center of circle 1 and the center of circle 2 .

Figure 9 on Page 81 is a schematic diagram indicating the over all pattern of first and second inertial lines of force as well as the resultant lines of force which assume involute curve configurations from the effects of the other two. This pattern is typical of all orbital or rotational systems which varies only in dimensions and magnitude of forces from system to system. The density of the lines of force is, of course, much greater than can be shown in schematic diagram form such as that of Figure 9. If it could be illustrated in true perspective it would appear to be a solid mass as the millions of lines of force intermingle and over lap with their respective patterns.

Item 1 in Figure 9 indicates the center of orbital rotation , the center of circle 2,the center of circle 3 and the center of the millions of circular lines of first function inertial force 4 between circles 2 and 3. It is also the center from which second function radially outward directed lines of force 5 emanate beginning at the orbital circle 2 and terminating at the inertial energy and influence field outer boundary circle 3. The resultant inertial lines of image accelerating force 6 assume their respective involute curve configurations because of the combined effects of circular lines 4 and radially outward lines 5. The first function circular line of force 2 acts on the real orbiting

or rotating body of matter as it perpetually strives to sustain orbital or rotational velocity and the critical time period (t) at their specified uniform operational levels.

Figure 10 on page 82 is a schematic diagram illustrating the definitely spiral configuration that emerges when numerous resultant lines of inertial force, of involute curve configuration, in this case only sixteen of the normal millions, which are actually imaginary and therefor invisible in every orbital or rotational system, are made visible im such a diagram. The question could conceivably arise, is there anything visible in nature that would tend to confirm ths existance of such a spiral , imaginary and invisible configuration in all orbital or rotational systems?

Perhaps the observatory photograph of the spiral galaxie Andromeda, shown in Figure 11 on page 82 offers a clue to a possible answer to the above question. Note the definite similarity between the two spiral configurations of Figures 10 and 11. However, there are two important factors to be considered before natural confirmation can be concluded from the evidence of Figure 11. First, this work firmly believes that inertial lines of force effect only the bodies of matter from which they emanate and second , information is not available to this work at this writing to clearly define the direction of orbital rotation in reference to the direction in which the lines of force spiral outward. In Figure 10 the directions are the same but is this true of those in Figure 11 or are their directions opposite? If inertial lines of force effect only the bodies from which they emanate would they actually be involved in the formation of a large group of bodies into such a spiral configuration? Let the reader be the judge in this matter.

Figure 12 on page 83 is a schematic diagram illustrating inertial function as it strives to sustain the existing forward velocity of a body of matter in rectilinear motion which has suddenly been quickly decelerated by an immovable obstacle to its forward motion, such as the vehicle versus tree trunk scenario described on pages 57, 59 and 60. Figure 12 is presented at this point in chapter two to illustrate that there is little or no difference in inertial function and behavior when a familiar restraining agent, such as the tree trunk, interrupts and prohibits continuing free and natural forward rectilinear motion of a body of matter, such as a speeding automobile crashing into a tree, from its function and behavior when a less familiar restraining agent, such as the string of the scenario of Figure 3 on page 58, interupts and prohibits the free and natural forward rectilinear motion of the lead ball, of the Figure 3 scenario, along the natural tangential path AB of Figure 3.

The primary difference appears to be embodied in the contact between inertia and the restraining agent. In the scenario of Figure 12, contact is for a very brief span of real vehicle deceleration time and an identical and simultaneous very brief span of vehicle image acceleration time which is correctly identified as the critical time period (t) for this scenario, and in which all of the inertial energy contained in its field of influence is totally expended toward acceleration of image.

In the Figure 3 scenario, second function inertia presses with considerable radially outward directed force against the real lead ball and the restraining agent, the string, but without expenditure of any of the energy of its field of influence and not for a very brief period of time but rather perpetually through out each orbit and through out each simultaneous critical time period (t), one after another. Why is that?

Let the reader consider this hypothesis as a possible logical answer to that question. In the scenario of Figure 3, second function inertia's radially outward pressure against the real lead ball and the string is not evidence of that required to sustain the real lead ball's uniform motion along the imaginary natural tangent path AB but rather it is evidence of that required to perpetually adjust the position in space of the lead ball's inertial image ,which is perpetually affixed to the base or starting end of tangent AB , such that AB is perpetually a true tangent to the orbital circle and that the real lead ball is perpetually in the appropriate position on AB to co-incide with its appropriate position on the orbital circle for that specific segment of the critical time period (t). Thus the uniform forward velocity of the real lead ball along the perpetually adjusted tangent AB is perpetually and automatically sustained by first function inertia simultaneously with its perpetual effort to sustain the real lead ball's specified uniform operational forward motion velocity through the orbital circle and there is no need for second function inertia to expend its energy for this purpose when it needs only to retain it intact as potential energy perpetually which is sufficient to perpetually sustain the constant adjustment of tangent AB.

Figure 13 on page 84 is a schematic diagram which illustrates the perpetual pattern of inertial image accelerated motion from orbital circle to the outer boundary circle of second function inertial energy and influence field as it would appear,if it was visible to the eye, in every system wherein a body of matter is forced to move through a circular path. Actually the pattern would be densely packed with many millions of such paths of motion for the many millions of molecules and atoms of the pertinent orbiting or rotating body.

Figure 14 on page 85 is a schematic diagram illustrating the perpetual pattern of natural tangential paths of motion in their respective orbital starting positions for each and every orbit or revolution of each and every molecule or atom of the orbiting or rotating body of matter of each and every system in which a body of matter is forced to move through a circular path by a restraining agent. While Figure 14 illustrates only eight such paths as they would appear if they could be made visible to the eye, the actual typical pattern would again be very densely packed with the actual multiple millions of such paths for the multiple millions of molecules and atoms of the orbiting or rotating body in multiple millions of starting points on the orbital circle.

Adding to the density of the pattern would be the overlapping constant repositioning of such paths as each progresses through each and every orbit or revolution. Add to that the mixed lines of force pattern of Figure 9 on page 81 and the mixed patterns become virtually solid and indistinguishable from one another and such a hypothesis as this offers a possible explanation for the perpetual consistancy of second function inertia and its energy and influence field.

The reader is asked to bear in mind that chapter two of this work from page 56 to this page 92 has been devoted exclusively to the development of a hypothesis which would logically redefine and more clearly explain the fundamental physics involved when a body of matter is forced to move through a circular path of motion so as to improve the reader acceptance environment for this work's proposal for a valid substitute for fossil fuels and atomic energy for the generation of electricity in the Inertial-Pneumatic Electric Power System. Hopes for achieving this important result hinged entirely on the almost accidental discovery by

the research and development effort, that has served as the base for this work, that precisely correct values of centrifugal force as well as derivation of the established equations for such values can and do consistantly evolve from the acceleration of the mass of the orbiting or rotating body of matter or, more specifically, the acceleration of an inertial image of the body of identical mass, through the length of an involute curve path of motion which is essentially a complete involute curve erected to the pertinent complete orbital circle, within the critical time period (t), which, in turn , is the elapsed time required for one complete orbit or revolution through the orbital circle.

This was a startling and seemingly important discovery since it strongly suggested that two identical derivation results can be accomplished by two totally different derivation methods. Established derivation results are obviously correct in their precise definition of centrifugal force values since multiple millions of practical applications over a period of several hundred years have provided more than adequate practical verification for them.

However, since the involute curve derivation hypothesis produces precisely the same practically proven results, this would seem to lay open to question certain aspects of each, such as the basic assumptions involved. Which of the two derivation methods best satisfies all pertinent fundamental laws of physics? Which of the two derivation methods leaves the least unresolved questions in the mind of the reader? Which of the two derivation methods best fits all aspects of natural functions in outer space? Which of the two derivation methods best explains where the energy comes from which neutralizes gravity when a Shuttle Craft achieves operational status in orbit about the earth? Let the reader be the judge as this work moves on to Chapter Three.