To: Melanie

From: Grandpa

Subject: Fundamental Physics Undergirding the Inertia Engine Concept.

Our technically oriented conversation Sunday, regarding this subject, was a great pleasure for me because you , Priss, and you Melanie , are the only ones I can talk to, who are sincerely interested , in a technical sense, in what I'm talking about and seem to show some promise that eventually you may fully understand it to the extent of being able to read it back to me and fully understand what you are saying and not just memorizing what I have told you previously.

I think this is so important because who knows when the Lord will call me home. I'm assuming , since He seems to have had this plan for my life and seems to have guided my whole life toward this end, that He will leave me here long enough to complete the task but then that's His business , not mine. If He has something bigger and better for me , so be it.

However, since we don't know, I believe top priority should be given to developing a complete understanding of the basic concept by some one else in the family and you two are the best qualified candidates. Hopefully, one, or both of you , can be brought into that position , in the very near future, if you will agree to give it an all-out try.

First of all, let me explain why I ultimately decided to call it the " Inertia Engine ". The most compelling reason is that Inertia is the source of energy and I hope to develop your knowledge of the role of inertia, when matter is forced to move in a circular path, to a point where you can fully understand this.

Of all the text book and encyclopedia descriptions and explanations that I have found , of Centrifugal Force , which I prefer to call Inertial Resistance, the one attached, on sheets (2) and (3), is the best and most complete, in my opinion.

However it makes the same error of omission as do all the others. It fails to explain what Centrifugal Force really is. You can see this as you read the paragraph I have outlined in red.

If I were to rewrite that paragraph, I would do so as follows:

"Since there is always action and reaction, there is a force, equal and opposite to Centripetal Force, which is called Inertial Resistance, which acts away from the center of motion. Inertial Resistance is defined as the resistance offered , by body inertia , to the constant acceleration, toward the center, by the restraining agent."

Before you can hope to understand this concept, you must fully understand Inertial Resistance, how it is generated by rotation only, a free natural commodity not derived from energy expended to generate, or sustain rotation. It exists everywhere in the universe where matter , in circular motion, exists.

(INERTIAL RESISTANCE)

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; 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 the **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

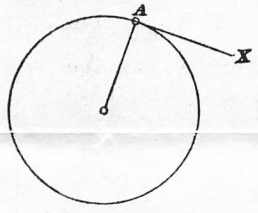

FIG. 8

to move radially outwards. 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 principles 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 × acceleration, let F_c equal the centrifugal (= centripetal) force, m the mass, and W the weight of the revolving body; then,

$$F_c = m\frac{v^2}{r} = \frac{Wv^2}{gr} \qquad (1)$$

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 1 minute is $2\pi rN$, and in 1 second $\frac{2\pi rN}{60}$, which is the velocity v. Substituting this value of v, and 32.16 for g in formula **1**,

$$F_c = \frac{\left(\frac{2r\pi N}{60}\right)^2}{r} \times \frac{W}{32.16}$$

or

$$F_c = .00034\ WrN^2 \qquad (2)$$

The derivative, of the above equation, that I use, as a base , is:

$F = .000028416\ W\ r\ N^2$, obtained from Machinery's Handbook.

It is more convenient for small dimensions since the radius (r) is in inches. ($\frac{.00034\ W\ r\ N^2}{12} = .000028416\ W\ r\ N^2$)

Let W = weight of a body in pounds;
M = its mass;
F = a constant force acting on it;
a = acceleration produced by F;

then, $$F : W = a : g$$

from which, $$F = \frac{Wa}{g} = Ma$$

since $\frac{W}{g} = M$. This is a fundamental formula and is one of the most important in kinetics.

Kinetics Defined:

The science which treats of changes in movements of matter produced by forces.

You have heard me mention this important and fundamental equation many times. It is directly related to the Inertial Resistance equations.

Let me know if you would like to participate in a concentrated program, to begin at an early date. I think you can do it and I'm willing to spend the time and effort.

By the way, this text book copy , sheets 2,3 and 4, are taken from my old ICS (International Correspondence School) course in Machine Design.

See the reverse side of this sheet.