The Special Theory of Relativity has been in use for a century now and was developed to follow the Law of Conservation of Momentum. However, there are still areas of study in Special Relativity that have not been fully investigated. Some of these areas are examined in the momentum creation device presented in this article.

Fundamental Concepts Revisited

One key revelation of the Special Theory is the relationship between energy and mass.

$$E = m_o c^2 \tag{1}$$

E – *energy*
m_0 – *rest mass converted to energy* E
c – *speed of light*

The relativistic mass of an object can be thought of as the Newtonian mass plus the mass of the kinetic energy of that Newtonian mass.

$$Kinetic\ \ Energy = \frac{m_o c^2}{\sqrt{1-\beta^2}} - m_o c^2$$

$\beta = v / c$
v – *velocity of mass* m_o

$$relativist\ ic\ mass = m = m_o + \frac{\left(\frac{m_o c^2}{\sqrt{1-\beta^2}} - m_o c^2\right)}{c^2} = \frac{m_o}{\sqrt{1-\beta^2}} \tag{2}$$

If an object has kinetic energy, this energy contributes to the object momentum. The relativistic momentum P can be thought of as the momentum of the rest mass plus the momentum of the kinetic energy of that rest mass.

$$P = m_o c\beta + \frac{\left(\frac{m_o c^2}{\sqrt{1-\beta^2}} - m_o c^2\right)}{c^2} c\beta = \frac{m_o c\beta}{\sqrt{1-\beta^2}} \tag{3}$$

The Spinning Shaft

The momentum creation device described in this article will use a spinning shaft as one element of the machine. The structure of a spinning shaft within the rules of Special Relativity will need to be examined.

A shaft is a solid cylinder that has significant axial length. The outer diameter of the shaft is inscribed by a constant radius rotating around a fixed center point. The locus of all the fixed center points down the length of the shaft is the axis of the shaft and, in this discussion, this axis is straight.

In Figure 1, two identical shafts are shown. Each shaft has identical lines along the outside surface, these lines running parallel to the axis of the shaft. Both shafts have a velocity in the direction of the axis of the shaft, but the shaft on the right also has a rotation around the axis. This rotation is shown by the two opposite vertical arrows. Both shafts exhibit length contraction, time dilation and 'failure of simultaneity at a distance' per the usual formulas in Special Relativity when viewed by our stationary reference frame. The shaft on the right has a twisted appearance caused by 'failure of simultaneity at a distance.' Since clock readings on the trailing end of both shafts are observed to be 'later' than clock readings on the front ends of these shafts (assuming the clocks show identical times in a reference frame in which the shafts are at rest), the trailing end of the rotating shaft will have additional rotation compared to the front end of that shaft.

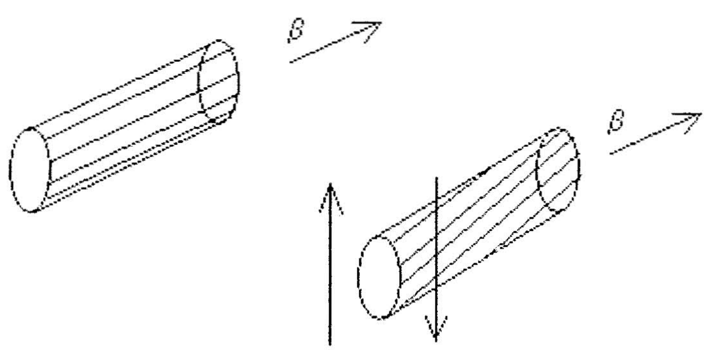

Figure 1

The shaft on the right is actually twisted relative to our stationary observing reference frame. The back end of the rotating shaft is actually displaced relative to the front end of the shaft. If the lines on the shafts were the tips of gear teeth running the length of the shaft, then the twist in the shaft would rotate a mating gear that was stationary in our observing reference frame. The rotation of the mating gear caused by the twist would be in addition to the rotation caused by the shaft rotation itself. Or, in other words, the shaft could be manufactured with a twist that was just the opposite to what is shown in Figure

1. With this backwards twist, the rotating shaft would then have straight (not twisted) gear teeth when observed at the conditions of Figure 1. In this case, any engaged gear that is located in our stationary observing reference frame would still rotate (following the rotation of the shaft) but would not have additional rotation due to the twist in the shaft.

The Momentum Device

The momentum creation device is shown in Figure 2.

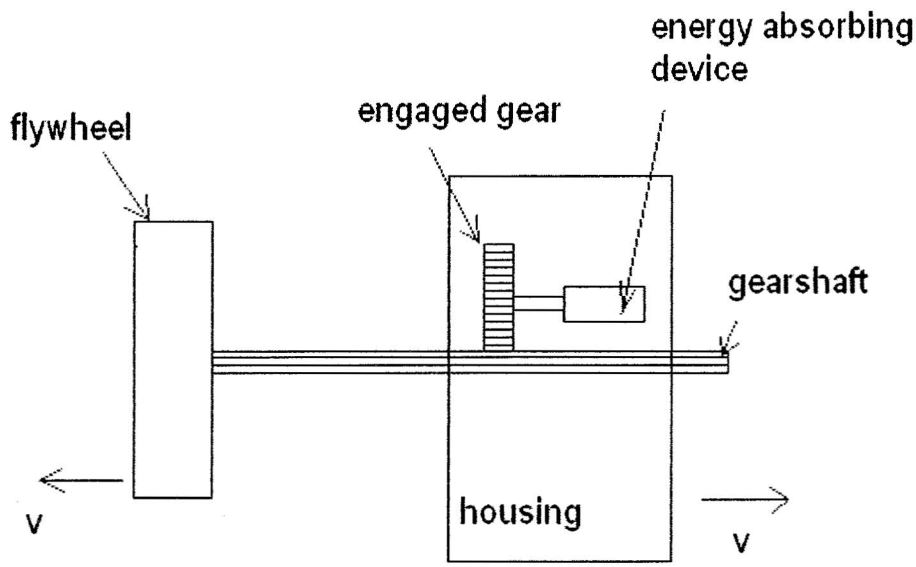

Figure 2

This device consists of a flywheel with a gearshaft (as previously described) attached. The flywheel is rotating at a relativistic peripheral speed and can be said to contain kinetic energy KE. The flywheel is also moving to the left with a velocity v (which may or may not be relativistic). The gearshaft is drawn with straight teeth in the figure, but could also be considered to have a twist, so slight that it might not be seen. If the periphery of the flywheel has a relativistic speed, the outer diameter of the gearshaft would be rotating with a peripheral speed that is just a tiny fraction of this speed due to the small diameter of the shaft. Therefore, it could be said that the gearshaft has no relativistic twist as described previously. Even if this twist is not ignored, this gearshaft could be modified by assuming it has a small backward twist. The backward twist built into the gearshaft is enough to make its teeth absolutely straight when viewed from the reference frame of the housing shown in Figure 2.

From the reference frame of Figure 2, the housing is moving to the right with a velocity v opposite in direction to the velocity of the flywheel. This housing has an engaged gear firmly mounted in bearings contained within it. The engaged gear has a small shaft that connects to an energy absorbing device, also fixed within the housing. This energy absorbing device can be a brake, generator with battery, pump with pressure reservoir, etc. Any device that can absorb energy and store it in the housing is acceptable.

As shown in Figure 2, assume the total momentum of the flywheel with its energy KE is equal to the momentum of the housing and all its included parts, but opposite in direction. The net momentum of the device is therefore zero relative to the reference frame of the figure. The gearshaft and engaged gear may be assumed to have frictionless surfaces. At this point, the energy absorbing device can be activated, and a transfer of energy from the flywheel to the energy absorbing device will begin.

Any portion of KE transferred from the flywheel to the housing alters the total momentum of the device so that it is no longer zero when viewed from the reference frame of the figure. Whether there is twist in the shaft or not, the only way to avoid breaking the Law of Conservation of Momentum is to have unequal, opposite forces applied simultaneously to flywheel (gearshaft) and housing as energy is transferred. This would cause problems with Newton's Laws.

That last statement deserves further discussion. The geometry of the machine elements can be selected to eliminate any twist between the gearshaft and engaged gear when viewed from the housing. Therefore, the housing does not see any reason why an axial force should exist. Other reference frames will see a twist and might believe there is an axial force. But, in Special Relativity, all reference frames must come up with the same answer. So, does an axial force exist? Would it be equal on both flywheel and housing? For a fixed transfer of a small amount of energy ΔKE, how could an axial force be the same for various values of gearshaft diameter (twist angle)?

Summary

There are a number of possible explanations for this paradox.

1. The Special Theory of Relativity has a flaw affecting the description of the device or its machine elements.
2. The Special Theory does not have a flaw, but the individual machine elements have a flaw in their description.
3. The grouping of the individual machine elements into the device system has a flaw.
4. There is a new, previously unknown phenomenon being described by this experiment.
5. The Law of Conservation of Momentum or Newton's Laws (or both) can be broken by such a device.

Thought experiments are the foundation for relativity theory. New discoveries in this field are dependent on the development of new and revealing thought experiments.