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A POSSIBLE EXPLANATION OF UFO PERFORMANCE CHARACTERISTICS

Raymond D. Manners

Educated in India and England, Raymond D. Manners has had a varied career in both science and engineering. His interest in astronomy dates from 1946 when he participated in a search for intersellar meteors and determined the motion and fine structure of the Perseid meteor radiant. He was associated for many years with the British Astronomical Association, the Royal Astronomical Society, and the Royal Astronomical Society of Canada. Author of many technical papers, he was involved in space science aspects of the lunar program from 1960 to 1969, specializing in lunar surface sciences, electromagnetic effects of the solar wind and studies of planetary formation. Manners is currently employed at Science Applications Inc., where he is developing remote area transportation techniques to assist in the search for new sources of energy. Married, with three children, Manners now lives in Arlington, Virginia.

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"When I first saw the cigar-shaped object it was hanging motionless at an altitude of about five thousand feet. I would estimate its size as approximately that of a medium-size jet aircraft—about 100 feet long and 20 feet in diameter. As I watched, it suddenly moved off at a tremendous speed toward the horizon, hovered for an instant about two miles away from my position, and then executed a right-angle turn and sped off in the new direction. I would estimate its speed during these maneuvers at about 1,000 miles per hour."

Does this story sound familiar? It should, because many UFO sightings by reliable observers follow a similar pattern. The object is seen hovering, then moving at great speed while simultaneously making abrupt changes in direction of flight. In fact, it is this capability of UFOs to apparently ignore the laws of physics that has been primarily responsible for our categorizing them as being from another planet or from some far away place in the universe, where either physical laws as we understand them do not apply or where technology is sufficiently advanced to permit the construction and operation of craft displaying these impressive performance characteristics.

They most certainly are impressive. Propelling a vehicle the size of a jet plane at a speed of a thousand miles an hour and being able to reverse course or change direction instantaneously is no mean feat. It is a fairly simple matter to make an estimate of the power required for such maneuvers and we find that we are dealing, not with hundreds or thousands of horsepower, but hundreds of thousands and even millions. How is it possible to pack such tremendous energy into our average UFO which varies perhaps from ten to several hundred feet in size? Our present technology is certainly capable of generating enough power, but a tour through a large hydroelectric plant or the engine room of an aircraft carrier will rapidly convince you that we are not about to package a million horsepower power plant into a 50 or even a 300-foot disk. At our present state of knowledge, even a nuclear power plant cannot be conjectured that would permit our average UFO to perform its simplest tricks.

Suppose that by some miracle we were able to provide a plant of the required power and dimensions, what then? Let us suppose that this plant could be accommodated in an aircraft fuselage, and that arrangements were made to provide the necessary motors and control systems. The pilot now selects full forward thrust, confident that the installed power can accelerate the craft to a speed of a thousand miles an hour within a second. Within less time than it takes to tell, the pilot can only be recognized as a thin film spread over a nearby bulkhead, and a fraction of a second later, the entire machine will be a pile of junk. Let us try again. This time, instead of using an aircraft fuselage, let us use an army tank as our basic structure. The engines are installed and everything is ready for lift off. Again, the pilot will be recognized as a thin film spread over a nearby bulkhead and the tank reduced to scrap. Our technology is simply unable to construct machines or to protect their occupants from the tremendous inertia loads which must be produced if we are able to simulate the performance of a UFO.

With suitable precautions, we can fire bullets from guns at muzzle velocities of several thousand feet per second and small particles can be accelerated in the laboratory to velocities of several miles a second. If we try to change the direction of flight of these objects, such as by allowing but the theory does correlate with observation and does fully explain why Newton's laws work, despite the fact that Newton did not reference gravitation and inertia to the universe as a whole. The contribution of the universe to inertia is enormous since the mass of the stars and nebulae more than offset their vast distances. The universe has about a hundred million times more influence on local inertia than the sun, for example.

The conclusion to be drawn from this is that inertia forces are inescapable and that the observed UFO flight characteristics are impossible within our own universal space time continuum. Inertial forces can perhaps be negated if we operate outside our known universe, or if we are able to operate in a postulated space time frame in which mass does not exist and which is, therefore, devoid of attractive forces. It is then perfectly conceivable that UFOs operated in a space time continuum which is not part of our observable universe, but which is a space time continuum peculiar to the UFOs and their inhabitants.

There remains another possiblity. We readily admit that our present knowledge of inertia forces and their relationship to the rest of the universe is at best fragmentary and probably equivalent to a new born baby's understanding of nuclear fission. We have a great deal more to learn and the possiblity always remains that with increased knowledge of these forces we may be able to determine a way to circumvent them or eliminate them completely. This would also mean that we would be able to control gravitation, the charges on sub-atomic particles, and also to influence the orbits of the stars and planets. (For example, when we had reached that stage of knowledge, a complete reconstruction of the solar system would be possible, changing the orbits and dynamics of all the planets to make them more inhabitable for mankind.) But we should also be able to operate within the universe as UFOs are apparently doing now. With no inertial forces to overcome and with complete control of gravity, we will be able to accelerate our vehicles to tremendous speeds in a fraction of a second with the only force required being equivalent to the force of thought. Micro-ounces of thrust would suffice to take us to the known limits of the universe and back, whether our machines were the size of automobiles or cathedrals. Inside these crafts, and shielded from the mass of the universe, we should feel no forces on our bodies regardless of abrupt changes in speed or direction.

The observed physical effects of UFOs, such as indentation made in the ground by their landing systems, and the many instances where human beings have allegedly entered their ships, suggest that their civilization has indeed discovered the secret of not only operating outside our known universal space time continuum, but also of transferring into our own frames of reference at will. It is not inconceivable that pulsating lights observed on UFOs are a physical manifestation of this transfer. Similarly, the unusual electromagnetic effects attributed to UFOs may be a consequence, not of their power units, but of their ability to distort

gravelectric and gravomagnetic fields through a process that can only by conjectured. It is quite possible, of course, that electromagnetic and gravitational forces are different manifestations of one and the same underlying principle. When we have discovered how these are related, perhaps we will also be able to explain the bizarre characteristics of UFOs. Apparently appearing and disappearing at will as they change their frames of reference, UFOs appear to be physical realities while, at the same time, they do not really exist. They come from, and exist in, and inertial space time frame of reference which is completely beyond our understanding and outside our conception of the universe.

We may consider ourselves to be like a flat fish in a very thin aquarium that allows the fish to swim up and down, but not sideways. The fish can never experience left and right, only up and down. Suppose now we introduce a needle through the aquarium side and jab it into the fish. What is the fish going to make of it? I believe we may be in the same position from the point of view of the UFO operators. They are in another dimension, perhaps from another universe, and may well regard us as we regard the fish with his incomplete conception of the real world. From our point of view, UFOs are only observable at certain times, but in actual fact, they can exist and operate both anywhere and nowhere at any time, past, present, or future.

The real answer to the UFO phenomenon probably lies somewhere in the directions indicated in this paper. Those of us living now may never know the answer, but surely the avenues of approach are clear. We need additional research into the relationship between the forces of gravity and inertia. We need to develop a complete understanding of the interactions between gravity and electromagnetism. we need more knowledge of the relationship of matter to the rest of the universe, and perhaps most importantly, we need dedicated research into the psychic sciences where it does appear that normally accepted physical laws often do not apply. When this is accomplished, I remain convinced that UFOs will be completely explained and that they will turn out to be, not anything so mundane as visitors from outer space, but a completely rational phenomena, fully understandable and predictable through our deeper understanding of the nature of our wonderful universe.

Mr. Richard F. Merritt, a business manager for a group of scientists, recently contacted NICAP regarding experiments they performed dealing with rotation and its properties. This group has done some very creative theorizing and has conducted limited experiments to test their theories.

With Mr. Merritt's permission, NICAP is presenting some of this work without commenting on the theories or experimental design.

UFO propulsion has been the subject of great speculation for a number of years. The following material could give new insight into possible propulsion methods.

THEORIES ABOUT THE PROPERTIES OF ROTATION

Richard F. Merritt

These experiments, dealing with rotation and its properties, reveal some heretofore unrecognized phenomena. Conclusions are that rotation confers upon objects a new inertial characteristic in addition to that attributable to the inertial mass which is present; rotating objects do not fall the same as similar non-rotating objects in a gravitational field; and rotating objects undergoing acceleration, create a field in which energy can be stored and which affects the inertial behavior of matter in its vicinity.

Some analysis shows that although the results of these experiments contradict the principle of equivalence of the General Theory of Relativity, they do not contradict any known experimental observations.

These experiments are only a beginning, and suggest many others which may be performed. The practical application of these discoveries lies in the solution of antigravity and nuclear fusion.

I. INERTIA, ROTATION, AND GYROSCOPES

A) Inertia

Much of this experimentation has to do with the description of matter and its inertial characteristics. Inertia can be defined as a measure of the tendency of a body at rest to remain at rest and a body in motion to remain in uniform motion; it is the property of resistance to change in motion associated with a material object.

Up to the present time, the inertial characteristics possessed by a given object were believed to be in direct proportion to only the inertial mass of the object. Now these experimental results indicate that the inertial behavior of an object is altered by rotation. This means that the total inertial characteristic of the object must be understood to be dependent not only on the amount of matter that is present but also on the rotational behavior of the object.

B) Rotation

A rotating object has a mass and a *moment of inertia.* For a single particle rotating about an axis the moment of inertia about that axis is proportional to the mass and square of the radius of rotation.

For a solid object the moment of inertia is the sum of the moments of inertia about a common axis of all the particles comprising it. At any angular velocity a rotating object possess a certain amount of angular momentum, proportional to the *moment of inertia.*

These are some of the parameters of rotation.

C) Gyroscopes

All rotating objects also possess gyroscopic properties, which are best studied by direct observation. If the end of the axis of an upright rotating flywheel placed in front of an observer were to be pushed toward the right or left, the resultant motion displaces that end of the axis, *not to the right or left* as expected, but towards or away from the observer—*at right angles to the original direction* of the applied force. This is the gyroscopic behavior, characterized by the 90° relationship between applied force and resultant force.

II. EXPERIMENTAL APPARATUS—THE FORCE MACHINE

A) Description

The apparatus used in these experiments is called a force machine. It is so called because large forces are generated in certain modes of its operation. It is presented in Figure 1.

Two flywheels, 10 inches in diameter, are mounted side by side inside a hollow aluminum cylinder ½ inch thick, 12 inches outside diameter, and 23¼ inches in length. The flywheel axes are parallel to each other, and they both intersect the imaginary cylinder axis perpendicularly at a separation of 10¾ inches. The cylinder ends are closed by circular

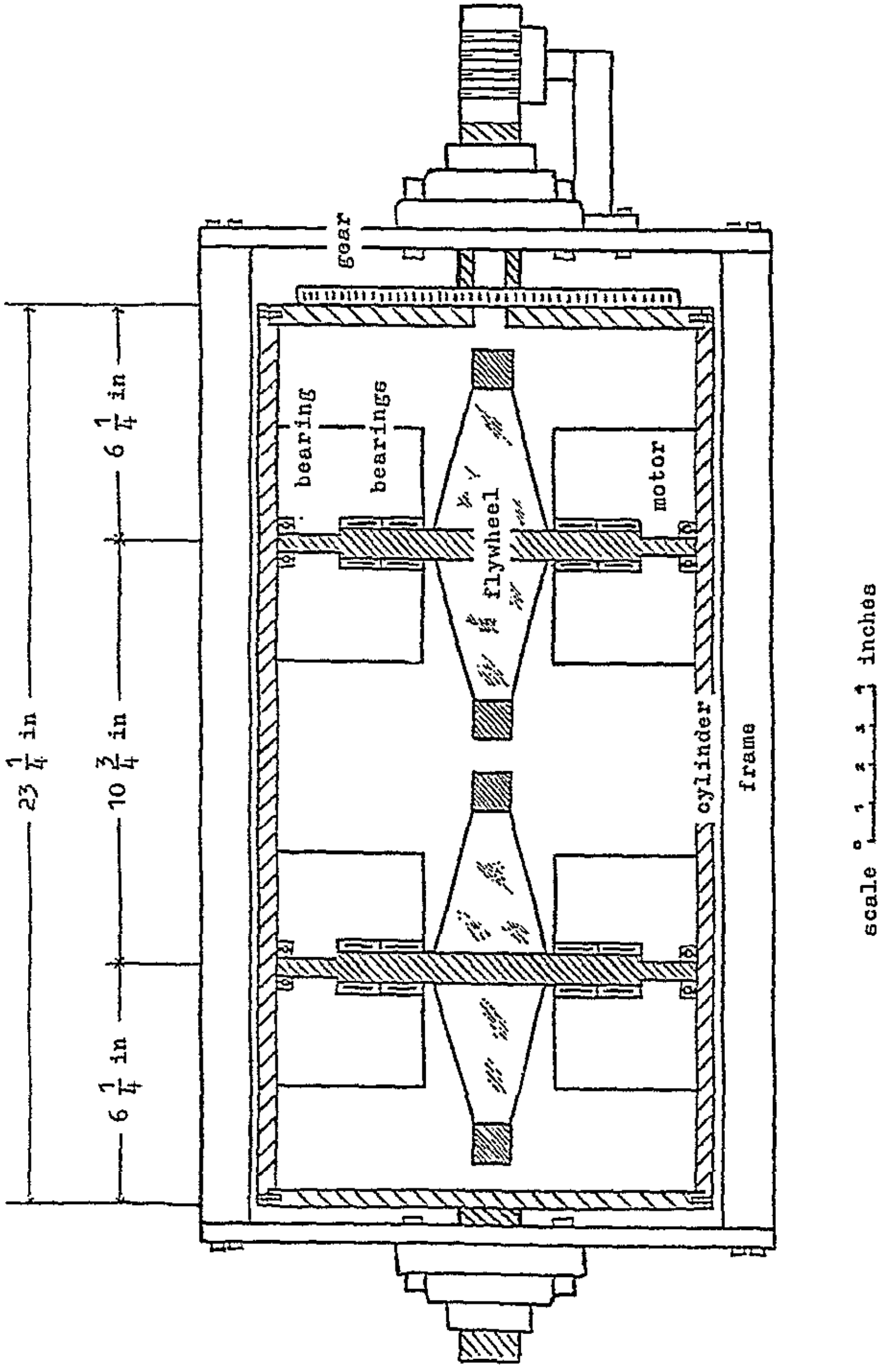
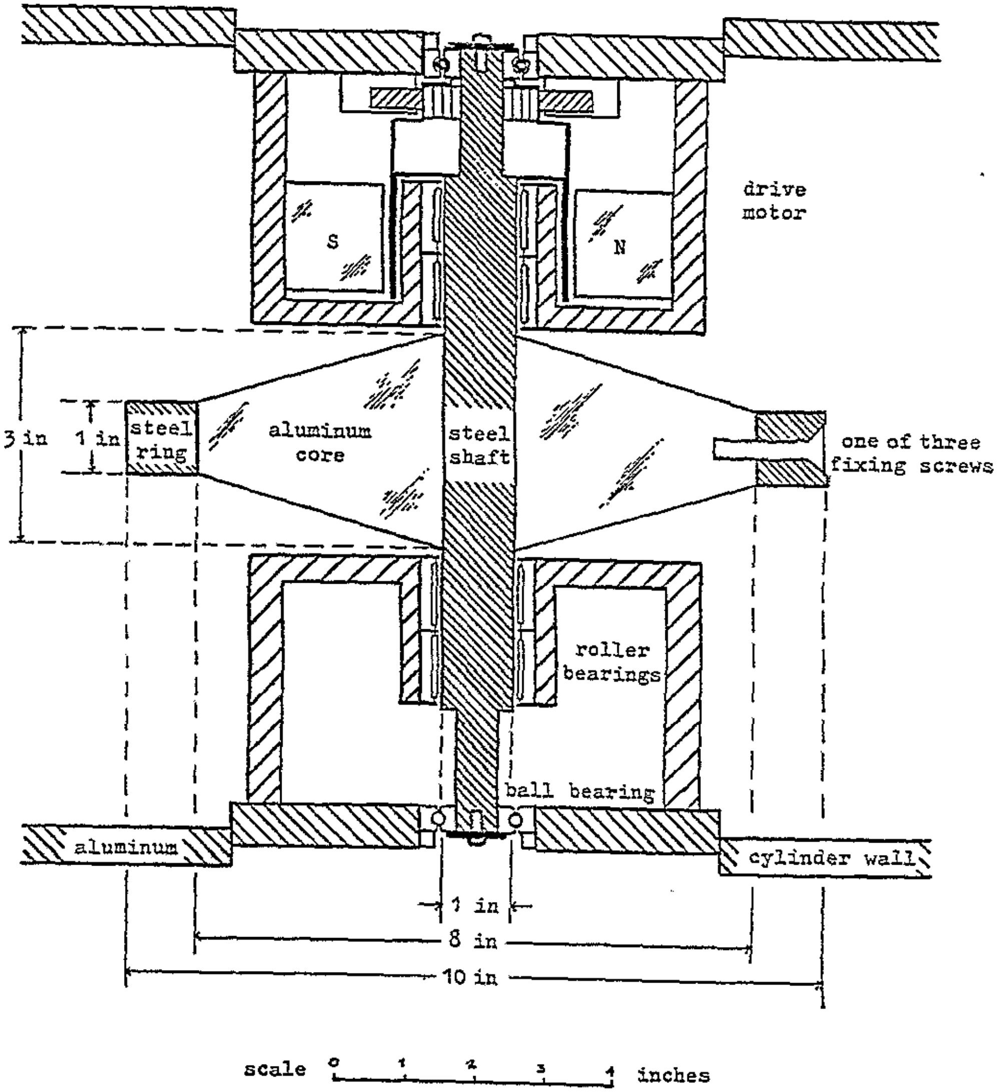


Figure 1. The Force Machine



Details of the Force Machine Flywheel

aluminum end plates to which are attached short steel axles which provide means to support the cylinder at both ends and make possible rotation of the whole cylinder assembly in a frame.

The cylinder assembly is mounted in a frame consisting of two square end plates and four braces. The axles attached to the cylinder ends pass through the frame end plates on flange unit bearings which allow free rotation, and the braces are drilled to accept eyes for suspension of the machine and bolts for attachments.

Each flywheel inside the cylinder is 20 pounds in weight, consisting of a hardened steel axle and aluminum flywheel core, with a 1 inch square steel ring of 10 inches outside diameter shrunk on an screwed to the aluminum section. The steel ring is 8 pounds in weight, and provides a mass concentration at the outermost edge of the flywheel.

B) Operating Conditions for the Force Machine

In operation the flywheels inside the cylinder are rotated in opposite directions at equal speeds. In this condition, the machine is considered "energized." When the flywheels are not rotating about their axes the machine is considered "quiescent."

Most experiments conducted deal with the difference in behavior of the machine under these two conditions.

C) Theory of Operation

The geometry of the force machine is such that axial rotation of the cylinder constitutes a forced precession of the flywheels within. It is a forced precession because the flywheels are not allowed to move in the direction of the gyroscopic forces created by precession, but are constrained by the rigid cylinder walls.

In the operation of the machine, when the cylinder rotates while in the energized condition, the two gyroscopic forces arising from precession, being each at 90° to two parallel flywheel axes, are directed against each other and "cancel." This causes forces of tension in one cylinder wall between the flywheel axes, and forces of compression in the opposite side, but there is no net torque transmitted from the cylinder assembly to the frame. This allows measurements of the behavior of rotating objects in the absence of the normally attendant gyroscopic forces and twisting motions.

A calculation based on the dimensions of the force machine shows that 2300 pounds of force are generated and transmitted to the cylinder walls by each flywheel at the cylinder rotational velocity attained in the first experiment to be described, 3.8 rps.

In this series of experiments the properties studied with the force machine are the motion of rotating objects undergoing forced precession, the motion of the energized force machine as a pendulum, and the effects of both types of motion in terms of a field they seem to create. **Analysis:** Examination of the graphs leads to the possibilities of an increased amount of energy being stored in the motion of the energized cylinder, requiring an increased time for dissipation through constant friction, or, an increased inertial characteristic exhibited by the energized machine, possibly due to a heretofore unrecognized but finally elucidated phenomenon.

In this case, if we consider that energy storage is related to inertia in ordinary mechanical terms, it is possible to conclude that the overall inertial behavior of the energized force machine is dependent on:

1) the inertial characteristics of the material of the cylinder assembly, and
2) the inertial tendencies the flywheels may exhibit as a result of their motion.

Furthermore, energy is stored in proportion to the total inertia.

Because the only change in experimental conditions between the two states is that the flywheels are rotating in the energized condition, inertial changes of the cylinder are likely due to this rotation, so the 11% increase in inertia of the whole cylinder reflects a much greater increase on the part of the flywheels themselves. Of the 167 pounds of the force machine cylinder assembly, only 40 pounds is rotating in the energized condition, so this is a 46% increase for the rotating masses alone, a quite significant change.

III. EXPERIMENTS, RESULTS, AND ANALYSES

A) Force Machine Precession Experiment

Introduction: In this experiment the motion of the cylinder as it rotates in the frame is studied. The results show that under the two conditions, quiescent and energized, the motion of the cylinder is not the same. This difference cannot be described by or attributed to any known cause or effect; analysis leads to the possibility of an alteration of the inertial behavior of the energized machine.

Experiment: For the experiment the cylinder is geared to a generator whose output is recorded continuously on a chart recorder, thus providing a time vs. cylinder rotational velocity graph. The cylinder at rest is given an impulse which accelerated it to about 4 rps, then is released and allowed to slow down and stop by itself, dissipating most of its energy through a large frictional load placed upon it by the generator.

Graphs of the performance of the quiescent and energized machines are compared directly with each other. In Graph 1, two direct tracings are aluminum end plates to which are attached short steel axles which provide means to support the cylinder at both ends and make possible rotation of the whole cylinder assembly in a frame.

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Graphs of the performance of the quiescent and energized machines are compared directly with each other. In Graph 1, two direct tracings are superimposed to show the difference in behavior between the two conditions. In both cases a maximum velocity of 3.8 rps is attained, and the two graphs are superimposed so that these points of maximum velocity coincide, allowing a direct comparison of the decay curves. (See illustration on page 23).

The energized machine takes longer to come to a stop from 3.8 rps than does the quiescent machine; the area under one curve is 11% greater than the area under the other.

1) During precession of the force machine the cylinder walls between the flywheel axles are in compression on one side and in tension on the other, and act as a spring in which energy is stored, thus accounting for the extra energy stored in the rotational motion of the energized machine; or

2) elasticity in the cylinder walls allows displacement of the flywheel axes away from their parallel position, constituting a change in angular momentum of the flywheels with a resultant reaction torque affecting the motion of the cylinder.

Both processes lead to the same results if it is assumed that the deformation in the cylinder walls is due to the gyroscopic torques.

In terms of changing angular momentum due to elasticity, each flywheel axle end undergoes a displacement measured at the cylinder radius, in the plane containing both flywheel axes. This displacement constitutes precessional motion in that plane, with a resultant torque appearing at right angles, at the cylinder axis.

At a certain precessional velocity the change in angular momentum for the entire cylinder is the sum of the angular momentum of the material parts of the cylinder assembly itself, plus any change in angular momentum of the flywheels caused by their displacement from the parallel.

It is possible to conclude then, that a previously unrecognized property of rotation accounts for the behavior of the force machine and that the discovery was made possible by the ability to notice changes in behavior of rotating flywheels, made possible by the absence of gyroscopic torques.

Rotating flywheels were investigated, and it was determined that no cause could account for the magnitude of the change except some new and different phenomenon which was being noticed for the first time. For clarification, two proposed mechanisms for the enhanced inertia from mechanical effects are discussed; both indicate very small changes in comparison to the measurements made.

One possible explanation is that frictional changes are occurring in the cylinder-frame bearings due to vibration in the energized machine; this would allow freer rotation of the cylinder, accounting for its increased travel time and apparent increased inertia. This does not occur, because in the experiment a large constant sliding frictional load is imposed on the cylinder by the instrumenting generator. This load dissipates energy at a constant rate to bring the cylinder to a stop in 6 or 7 seconds from 4 rps, in contrast to 35 to 40 seconds taken by the cylinder to stop given the same impulse in the absence of the generator and its load. In the instrumented condition therefore frictional changes due to vibration are very small in comparison to the constant load and cannot be causing the large changes actually observed.

The other possible explanation is that the elastic properties of the materials used in the force machine leads to an inability to truly constrain the flywheels during precession.

B) Force Machine Pendulum Experiments

Introduction: In these experiments the entire force machine is suspended and its behavior as a pendulum is studied. It appears that when the machine is energized its swinging motion is noticeably non-sinusoidal, and its period is slightly altered; furthermore, the swinging energized machine creates some field which affects the motion of objects in its vicinity. None of this behavior is explainable by any known mechanism, but can be best accounted for in terms of the new understanding of the inertial behavior of the energized force machine gained from the first experiment.

Experiment 1: To be studied as a pendulum the force machine is suspended from four 3/8 inch nylon cables spaced as shown in Figure 2. The swinging motion is stabilized in a direction parallel to the axis of the cylinder by the separation of the cables at the ceiling being more than twice their separation across the width of the machine.

The period of the pendulum is measured under the two conditions, quiescent and energized. The total elapsed time for 10 cycles is measured with a stopwatch, the first cycle starting from an amplitude of A = 63.5 inches (=59°). The cylinder is left free to rotate, although it does not do so. The orientation of the flywheel axes in space does not seem to affect the results.

The data indicate that the period of the energized pendulum is slightly increased over the period of the quiescent pendulum, as shown in the tabulated results.

Period (T) x 10	Quiescent	Energized
29.0 sec	19	8
29.1 sec	18	11
29.2 sec	3	10
29.3 sec	0	1
Total runs	40	30

Average Period, Quiescent machine 2.906 sec
Average Period, Energized machine 2.911 sec

The differences in period reflect differences in the gravitational accelerations experienced by the quiescent and energized machines. Again, since the energization of the machine consists of rotation of the flywheels within, the differences can be attributed to rotation, with the change for the entire 214 pound pendulum being caused by 40 pounds of active mass.

Alternative explanation of the pendulum experiment results is not possible; the only effect energization could have is vibration of the cables leading to elongation or frictional changes at the supports, but observations made during the experiment invalidate both possibilities.

So in this experiment the alteration of the inertial characteristics of the energized machine first noticed in the force machine precession experiment appear as a change in the gravitational acceleration experienced by the energized machine.

Experiment 2: Visual observation of the energized force machine reveals that its motion is distinctly unlike the motion of the quiescent pendulum. Some non-sinusoidal motion seems to occur, especially noticeable towards the end of each swing.

For an illustration of this phenomenon two identical force machines are suspended next to each other to swing in parallel planes, adjusted in length to be of identical periods when both are in the quiescent state; the suspension geometry of the single pendulum is duplicated in the second. A direct visual display of a comparison between the two pendula is provided by a television camera mounted on one machine continuously observing a target image mounted on the other machine. A TV monitor and video tape recorder display and record the information. To ensure like behavior of the pendula the size, shape and weight of the camera are duplicated in a dummy and mounted on the target machine.

In operation when the two machines are swinging together the target appears in the center of the monitor screen. If the motions are exactly matched, the target remains steadily fixed in the center, whereas any relative differential behavior on the part of the two machines is visible as a displacement of the target from the center.

The system is adjusted so that motions of two quiescent machines remain synchronous for about a minute from a starting amplitude of $\alpha = 45°$. Then when one machine has been energized and matched with the other, the two pendula can be expected to experience a slow relative drift due to the change in period measured in the previous experiment. Instead, superimposed on this drift is an abrupt differential motion taking place at the ends of each swing, described by the target moving swiftly back and forth about the center for every reversal of direction of the pendula.

Analysis: The observed motion is not attributable to only a change in period and indicates that the swinging motion of an energized machine is different in transient behavior as well. This is reasonable, considering the increased inertia of the energized machine noticed in the precession experiment. The gravitational force on both machines is identical, in

proportion to the gravitational mass of both machines, which is the same. The increased inertia of the energized machine, as compared to the quiescent machine, causes it to hesitate slightly in getting under way at the beginning of its fall under the influence of the same gravitational force. This is the differential behavior shown by the displacement of the TV target. At the other end of the swing, both pendula are decelerated by the same gravitational force, still in proportion to the same gravitational masses. During this deceleration while the quiescent pendulum is coming to a stop the energized machine experiences less deceleration and catches up with it. This differential behavior, again noticeable on the TV screen, almost restores the two machines to synchronism. The change in period is therefore very slight even though the change in transient behavior of the two machines is very large.

In consideration of this idea, the concept of a field generated by the energized force machine best fits the data. The behavior of this field can be deduced from the experiments. The interaction between the energized and quiescent machines occurs at high amplitudes but not at the lower, and this correlation of the amplitude to the effective radius of influence on a similar parallel pendulum suggests the mechanism of a field, with the strength dependent on the amplitude of motion. The hesitation experienced by the energized pendulum just before and after reversing direction is the point of maximum differential behavior and occurs at the point of maximum acceleration, further suggesting that the inertial effect may be elucidated in proportion to the acceleration experienced by the energized machine. Thus at high amplitudes a large field generated by an accelerated energized machine affects the inertial behavior of a quiescent machine and causes it to swing in synchronism; at lesser amplitudes this field is diminished in strength and at a certain point is no longer strong enough to keep the two pendula synchronized.

This field has been named the *OD Field*, and its dependence on the acceleration of the force machine suggests a further analysis of the force machine precession experiment.

D) Radio Frequency Shift Experiment

Introduction: This experiment was conducted to test for the presence and effect of the OD field on electrical circuits, and the materials out of which circuit components are made. If through the agency of a field created by an accelerated energized force machine the inertial properties of the materials used in the components were altered, this alteration might be detected in the behavior of the circuit. Specifically, if the inertial properties of the parts in an oscillator circuit were somehow altered, this would be indicated by a change in its frequency, detectable by some means. Such changes are actually observed in this experiment.

Experiment: The experiment makes use of the principles of FM radio operation. In this system a transmitter broadcasts a signal modulated about a central carrier frequency. The receiver has within it an oscillator circuit of variable frequency which is adjusted to match the carrier frequency of the incoming signal. When the two are matched, proper demodulation converts the signal to useful information. Very precise tuning of the local receiver oscillator to the transmitted frequency is effected by a part of the discriminator circuit, which represents slight differences in the two frequencies as a voltage which can be read on a meter, (the tuning meter on an FM receiver). When matching of the frequencies is exact the voltage is zero, while when it is less than exact the voltage has a positive or negative value depending on the receiver oscillator being tuned to either above or below the exact frequency of the carrier.

Thus, the FM receiver in conjunction with a sensitive tuning meter reading provides a means of comparing the frequencies of an oscillator at some remote place to that of one situated in the receiver itself. Once tuned, any deflection of the meter needle represents a relative deviation in frequency, one from the other, so if the inertial properties of electrical circuits, particularly the oscillator in the receiver, is affected by a swinging energized force machine to cause a change in frequency, this would be visible.

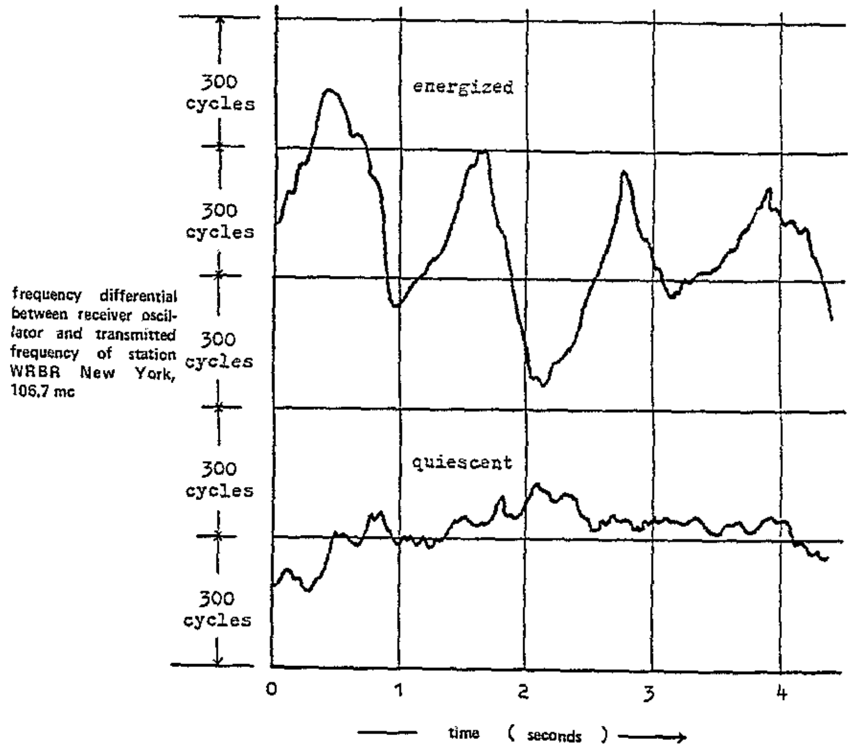
This in fact is found to be the case—with a quiescent machine swinging next to the receiver, no variation can be detected, but with an energized machine swinging there is a noticeable alteration in the relative frequencies, characterized by a deflection of the needle which occurs in time with the period of the pendulum, made to swing at = 65°. The effect is non-directional within the laboratory.

The receiver was tuned to different stations at known distances, including the oscillator in another FM receiver placed in the vicinity of the experiment. The change in frequency is greatest with respect to a station 70 miles distant, and less for nearer stations. When tuned to the other oscillator in the same room, the change is also small.

Graph one consists of a comparison between the discriminator voltages when the quiescent and energized force machines are swinging in the vicinity of the FM receiver. The vertical axis is calibrated to reflect changes in frequency. In the energized condition the swinging machine causes a noticeable shift in frequency between the receiver and station oscillators, in time with the period of the motion.

The discriminator voltage is continuously recorded on a chart recorder and Graph one consists of direct tracings of two portions of the record. The fluctuations noticed in the quiescent condition are due to slow drifting and the variable transmission characteristics of the ionosphere, while the fluctuations in the energized contition show a much larger and distinctly periodic variation. The fact that the period of the frequency shift is not exactly equal to half the period of the pendulum on this particular record may be due to inaccurate calibration of the time axis on the chart recorder, a leased used machine with a gear-driven timing mechanism; it may also be partly due to a superimposed fluctuation caused by ionospheric conditions. What is important is that with the machine energized the fluctuations are large and distinctly periodic, a condition which cannot be duplicated under any other circumstances.

To avoid the possibility that fluctuations in the house line voltage might be caused by variable power consumption by the swinging energized machine and affecting the frequency of the receiver oscillator, the force machine power supply can be disconnected from the house circuit (unplugged). Even then the large periodic frequency shift persists as the energized (but slowly running down) force machine is swung.



Graph 1. Radio Frequency Shift Experiment

Analysis: The interaction between an energized force machine and a tuned electronic circuit such that the frequency of the circuit is altered indicates the existence of the OD field. No other explanation can be given for this behavior, and this finding is consistent with the results of the previous experiments.

B) General Relativity and the Force Machine Experiments

Discoveries as these regarding the inertial behavior of matter raise questions about the exact definitions of inertia, inertial mass, and its relationship to gravitational mass. Since the results contradict the principle of equivalence upon which the General Theory of Relativity is based, this is discussed here.

There are known two different mechanisms which can cause an object to accelerate. 1) Under the influence of an applied motive force an object accelerates in proportion to a parameter called the inertial mass of the object, and 2) immersed in a gravitational field an object accelerates in proportion to the strength of the gravitational field. By definition, the gravitational force manifested on an object by the field is proportional to a property known as the gravitational mass of the object.

In the past the inertial mass, which is the property of an object with which an inertial force interacts, and the gravitational mass, which is the property with which a gravitational force interacts, have been thought to be equal for all objects. No test devised could distinguish between the two masses which are defined so differently. Very often the validity of this apparent equality has been assumed without any conclusive proof, and the two masses have been identified and used interchangeably in the description of the motion of matter.

In reviewing the fundamentals of the Theory of General Relativity, Einstein writes, "A little reflection will show that the law of equality of the inert and the gravitational mass is equivalent to the assertion that the acceleration imparted to a body by a gravitational field is independent of the nature of the body." From this he postulated the "principle of equivalence" on which is based his Theory.

Now it has been shown by the force machine experiments that rotation alters the gravitational acceleration experienced by a body, so although it has been shown to a high degree of accuracy that the gravitational acceleration is independent of the nature of the object in terms of the molecular structure or density of materials, the acceleration is not independent of changes in nature which may occur as a result of rotation. This invalidates the postulate, and forces a renewed understanding of the relationship between inertial and gravitational mass.

The inertial and gravitational mass are indeed different, but in the special case where there is no rotation present they are not distinguishable. When an object rotates it gains in inertial characteristics, but the gravitational force remains in proportion to a constant gravitational mass, and a decreased gravitational acceleration results.

Although inertial and gravitational interactions of the magnitude and character displayed by the force machine experiments are not possible in the General Theory, they were nevertheless suggested to be taking place at a level far below the threshold of observation.

Einstein wrote: "The inertia of a body must increase when ponderable masses are piled up in its neighborhood," and "a body must experience an accelerating force when neighboring masses are accelerated, and, in fact, the force must be in the same direction as that acceleration." These effects would however, be too small to measure in the laboratory.

Likewise, associating rotation with gravity, he calculated that a spinning rod would radiate gravitational waves, the power of this radiation being too small to be observed.

In the General Theory of Relativity, therefore, which is a geometrical construct capable of describing all known phenomena, the possibility of inertial and gravitational/rotational interactions was a logical consequence. What was not known at the time it was formulated was the existence of the phenomena now revealed by the force machine experiments, that rotation has properties associated with it which cause inertial/gravitational interactions to occur on a macroscopic level.

Conclusion

These experiments with the force machine are only a beginning, and antigravity and nuclear fusion confinement promise to be two interesting features of future development.

It is my hope that these ideas will be genuinely examined and appreciated by the reader. I have maintained a distinction between the actual experimental results and the theoretical mechanisms postulated for them, so acceptance of the results does not necessarily constitute acceptance of these postulations.

LETTERS

May 23, 1974

Editor

In the April-June 1973 issue of the Quarterly you quote from Michael Michaud regarding the possibility of interstellar flight. It is unfortunate that this quote bases conclusions on erroneous physical theory and ignores the most difficult problem of interstellar travel.

It is not possible to continuously accelerate at the rate of one *g*, or any other rate, without eventually running into the speed of light. Near that speed the vehicle mass increases very rapidly, correspondingly increasing the thrust required to maintain the constant acceleration. In the limit, at the speed of light, the vehicle mass becomes infinite and so does the thrust requirement. An acceleration of one *g* is about 10m/secs,2. Since the speed of light is 3×10^8 m/sec it takes about one year to reach the speed of light with a one g acceleration. Thus the 21 and 28 year periods mentioned are nonphysical unless one has a means of jumping across the light barrier. Of course, in that case the discussion of time dialation effects is irrelevant anyway.

The most difficult problem of interstellar travel is the energy requirement. If all the mass of the vehicle including fuel, motor, structure and payload is converted into energy for propulsion, then if the conversion efficiency is less than one, we can only approach the speed of light. This means that there is no energy left to decelerate at one's destination or to return to the starting point. Those who have carefully studied the interstellar travel problem recognize that energy storage capacity and conversion efficiency so severely limit travel, that truly interstellar distances can't be covered in the span of a passenger's lifetime unless we assume that our present understanding of physics is in error or is deficient.

Of course there are many practical problems involved also. How does one know which stars have inhabited planets. The choice of destination becomes difficult even at moderate distances. At home base the travel time becomes so long, that those launching the probe may have forgotten they sent it by the time it returns.

It is fine to speculate about what might be, if physical law is extended or modified, but one should point to the deviations from present knowledge. There should be a clear demarkation between well established physics and speculation about what might be. Your care in this matter will be greatly appreciated.

Best Wishes;

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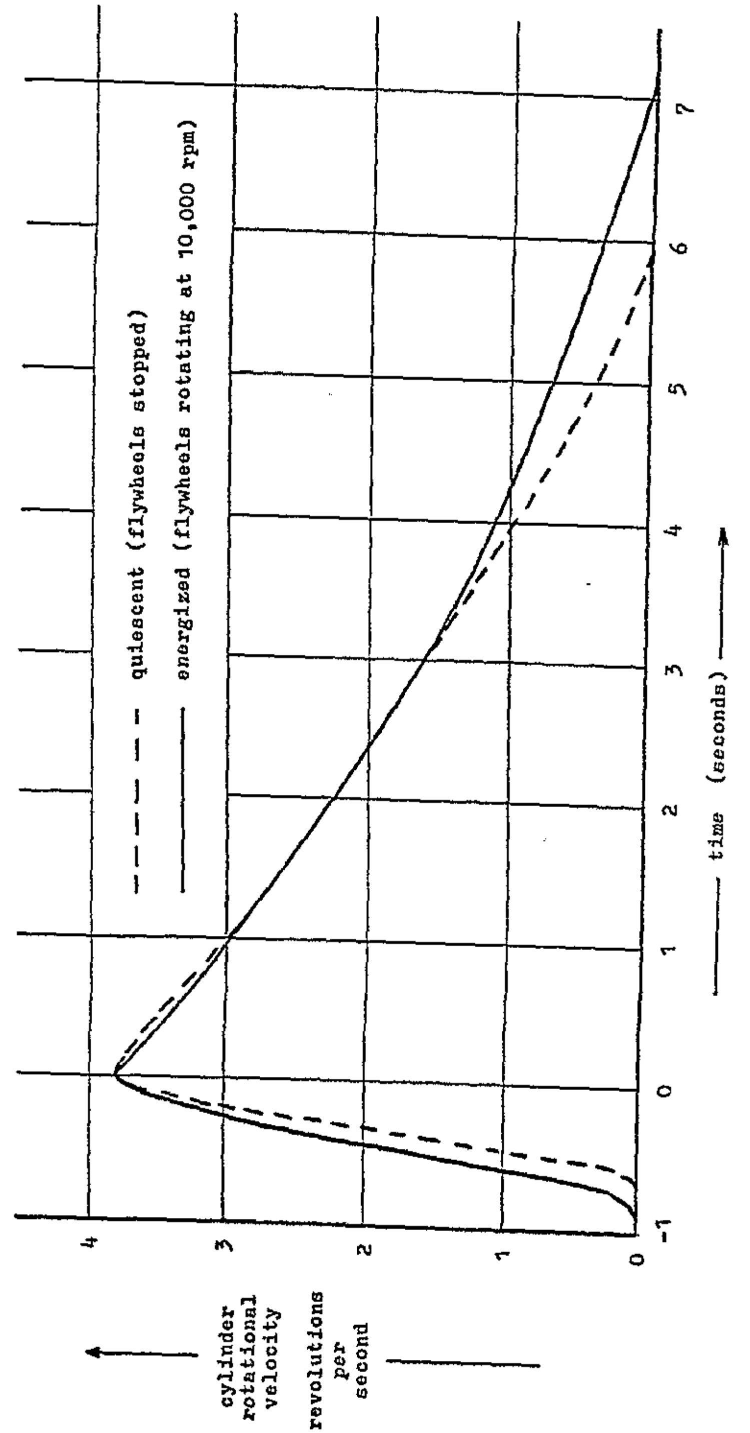

Transient Behavior of the Force Machine