MORTON'S SPACE DRIVE

by Charles L. Morton

Charles L. Morton outlines a series of high voltage experiments and suggests some kind of resonant pulse emission that produces thrust. The thrust levels cause slight motions of a device suspended in pendular fashion. He says a steady thrust was finally achieved in his experiments.

Charles Morton was born in Yuma, Colorado on November 20, 1932. He was three years old when his father died in an accident. Thereafter, he and his mother moved to a small farm in Missouri. Morton attended Kirsville State Technical College and the University of Missouri at Columbia, where he majored in forestry. Most of his occupation has been in forestry.

In the winter of 1965, Charles Morton went to work as an electronics trainee for McDonnell Aircraft in St. Louis, Missouri. Since then he said his life has never been the same. While at McDonnell he read some things about UFOs and concluded that they used some kind of oscillating electric field in the megavolt range. He figured there must be some way for a high frequency electric field to repel matter, without attracting an opposite charge. For whatever reason, he quit McDonnell and went back into the tree business. Curiosity, however, drew him back to his idea and experimentation with field forces.

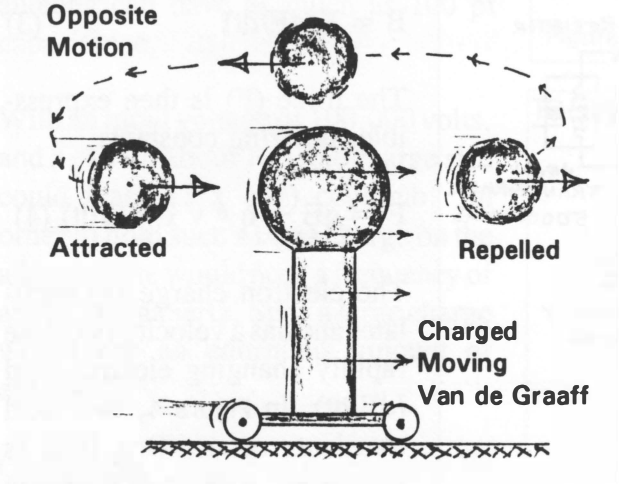


Figure 1

Early Research

Beginning in January 1966, I obtained a Van de Graaff generator to test my ideas and found that upon discharge it produced a kind of electric explosion ten times stronger than the static field....But, it attracted an opposite charge at the same time.

In 1967 I discovered that a moving Van de Graaff or other cha ged body caused a strange shift in the electric field. Repulsion for either charge [positive or negative on a balloon] increased ahead of the charged Van de Graaff ball--while attraction for either charge increased behind the charged ball. To the side in parallel with the direction of motion, the charged balloon moved in the opposite direction. This is illustrated in **Figure 1**.

[Mr. Morton related in a telephone conversation that two Van de Graaff charged balls, spaced and suspended to revolve around a common center were difficult to move. In contrast, the uncharged balls spun easily. This is illustrated in **Figure 2.**]

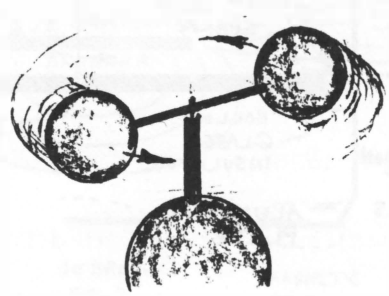


Figure 2

I tried firing Van de Graaff sparks through a glass tube at a metal target. A new effect showed up in the form of a narrow beam that ionized everything in its path. The beam could either attract or repel matter. See **Figure 3**. [Charles Morton said that the

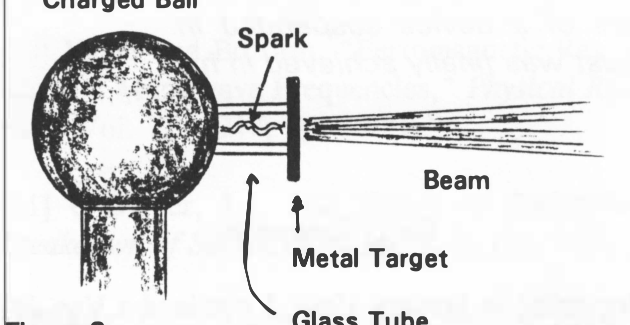


Figure 3

effects did not work using a Wimshurst generator.]

I think the drive is a field reaction against space itself, neither radiation nor ion propulsion. The effect was first obtained with a discharging Van de Graaff generator, and it finally evolved into an antenna-like device that attracted mass at one end and repelled mass at the other. Fifty-thousand volts were required to produce thrust forces.

By 1968 I had gone from the Van de Graaff power source to a transformer [neon type] that powered the antenna-like device (**Figure 4**.)

Thrust Experiment

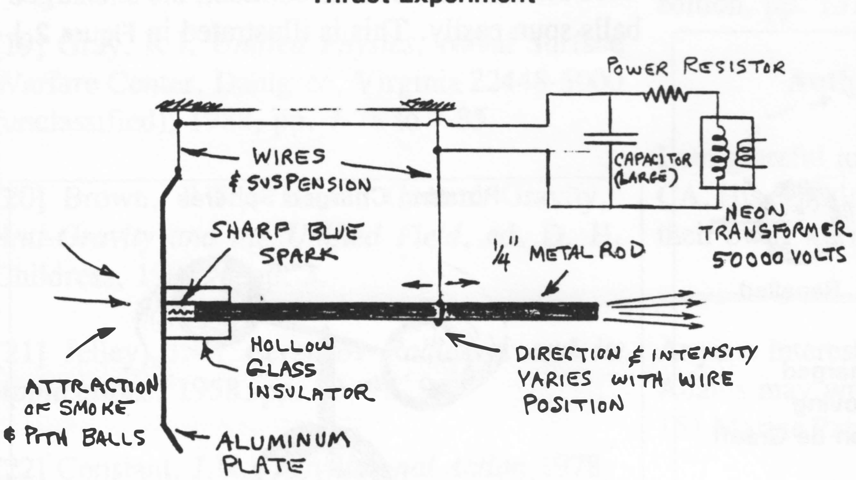


Figure 4

In 1974 I decided this could not be a pure electric field or magnetic field effect--so it must be a third field. I didn't buy the gravity theory that [T.T.] Brown had proposed, but were there any other fields to choose? Some of my Van de Graaff experiments had suggested some kind of spherical standing waves around the VDG [detected by the use of a fluorescent tube lighting at different distances.] What if all charges had such waves? Experiments had shown such waves deflected objects that tried to cross them.

In 1982 I considered the drive to be within practical development. In fact, it was quite feasible, except for one thing. High voltage equipment is very expensive. A 100 kv triode costs $10,000. I made a few attempts to locate a used one and finally gave up.

Morton's Theory

An electric force is expressed by equation (1):

$$F = q \bullet E \pm q \frac{\Delta \text{Potential}}{\Delta \text{time}} \quad (1)$$

[Editor's Note: Equation (1) is the form used by Mr. Morton. To achieve dimensional consistency we interpreted this in the form of equation (2).

$$F = q \bullet E + qv \times B \quad \text{(Lorentz equation)} \quad (2)$$

Here (B) is taken as an instantaneous value generated by the changing electric field (dE/dt).

$$B = K(dE/dt) \quad (3)$$

The force (F) is then expressible, ignoring constants:

$$F = qE + q \bullet v \times (dE/dt) \quad (4)$$

The electron charge (q) oscillates and has a velocity (v) in the rapidly changing electric field (dE/dt). In **Figure 4**, two field transients occur. One field is non-linear, a result of the spark pulse, on the order of nanoseconds, which may jar the atom itself. The second field is the more traditional wave oscillation and is a function of the antenna length.]

The transient wave generated is thought to be at gamma frequency, similar to a synchrotron beam. The beam can carry as much energy as a maser, and when it hits a conductor, it sets up a longitudinal current at the natural frequency of the antenna-like conductor.

The action described is based on the idea that two charges may exchange momentum through their virtual photon fields [probability waves.] (**Figure 5**) Normally one would assume a charge moving back and forth on an antenna would only cause vibrations. But if a de Broglie wave field is generated it has a 180 degree lag. (**Figure 6**) The high velocity of the antenna charge also has a Cerenkov effect. The result is a kind of rectifier effect, as shown in **Figure 7**.

As long as the charge remains relatively small, the transverse radiation field will carry the most energy, but as charge approaches ($1x10^{-4}$) coulombs (**Figure 8**), it becomes tremendously powerful. So thrust depends primarily on the size of the charge stored on the antenna.

This would mean capacitance and input line voltage would be critical factors, although amperage plays a role in antenna gain. Experiments have shown an antenna can have as much as 100 pf capacitance.

With an input voltage of 100,000 volts, and a gain of about 100, the charge size could reach (1×10^{-3}) coulomb. In order to hold such a large charge on the antenna, one would need a frequency of about 1 megahertz. Such a large charge would use an enormous amount of energy.

One possible source of energy may lie in the discovery that negative pi-mesons may be produced by gamma-photon bombardment. These could cause atomic fusion if heavy hydrogen were present.

One point of interest is the velocity of the field. This has been one of the most difficult of the engineering problems because on one hand a displacement of electric charges should not be capable of exceeding the speed of light. On the other hand, a de Broglie field is defined as being capable of infinite velocity [de Broglie waves are always faster than the speed of light.] Actually, this is a special case where the field is in a state of

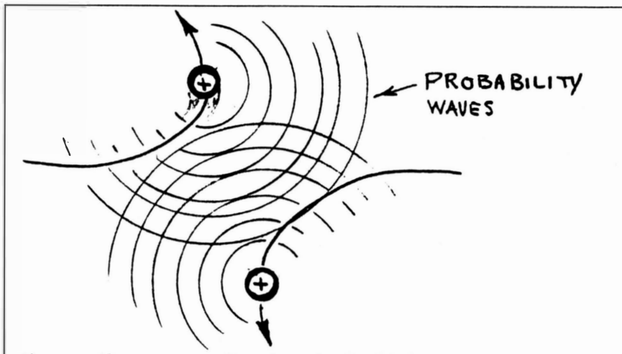


Figure 5 **Coulomb Collision**

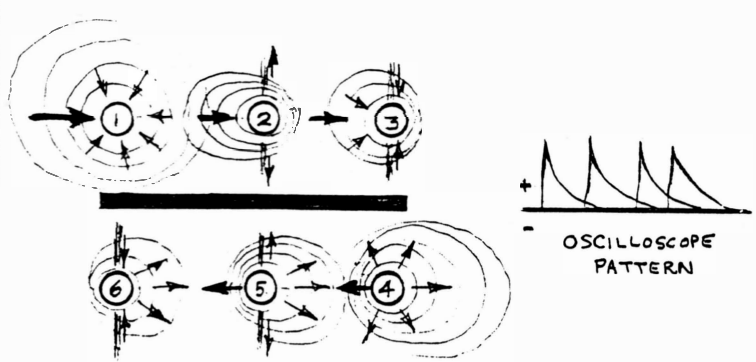


Figure 6

Rectifier Effect

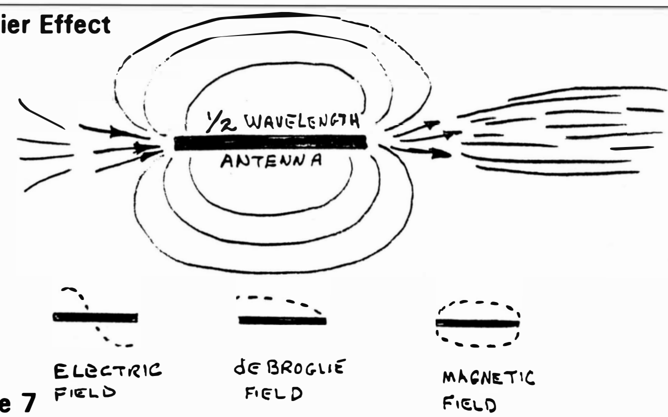


Figure 7

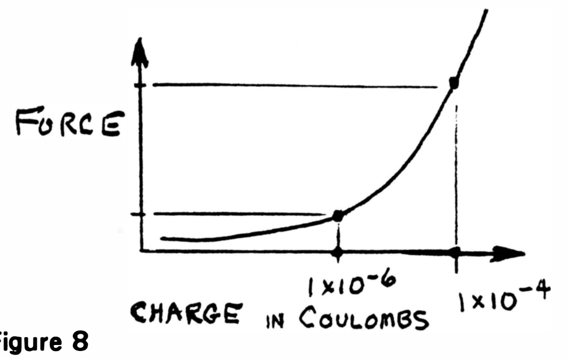


Figure 8

change and the speed of light is violated, as has been observed in some exploding stars.

Normally we can assume the displacement current moves at 98% c, relative to the antenna charge, but the antenna charge is also moving at 98% c. But with the [electron] probability waves in a state of change, the antenna charge would appear to have a much greater velocity.

The lowest velocity the field is capable of moving in pure space is 5000 c [c = the speed of light]. This is based on the shift in the de Broglie wavelength. This would seem to indicate the craft would continue to accelerate long after it passed the speed of light relative to a fixed star.

If one accelerated at 1 G, it would take 30,000 years to reach 5000 c, which would seem to indicate such velocities are unattainable. Apparently a ship propelled by this drive would feel no G-force because the transverse field would cancel it. At one mega-G it would take 40 hours to reach 5000 c. The surprising part is it would not take an unrealistic amount of power--about one mega horsepower for a light ship. Assuming my idea for atomic fusion works, star travel would be feasible.

Actually, I don't suppose man will be testing any of these extremes in the near future, but I have shown them as potentials of what the drive is capable of doing. Models have been built that produced a few ounces of steady thrust, or a few pounds for an instant.

The drive is believed to be propelled by a current of virtual photons, which is absorbed at one end of the antenna and emitted at the other. The photons are exchanged with the environment and even distant stars. The drive attracts mass at one end and repels it at the other. Mass is also attracted and repelled in the transverse, which brings us to another question. With such extreme velocity potentials, would collisions with meteors be a problem?

In my experience with small models, some unexpected repulsive force prevents collisions with anything. When an object gets within one diameter, relative to its size, from the drive, it is repelled. This means large objects begin repulsion at a greater distance proportional to their size.

From this evidence I would conclude the drive is almost collision-proof, can travel at infinite velocity, generate its own power from hydrogen fusion, and cancel its own G-forces internally. Tests have shown the transverse field does not affect external thrust. Models of less than 10 tons of thrust could use conventional electrical equipment.

Anyone interested in communicating with Charles L. Morton may contact him at: P.O. Box 135, Grant, Colorado 80448.

Some of the ideas expressed by Mr. Morton are not familiar to *ESJ* and could not be clarified prior to print deadline. We hope to remedy this situation as our communication with Mr. Morton continues.

The Pulse Device

by Klaus Schlecht

As a builder, experimenter, and scientific adviser at Dipl.-Ing. Weißmuller, University Karlsruhe, Germany, I would like to thank Charles R. Morton of Lyons, Kansas, for his ideas and dimensions regarding the pulse device.

The experiment was held on January 31, 1985 in the Hochspannungsinstitut of the University Karlsruhe, Germany. Main eyewitnesses were assistant engineer Weißmuller, an electronic engineer, Hoffmann, Karlsruhe and myself.

The pulse device was connected to a circuit, as shown in **Figure 1**. The various test modes and results are listed in **Table 1**. The energy beam, which spreads out during the experiment, was not a conventional version of ion propulsion. This was easily surmised by: the form and the color temperature of the spark inside the spark gap channel; the attraction repulsion behavior of a pair of test balls; and a neon lamp that was 25% ignited (luminous) in the test beam.

The luminous ignition effect would occur if the lamp was held rectangular with their holder–at a distance of about 20 cm to the antenna rod; exactly in the beam spread out direction (circuit mode 1 and 2 in **Table 1**) and between the antenna rod and the lamp. Under this condition, the lamp ignites synchronously with the discharge frequency of more than 1 kHz.

In circuit mode 3 and 4, at 1 meter from the spark gap channel; the suspended test balls–under the attack of the energy beam–began to twist among themselves. This did not apply to the other circuit modes. All test balls, mounted at a 1 meter distance before the antenna rod and the spark gap channel, made a repulsion attraction movement, as a function of the energy wave spread out direction that depended on the circuit mode.

Because of the trafo limit in the power station, it was not possible to tunnel talcum powder with the energy beam of the pulse device into a distant metal box. The amperage gap of the transformer could only lift the powder to a small extent before the fail-safe fuse brought further events to an early end.

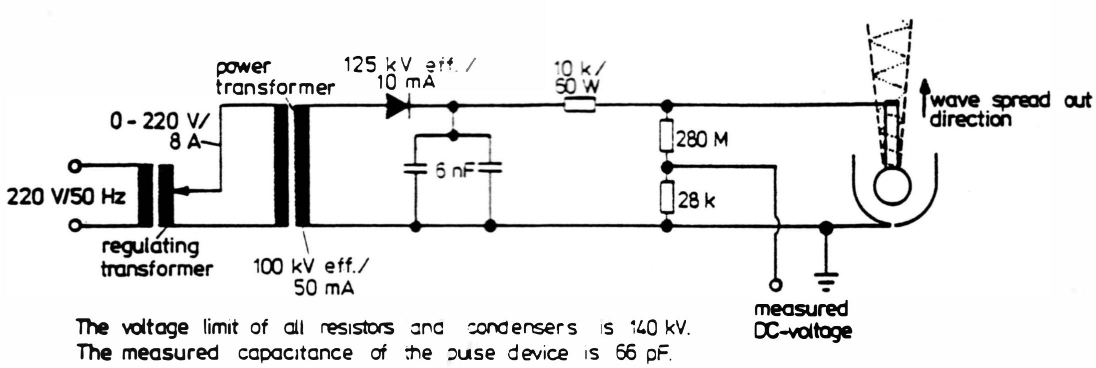


Figure 1 **Circuit Diagram of Connection Mode 1**

With a Tesla transformer, however, (in the opinion of the eyewitnesses) there will be no lack of energy for a successful powder beaming.

The device has a measured capacitance of 66 pF, designed for a maximum energy storage capacity (see **Figures 3** and **5**). The energy beam spread out direction of the spark gap channel is sufficient, at a distance of about 4 m, to cause air to collapse between the experimenter and the pulse device.

This effect gave rise to fluttering trouser legs and brought a clean and precise spark noise of 100 dB/A minimum sound pressure to our ears.

The discharge frequency could be determined after the given circuit diagram of **Figure 1**:

Discharge Time Constant = $R \cdot C$
Discharge Time Constant = $10\ [k\Omega] \cdot 66\ [pF]$
Discharge Time Constant = 0.66 [ms]

Discharge frequency ≥ 1 [kHz]

The resulting pulse device charge (Q) is:

$Q = C \cdot U$
$Q = 66\ [pF] \cdot 100\ [kV]$
$Q = 6.6$ [coulomb]

ADDENDUM

The electrostatic lifting power, which is necessary to bring a talcum particle in levitation, is about 0.9 pounds.

Therefore at a voltage of 100 kV, for this *given* pulse device, it is estimated that two amperes is necessary in reaching the electrostatic levitation point of a powder particle.

The most efficient power transformer of the university could only deliver 50 mA at 100 kV. Therefore the aforementioned amperage gap =trafo limit.

At 100 kV, the minimum amperage needed to bring the pulse device to work is 300 mA. This value is the upper limit for the fail-safe fuse system.

[*Editor's Note*: Only a small portion of this research report is included in this article. Also, figure numbers represent those in Mr. Schlecht's original.

Additional reference to Charles Morton and his space drive can be found in the article, "Morton's Space Drive," in *ESJ* #4.]

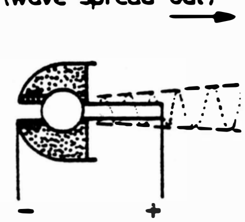
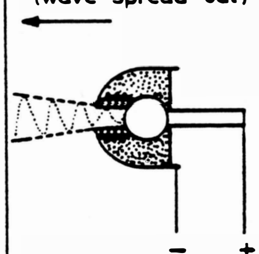
mode	spark-gap reduction distance between the hollow valve and the sphere in [cm]	resulting break-down voltage in [kV]	polarity	pulse direction (HF-spread out)	circuit connection
1	0,5	15,5	antenna + (tip)	along antenna (outside)	(wave spread out) 
	1,5	32	pulse device - (plate)		
	2,5	43,5			
	3,5	52			
	4,5	58			
	5,5	72			
	6,5	80			
	7,5	89			
	8,5	94			
	9,5	98			
	10,0 (at no reduction gap)	100 -106			
2	0,5	17,5	antenna - (tip)	dito.	dito., with opposite polarization
	1,5	30	pulse device + (plate)		
	2,5	43,5			
	3,5	58			
	4,5	78,5			
	5,5	91			
	6,5	101			
	7,5	110			
	8,5	120			
	9,5	122			
	10,0 (at no reduction gap)	120-122			
3	0,5	18	antenna + (tip)	along spark gap channel (outside)	(wave spread out) 
	1,5	32	pulse device - (plate)		
	2,5	45			
	3,5	57			
	4,5	68,5			
	5,5	70,5			
	6,5	79			
	7,5	86			
	8,5	95			
	9,5	97			
	10,0 (at no reduction gap)	99-102			
4	0,5	16	antenna - (tip)	dito.	dito., with opposite polarisation
	1,5	32	pulse device + (plate)		
	2,5	34			
	3,5	48			
	4,5	63			
	5,5	78			
	6,5	100			
	7,5	112			
	8,5	134			
	9,5	(Trafo limit)			
	10,0 (at no reduction gap)	dito.			

Table 1 **Measured DC- values at four connection modes**

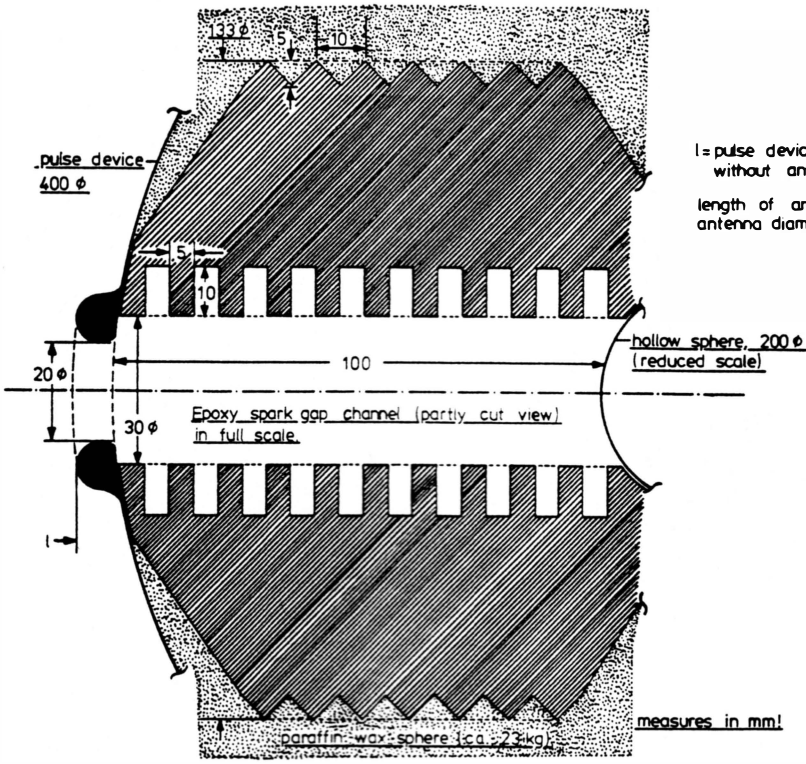


Figure 2 - Spark gap channel

r - Coordinate = radius of the device in 10^1 [mm]. z - Coordinate = position of the earthed plane, which is necessary for reckoning. In 10^2 [mm].

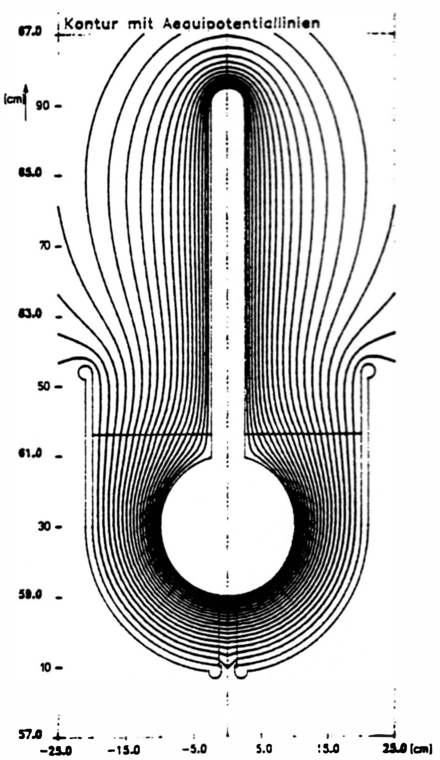


Figure 3 Static field lines of a pulse device with a 200 mm o hollow sphere.

Mathematical model. The charge density has on areas with highest green contrast its maximum. Coordinate explanation see Figure 3. TG 1 = Tachiongenerator Mk. 1.

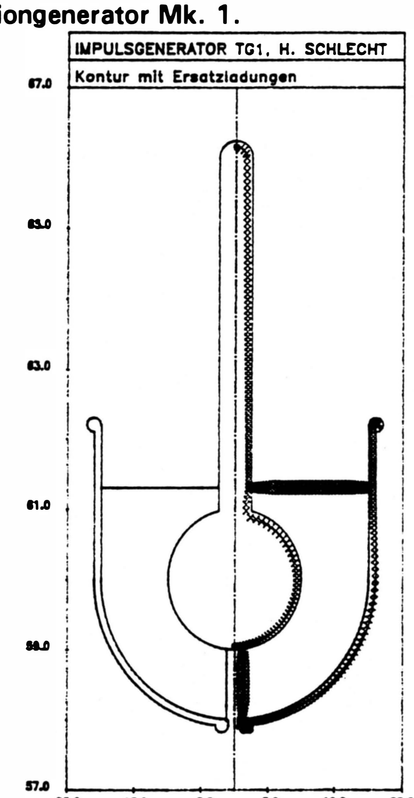


Figure 5 Static charge density of the pulse device from Figure 3

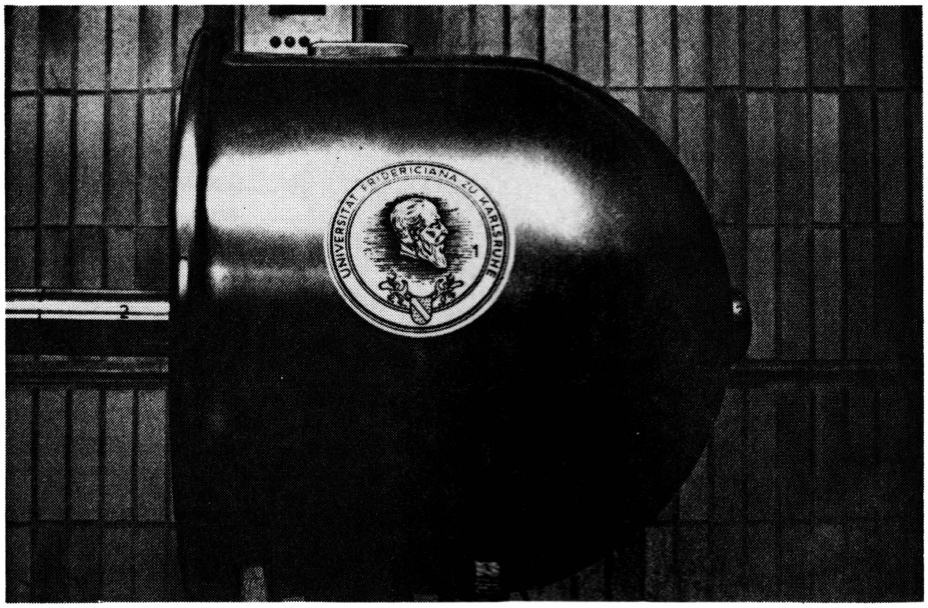


Figure 6 Pulse device - side view

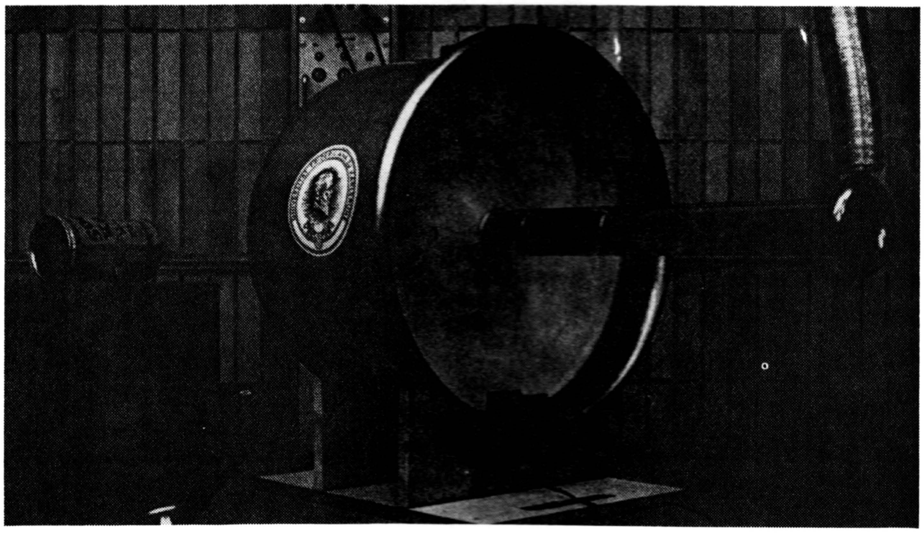


Figure 8 - Pulse device (circuit connection mode 3)

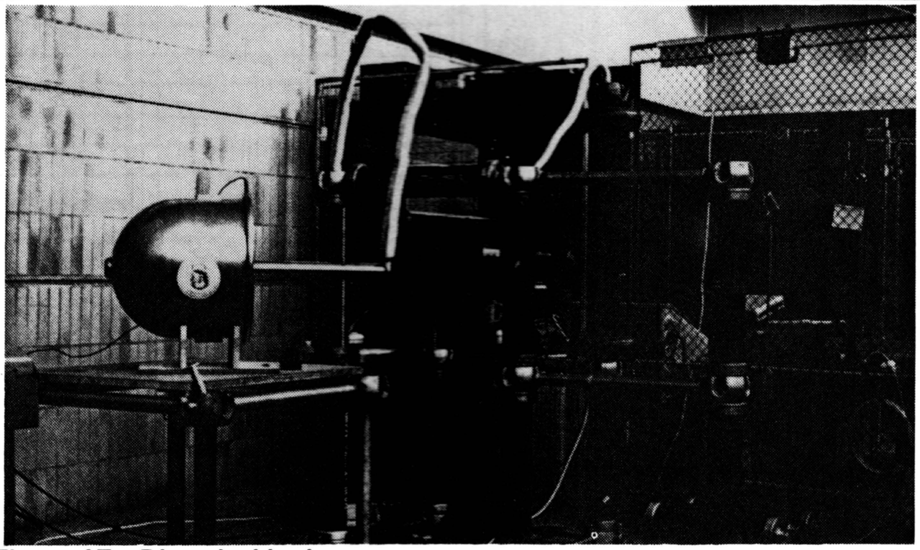


Figure 17 - Dito., inside the cave

Information from
Alexander Peterson
11200 Gravois Rd., Apt. C
Saint Louis, MO 63126-3622

Electrical Pulse Generator

Reminiscent of the Searl levity disk generator (see *ESJ* #1), Alexander Peterson comments on the electrical pulse generator. Mr. Peterson writes:

> U.S. Patent # 4,613,779 - Electrical Pulse Generator, was issued on September 23, 1986. This electrical pulse generator has two magnetic fields at 90°. **Figure 2** shows electromagnets (or magnets). Magnetic field jumps across as shown in dotted lines. Another coil wound on non-magnetic material is placed in the gap of electromagnets. As the electromagnets turn, they induce a voltage in the toroidal ring coil. The magnetic field cuts across the coil at 90°. The load current in the ring coil stays inside the toroid. This magnetic field is 90° from the exciting field. This allows the motor to free wheel without drag, regardless of the load from the ring coil. It is 'free from opposing magnetic fields, contacts, slip rings, and moving wires.' With low friction bearings or other types of bearing the motor drive power is minimal. The energy developed with the 'proper design' can exceed ten times the input. This should have been done 100 years ago. Study carefully. This has real potential. Electrostatic type machines can be built on a similar principle with certain modifications.

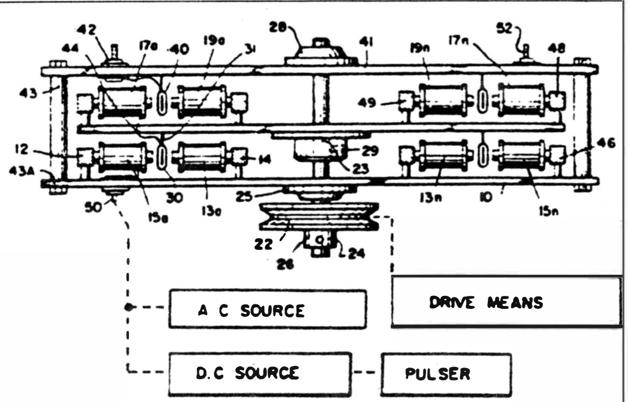


Figure 1 Electrical Pulse Generator—side view

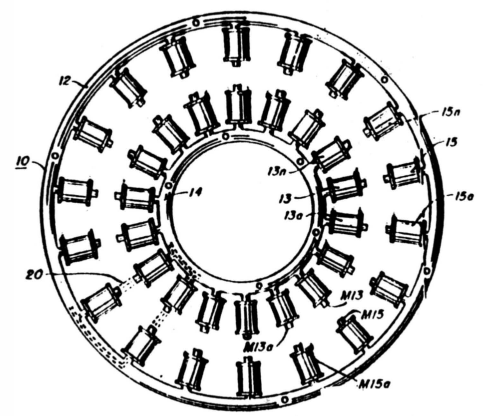


Figure 2 Electrical Pulse Generator—top view

Patent Abstract

An electrical pulse generator comprising a series of electromagnets spatially positioned about the outer circumference of a disc-like base and a second series of complimentary electromagnets positioned about an inner position on said disc. One of each said first and second series electromagnets positioned relative to each other creating a magnetic field there between. A second disc-like base rotatable above and parallel with said first disc. A continuous coil winding ring mounted on the underside of said second disc and positioned relative to said first and second series of electromagnets to traverse said magnetic field upon rotation of said second disc and thereby inducing a voltage/current potential in said winding coil.{N105 L706}

Information from
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Physical Constants

Mr. Morton discovered the numerical value of the gravitational constant (G) to be close to that given by the following combination of physical constants:

$$G = \frac{1}{\varepsilon_o}\sqrt{\frac{-h}{2\pi C}} = 6.70 \times 10^{-11}$$

where:

ε_o = permittivity of free space = 8.85×10^{-12} Coul^2/Newton-meter^2
h = Planck's constant = 6.63×10^{-34} Joule-sec
c = velocity of light = 3×10^{8} meters/sec

The accepted value of (G) is 6.67×10^{-11} newton-meter^2/Kg^2. Mr. Morton is not concerned with the balancing of dimensional units, but rather the reason for the close numerical result. The dimensional units become a real quandary. Mr. Morton would like some clarification from someone on this matter.

Experiments with Aluminum

BY CHARLES MORTON

I ran a radio frequency current through aluminum powder in a U-shaped tube capped with funnels (see below), and found that the current caused the aluminum dust to collect in glass jars placed above the funnels.

With more experimentation, I observed that most of the powder in the jars had risen from only one electrode. Furthermore, greater concentrations of powder were consistently found in the northwest and occasionally in the southeast sides of the jars.

Closer investigation revealed that the powder was rising to the jars, not from the electrode wire, but from the edge of the funnels; particularly on the northwest side.

After a significant quantity of aluminum was collected from the jars, it was observed to exhibit cohesive and adhesive properties, clinging to itself and my fingers. When I wet the powder and let it dry, I found it lost this property.

This could be explained in terms of an electrostatic charge buildup on the aluminum, causing the particles to repel each other and distribute themselves on the jars, clinging with the attraction of instantaneous dipoles. The fact that water can remove static cling is not unfamiliar, either.

I, however, believe an electric charge would cause the powder to repel itself and explode. Furthermore, it should leak off the dust when handled. I therefore, offer another explanation.

The experiments in fact began as an attempt to isolate negative mass. I worked with aluminum dust because I supposed it contained great quantities of the substance.

I believe that matter is a fourth-dimensional dipole of positive and negative matter, with only the positive matter detectable in our normal perception of three dimensions. A process capable of flipping the dipole over, I speculate, would cause matter to fall up in our cosmos.

It might also be possible to break the dipole, thereby creating a mass particle analogous to an ion or electric charge. I think this is what happened when two pieces of metal were joined together by means of a high frequency current.

I believe that the attraction between positive and negative mass is so powerful it forms something like a covalent bond when negative matter is trapped in three dimensions. This is what caused the dry powder to get sticky. I hypothesize that if one could trap negative mass in three dimensions and cause it to flow through a coil, the resulting field would cause the coil to move into the fourth dimension.

I intend to investigate further with larger capacitors which will intensify the effect.

Charles Morton
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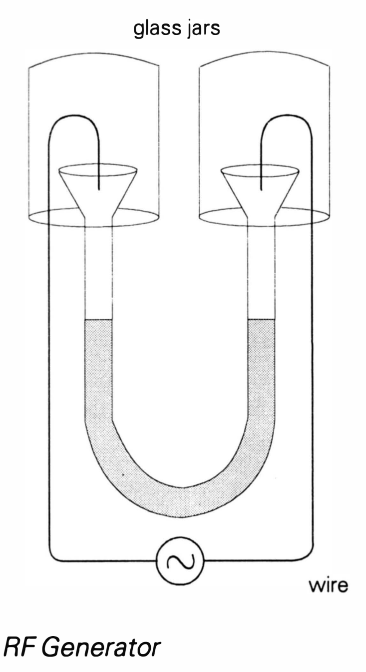
Grand Canyon, AZ 86023



Ed. Note: All aluminum powder is coated with an aluminum oxide film (dielectric) when exposed to air. Such aluminum powders will show very high ohmic resistance with a multimeter; that is, they are nonconducting at low voltages, but they might acquire and hold a net voltage when exposed to high-voltage field oscillations.

On: The Alzofon Papers

In regards to the recent article "The Alzofon Papers," in *ESJ*#13, I have a few relevant comments to submit: For those of us who have taken a graduate course devoted exclusively to nuclear magnetic resonance (NMR), besides undergraduate physics experiments in NMR, it is disturbing to see Alzofon's material refer to it without mentioning NMR.

Alzofon's method of NMR is the standard which is used so extensively throughout the world that it is surprising he would claim new results. For example, his claim of flipping the nuclear spins rapidly "should lead to an increase in the gravitational force" does not seem to have an argument or evidence preceding it. Increasing mean disorder needs to be related to gravity fundamentally.

The first word of the abstract and the first heading both refer to experiments but no experimental results are revealed. For anyone to believe that flipping nuclear spins is going to cause gravitational anomalies, we need to see data and percent weight changes.

By the way, your second diagram is incorrect if it is a strong magnetic field. The nuclear energy levels will split in a magnetic field (usually to two states) allowing only WITH or AGAINST spin directions. The AGAINST direction requires more energy which the radio wave supplies. (Your first stage is okay, but the second stage should show aligned nuclear spins WITH the magnetic field, and the third stage should show aligned nuclear spins AGAINST the field.)

Thomas Valone, M.A.,P.E.
Pres., Integrity Research
Washington, D.C.

Ed. Note: *Dr. Alzofon has mentioned to me the amount of weight change, I would call it appreciable. However, he is of a quiet conservative nature and does not yet want to make specific claims of percent weight loss. He feels additional experiments are required. He is now retired, but has quite an impressive record in aerospace technology problem solving. George Hathaway has some knowledge of his early experiments. The diagram error is my own, thanks for the correction.*

Morton's View

The last issue (#13) is greatly improved, although the math was barely comprehensible. It actually sounded like research scientists talking. At least one could trust their experiments although I disagree with their theories.

On another point, I would like to comment, I have a lot of respect for Ron Kovac, but I think he is getting mixed up on the ion emission from the Tesla coils. Although I have no doubt that the high voltage terminal can emit ions, the base of a Tesla coil has almost zero voltage. The base has high amps and magnetic field, not voltage.

In one of my experiments I had a very powerful field. When a pith ball was brought near the attractive end, the force suddenly reversed about one inch from the drive. This would lead one to assume the ball ionized, but when the same ball was brought to the repulsive end, it was attracted at one inch from the drive. The repulsive end always ionized objects, but iònization didn't reverse the attractive or repulsive end.

Obviously something happened to matter at very close range that changed the nature of matter. It could not have been simple ionization or the attraction at the repelling end would have reversed as soon as it touched the metal ball.

Charles Morton
Grand Canyon, AZ

Address Letters To:
Letters to the Editor—ESJ, 73 Sunlight Drive, Leicester, NC 28748 USA. We reserve the right to publish and to edit for clarity and length.

Experiment

Aluminum Dust Experiments

Charles Morton

Charles Morton, who has a background in electronics, performs experiments in his free time.

Morton can be contacted at P.O. Box 281, Death Valley, California 92328.

Over the past few years, I have conducted several experiments in which I subjected aluminum dust to different forces. In experiments with aluminum and other materials, I observed some unexpected results.

Application of Tesla Coil RF to Aluminum Powders

Using an altered Tesla coil circuit as the power source, I subjected aluminum dust to a radio-frequency current and it acquired a property similar to surface tension in water. That is, it manifested the action of a short-range force which caused dust particles to cling together in clumps or chains. Some particles even rose upward.

This effect was most pronounced when the aluminum dust was immersed in oil. In oil, the aluminum developed patterns that resembled smoke or cloud formations. These patterns changed continuously, very slowly, like a growing plant.

Interacting in alignment with the earth's magnetic field, the aluminum dust formed whorl patterns. See Fig. 1. Although this is classic behavior for an ion in a magnetic field or a paramagnetic metal, the dust should have been moving much faster since force is the product of magnetic field strength, charge, perpendicular velocity, and length. This dust moved so slowly, its movement could not be noticed directly by the unaided eye.

However, under a magnifying glass, one could see that individual grains were moving much faster within the whorl pattern boundaries. This would suggest that the particle motion was increased, somehow more confined, and produced an altered state in the metal. Since almost all matter is paramagnetic, one can only wonder why smoke, dust and clouds don't form these whorl patterns.

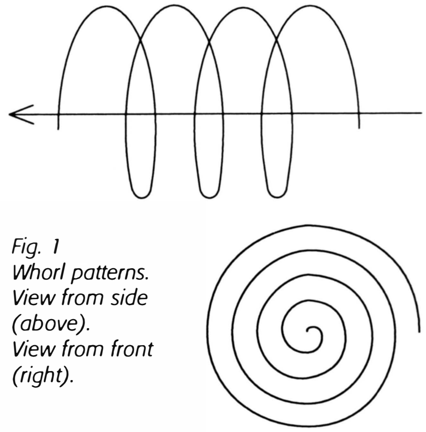


Fig. 1
Whorl patterns.
View from side (above).
View from front (right).

Something even stranger happened when I floated metal grains on the surface of oil. The grains moved toward the earth's south magnetic pole. I suppose that this action was more motivated by an avoidance of a high field intensity, than it was by a south-seeking motion. This was not very surprising since high frequency magnetic fields repel aluminum and copper. It did show, however, that individual molecules are in a high energy state.

When I started running the Tesla coil high-frequency currents through powdered metal, I got small explosions. To dampen the explosions, I covered the metal with oil and water.

When high-frequency was run through aluminum dust, bright bluish-white sparks blinked off and on all over the surface. This resembled one of the effects observed by John

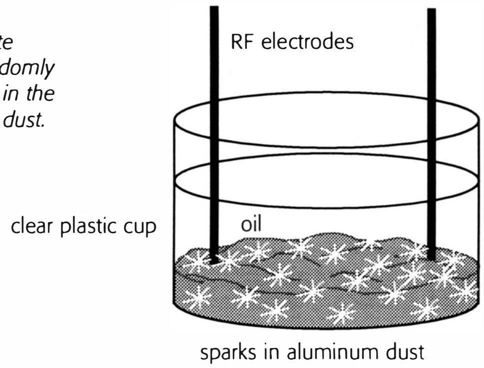


Fig. 2 Bluish-white sparks randomly appearing in the aluminum dust.

Hutchison. If the aluminum were under an inch of oil, bluish-white sparks were still observed. The sparks appeared and disappeared at random and did not seem to be confined to the surface of the dust. See Fig. 2.

Bluish-white sparks are indicative of very high energy, and the sparks observed sometimes even vaporized the oil. If the sparks were the result of resistance heating, one would expect the fire to appear next to the input wires and get dimmer with distance. Although the sparks were more numerous near the wires, they also appeared far from the wire with undiminished brightness. This phenomenon may not be dismissed as corona discharge, brush discharge, nor spark gap discharge; oil has a resistance of 300,000 V/inch.

This experiment produced several unexpected results. The phenomenon closely resembled the vanishing talcum powder experiments (*ESJ* 6, p. 18 and *ESJ* 4, p. 35). Although powdered aluminum has a very high resistance because its surface is oxidized, one would expect it to spread the current out evenly and be heated uniformly. It is not known why the current caused aluminum dust to float on the surface of oil.

Effects of Microwaves

I decided to investigate the effects of microwaves on metal dust. If one uses a microwave oven for these experiments, one must include a glass of water in order to help absorb microwaves so the metal dust reaction does not get too energetic.

In one experiment, I had a glass turned upside-down over aluminum dust, and subjected it to a microwave current. Suddenly, the glass turned milky-white. I shut off the power, and when I saw that the color would not change, I turned the glass upright, and a white vapor rose out of it and vanished. I supposed that the vapor was probably very fine particles of aluminum or aluminum oxide.

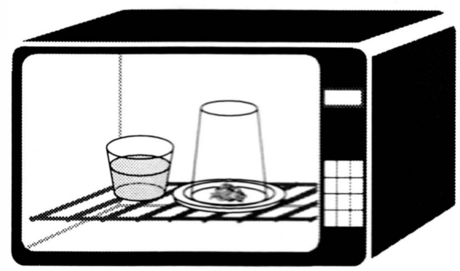


Fig. 3 Heating metal dust.

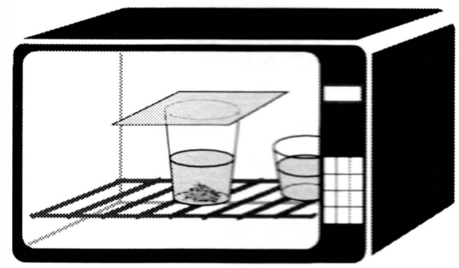


Fig. 4 Heating manganese dioxide.

In another experiment, I placed metal dust on a saucer, and covered it with a glass to prevent any reaction products from escaping. See Fig. 3. I heated various substances covered in this way in the microwave. With heating, the metal dust was observed to fly in all directions. My tests revealed that aluminum will vaporize easily, but lead and iron take longer.

When aluminum vapor was allowed to cool under an inverted glass, microscopic metal deposits appeared at the top of the glass. This method was used to collect evaporated metals. When I performed the same experiment with salt and sugar, I kept getting what looked like drops of water on top of the glass. When the same experiment was tried with smoke, water was deposited at the bottom of the glass.

One of the most unexpected results occurred when I was trying to levitate some manganese dioxide, the black material found in batteries [actually a mixture of ingredients]. When I placed some of this substance in a glass of water, it sank like a rock. I covered the glass with cardboard, and heated it in a microwave See Fig. 4. At first, the water turned jet black. I removed the materials from the microwave, and let them sit undisturbed.

A little over an hour later, most of the manganese dioxide had settled out, but a small portion was found to be floating on the water. After leaving it alone overnight, black powder was found to have risen and become deposited on the cardboard lid. The crystals had risen overnight without any electromagnetic fields acting on them.

I found that MnO_2 reacted more strongly than the other materials, but it, too, left drops of clear fluid. Since the original salts were magnetic, I brought a magnet near them, and the white crystals turned back into black dust. I left the crystals alone, and after a few days, noted that they were turning back into a fluid. The process ran only halfway to completion.

The same effects occured with pure metals in water, but metal oxides worked better; at least iron oxide and silicon oxide responded strongly. This may have been because oxygen is a magnetic gas. The effect seemed more linked to high frequency currents than magnetic fields. So far, I have only been able to produce microscopic quantities of altered metals due to limited radio frequency amperages.

Effects of DC Current

Experiments were performed in which I ran DC currents through powdered metals, metal dusts in oils and metal dusts in water. When I switched from aluminum dust in oil to aluminum dust in water, I discovered that the aluminum metal just evaporated with the water. So far, I have gotten aluminum, brass, copper, iron and even lead particles to float on top of the water.

When a DC current was run through aluminum and water, both electrodes attracted the aluminum. With evaporated aluminum (altered state collected from RF experiment), only the positive terminal attracted the aluminum. Powdered copper was repelled by both terminals regardless of its condition. Iron didn't seem to show any attraction to either electrode. Evaporated (altered) lead was attracted to the positive electrode, but it usually just remained suspended in the water. It didn't float easily until it hit the positive pole. Then it floated.

In water, evaporated aluminum and iron showed a strong attraction for glass, plastic and fingers; but evaporated copper, brass, and lead showed no attraction for the same. Aluminum was only attracted to a hot glass. In water, aluminum was repelled from the cold sides of the glass.

Static Electric Charges Held on a Metal

In my experiments, I noticed that aluminum metal was developing what appeared to be static electric charges. Now, it is well-known that metal will not hold a static electric charge for long; but the charges built up on the aluminum were persistent. Even when metals charged oppositely were brought together, it still took hours for them to discharge.

Ed. Note:

Morton has stated that he thinks that the portions of metallic dust that have risen upward to deposit on the top of the glass or on the cover plate may represent an altered state of mass. He has suggested that it has become lighter than air, has negative mass or antigravitic properties. He would like others to review and perhaps duplicate his experiments. He would also like to hear definite explanations of the phenomena he observed. I would also like to hear definite explanations.

The Morton Electric Thruster

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Charles Morton has contributed numerous thoughts, comments, and descriptions of his experiments to *ESJ* over the years. His propulsion concepts are simple and worthy of careful investigation. In some respects, his concepts compare to those of Townsend Brown, but it is clear that Morton has introduced original ideas. The *ESJ* Lab is planning to set up Morton's experiments and would like to hear from network experimenters interested in contributing knowledge and/or time toward what we shall call the "Morton Project." The experiments are to be done in collaboration with Mr. Morton, and the results will be published.

MARCH 25, 1999

For about 20 years, my space drive has remained dormant because developing my drive in the way I envisioned it, a transmitter operating from a high-voltage power source, was unaffordable to me. Later, however, it occurred to me to try another method. I obtained an audio amplifier (100 watt) and used it to power a car spark coil. The drive got about an ounce of thrust, but because the spark coil had a common ground, I got an awful shock turning it off.

Now, I think that by using a 1000-watt radio frequency amplifier, with an impedance matcher and negative feedback for a frequency source, I might very well have the basic design for a full-scale craft. This is the hurdle Brown never got past. He considered using a controlled frequency but didn't understand the laws on which his drive operated.

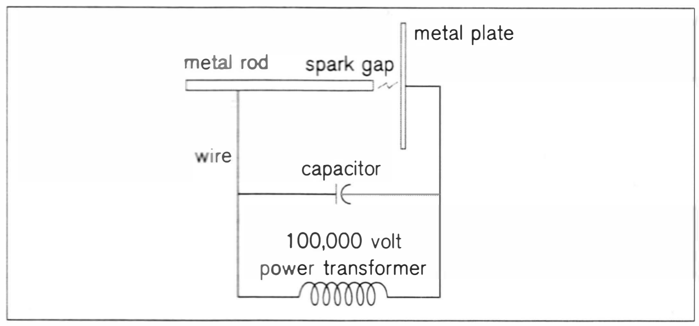


FIGURE 1 The first drive produced 1/8 ounce of thrust.

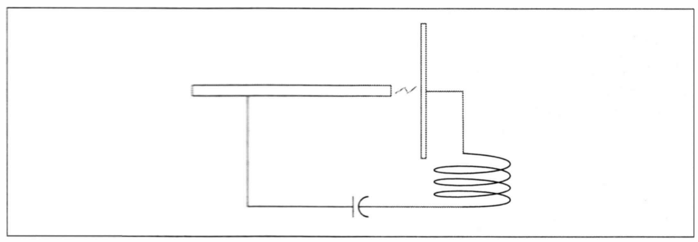


FIGURE 2 Using a large coil reduced television static.

APRIL 7, 1999

One of my concerns is that 30 years of my research and discoveries may go to waste if I can't interest other researchers. My drive started as diagrammed in Fig. 1. It got maybe 1/8 ounce of thrust.

One day, however, I changed the circuit and tried using a large coil to cut down on TV static. (See Fig. 2.) At first it didn't move at all. Then thrust climbed to a couple of ounces. Thrust continued to increase with coil size up to a point, where it levelled off, as shown in Fig. 3. Obviously what I had was a series tank circuit which has a resonance gain of 1-10. (See Fig. 4.)

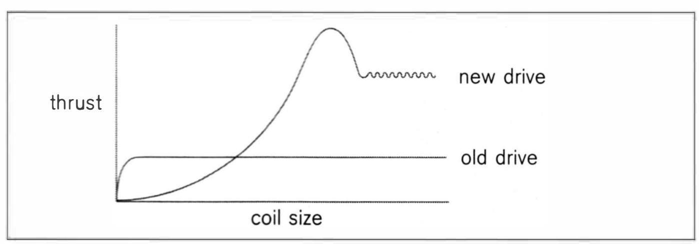


FIGURE 3 Thrust increases with coil size, then levels off.

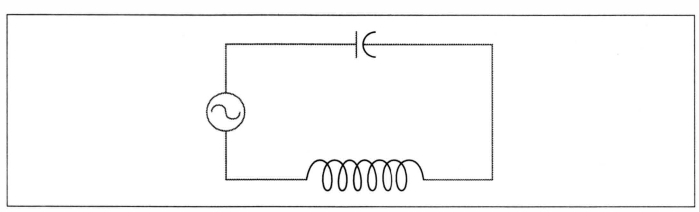


FIGURE 4 Linear tank circuit.

What I needed was a parallel tank circuit with a resonance gain of as much as 8000. (See Fig. 5.) But that would call for controlled frequency because the resistance goes up in a parallel frequency as you approach resonance. (See Fig. 6.) The drive would look something like the schematic in Fig. 7.

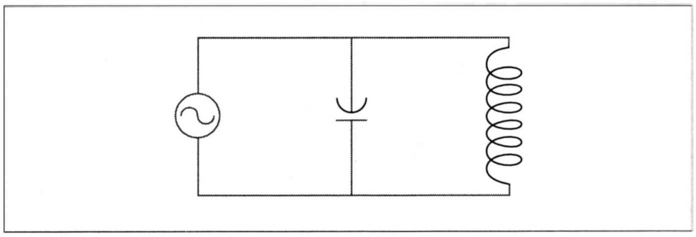


FIGURE 5 A parallel tank circuit.

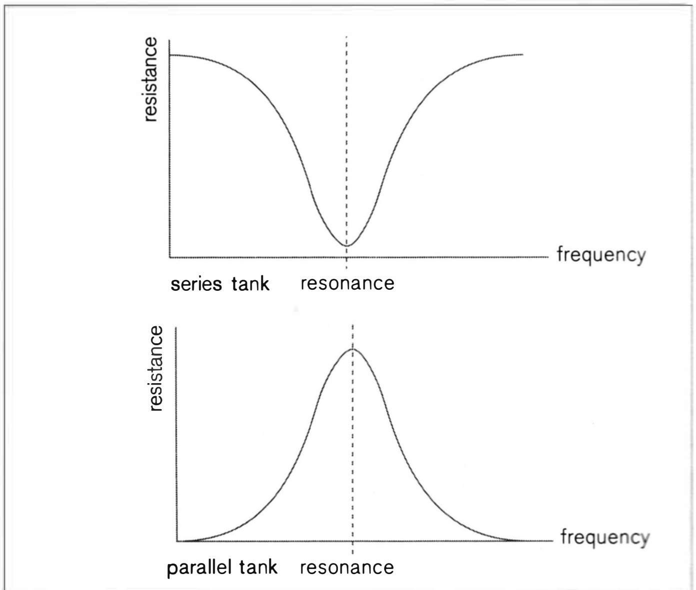


FIGURE 6 Controlled frequency.

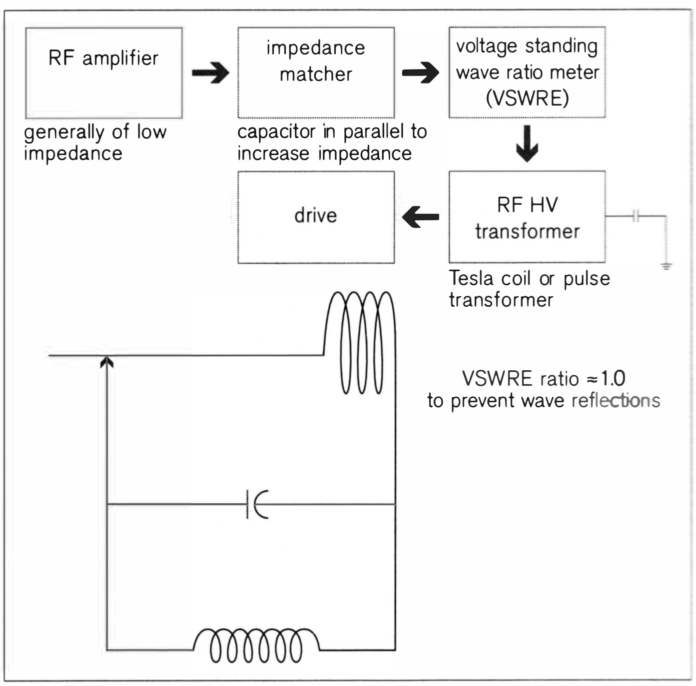


FIGURE 7 Drive schematic.

Parallel tanks need a high-resistance input to keep the charge from leaking off into the transformer, and the RF transformer would radiate the power. That is why I always had to use iron core transformers to block the HV. It will not be easy to get the charge to stay on the drive system. When it starts to work, you will notice a pith ball can be attracted to the coil. Also, a fluorescent tube will light up near the coil to indicate that the drive is working if it's field is too weak to detect with pith balls. Again, the point of contact on the rod is very critical. (See Fig. 8.) There are node points on the rod where thrust reaches a maximum, drops to zero, then reverses.

APRIL 26, 1999

My first model put out about 1 ounce of thrust with 30 watts of power supplied, even though I did about everything wrong.

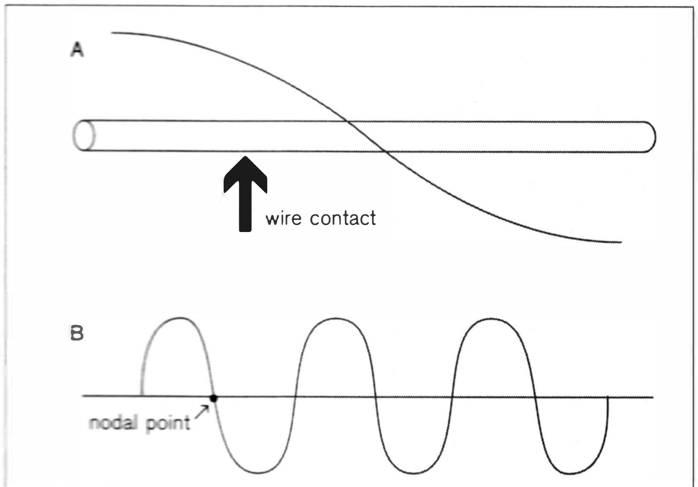


FIGURE 8 The point of contact on the rod is critical. At the node points (A), the thrust reaches a maximum, drops to zero, then reverses (B).

MAY 7, 1999

I doubt very much if anybody could duplicate my model from the brief description given, but I am willing to work with someone that is competent and experienced with the ideas presented. Many times I had tried to combine my drive with a coil, with no results. The coil which eventually worked had certain peculiar characteristics known to radio technology. A radio-frequency coil alone will simply attract material, but when combined with the straight rod, it can be tuned to attract or repel matter. (See Fig. 9.) With the straight rod vertical and the coil on the bottom, what kind of machine does the apparatus resemble? (See Fig. 10.) Actually, the position of the coil makes no difference. Another configuration looks like the *Enterprise* on Star Trek. It is the rod that determines the direction of thrust.

MAY 19, 1999

If a spaceship left earth carrying a light that blinked once each second, and the ship accelerated forever, this is what you would observe on earth: The once-per-second blinks would get further and further apart and finally stop, at the velocity of light. So, you would conclude time stopped. But on board the ship you would notice nothing unusual, until you passed the speed of light. Then, you would observe the earth ahead of you but shrinking rapidly. An observer ahead of you would see the light blinking faster and faster, while an observer at right angles would see nothing unusual.

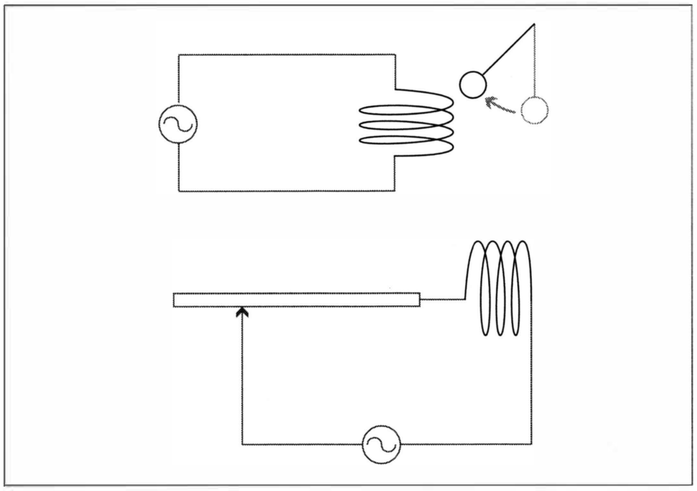


FIGURE 9 A radio-frequency coil alone will simply attract material, but when combined with the straight rod, it can be tuned to attract or repel matter.

Contributions from Morton formerly published in *ESJ*:
ESJ #4, p. 35-38, "Morton's Space Drive"
ESJ #6, p. 2, "Activity Update" (on Schlecht's tests of Morton drive)
ESJ #7, p. 45, "Physical Constants"
ESJ #9, p. 4, "Activity Update" (request for breakthrough Tesla coil info.)
ESJ #13, p. 37, "Experiments with Aluminum"
ESJ #14, p. 4, "Morton's View" (pith ball charge)
ESJ #17, p. 21-23, "Aluminum Dust Experiments"
ESJ #20, p. 6, "Linking Tesla and Brown Devices Proves Difficult"
ESJ #22, p. 25, "E-Field Propulsion Concepts" (Van de Graaff beam)
ESJ #27, p. 5, "Tin Can Fusion"

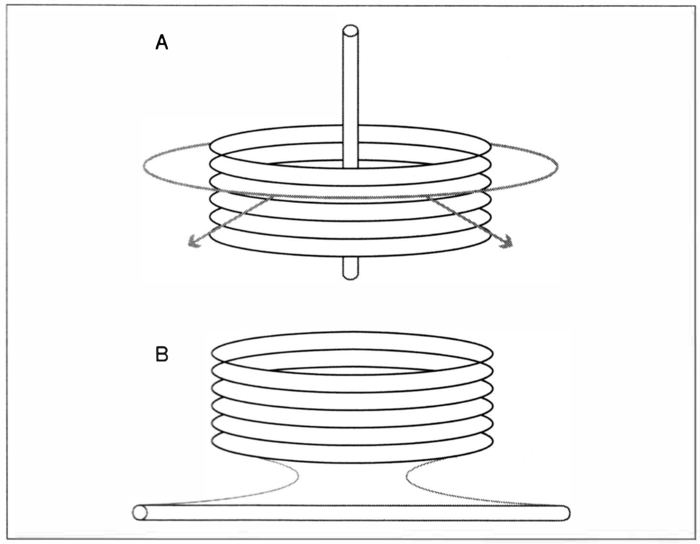
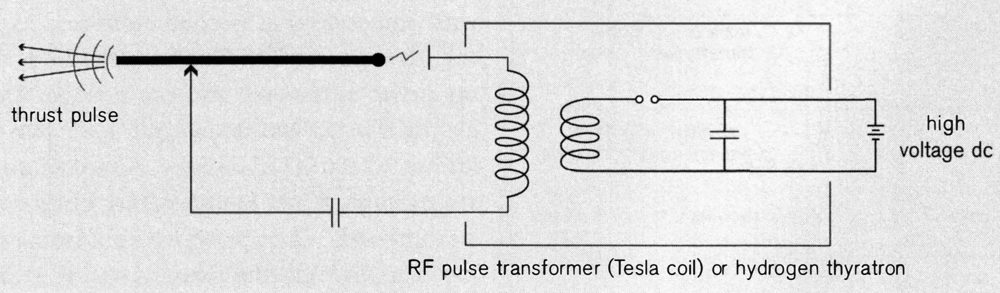


FIGURE 10 With the straight rod vertical and the coil on the bottom (A), what kind of machine does the apparatus resemble? A Tesla coil! Another configuration (B) looks like the *Enterprise* from Star Trek. It is the rod that determines thrust direction.

EDITOR'S NOTE

Given the setup described by Mr. Morton and using spark gaps to generate the high-voltage pulse, at least two things will happen: (1) There will be a transfer of electrostatic charge to the rod, and (2) The rod will act as a high-frequency oscillator of this electrostatic charge, possibly in the near gigahertz range, depending on the size of the rod.

Mr. Morton's circuit appears to be worthy of further investigation. His experiments are similar to some of Tesla's and those reported by Richard Hull and Charles Yost in *ESJ* #22, pp. 24-32, Figs. 7, 8, 18, 19, and 20.



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Morton Experiment : Report #1

In *ESJ* 29 (pp. 6-8), Charles Morton described experiments he conducted in which he was getting thrust from a simple L-C circuit with a spark gap. (See Fig. 1.) Some crude initial experiments were performed in the Electric Spacecraft laboratories to investigate possible causes of the observed thrust and how it might be increased.

THE BASIC EXPERIMENT

Although Morton stated that thrust could be obtained using either a series or a parallel circuit, all experiments at the Electric Spacecraft laboratories utilized a series setup like that shown in Fig. 1. The inductance component was not incorporated in these early experiments. The spark gap was varied between ½" and 1¼" to develop potential differences between the plate and tube of 30 to 80 kV. It was noted that each time the device sparked, a very strong impulsive movement was observed. The impulse force was estimated to be between two and five grams. It appeared to be a Coulombic force because the lead wires impulsed as well as the plate and tube. Nonetheless, the device clearly experienced an impulse of about ⅛" apparently, in the direction of the disk electrode.

A device was constructed at the Electric Spacecraft lab to begin investigations of experiments described by Charles Morton. A sectorless DSI Wimshurst generator was used to develop a high electrostatic potential. The device consisted of a thin, 3" diameter steel disk held about a half inch from the end of a perpendicular, 8" long × 3/16" diameter aluminum tube. The disk and tube assembly were supported by a flexure of two parallel plastic I-beams attached to the tube. To increase the sensitivity of the flexures, hollows were carved out near the top and bottom of each I-beam.

After the initial tests, which used only a single spark gap, it was clear that better electrostatic shielding of the input conductors from the Wimshurst was needed. It was also noted that a series of spark gaps would allow higher voltage to be pulsed to the device. The effects of partitioning the aluminum tube into segments were also considered worth investigating in subsequent experiments.

Three configurations were investigated, and it was becoming increasingly evident that Coulomb forces (electrostatic field forces) were the primary reason for the thrusting action, dominating the ion wind force by at least an order of magnitude, and masking any possibility of discovering other force effects.

Configuration 1: The first series of experiments used only a single spark gap between the disk plate and the tubular rod. (See Fig. 2.) This did not allow sufficiently high voltages to be developed prior to sparking. Rapid sparking, 5 to 10 times per second, occured which did not cause the device to move. Slow or occasional sparks did reveal an impulsive motion. This was interpreted to be an inertial effect.

Configuration 2: In order to increase the voltage, a series of spark gaps was added between the lead wire and the aluminum tube. (See Fig. 3.) The impulsive movement was now much stronger.

Configuration 3: For the third configuration, the single tube was replaced by a series of tube segments which also formed spark gaps. This was accomplished by holding the segments in a snugly-fitting plastic channel which maintained the separations between consecutive tube segments. (See Fig. 4.) This increased the spark potential to about 80,000 V.

The multiple spark gaps increased the impulsive motion considerably, to about ¼", making causal factors easier to decipher. When one's hand was brought near

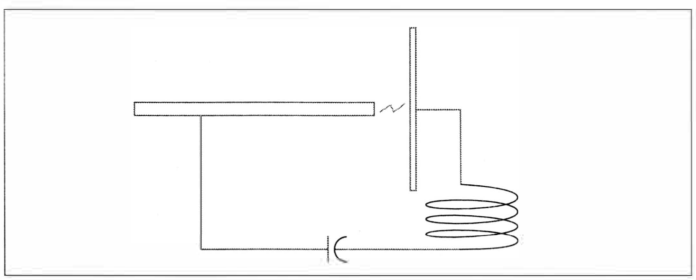


FIGURE 1 Schematic of apparatus proposed by Charles Morton.

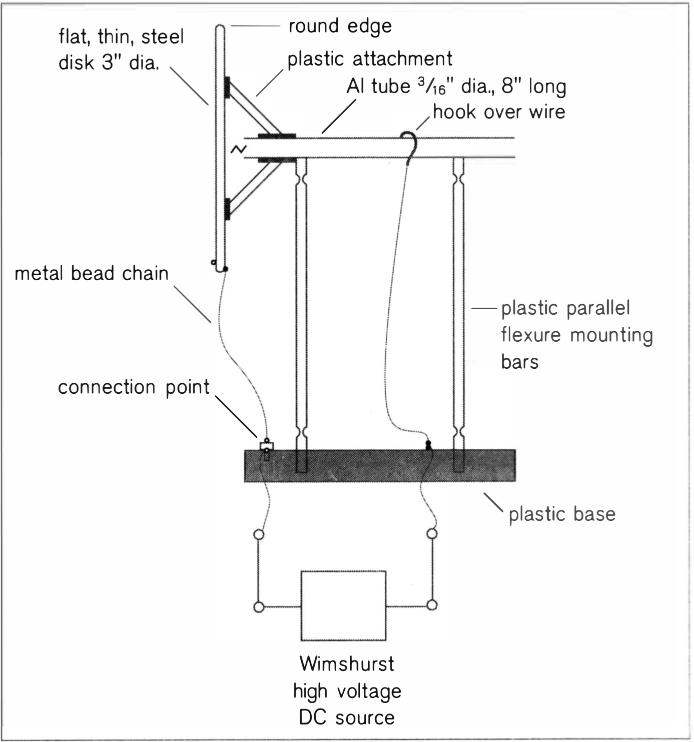


FIGURE 2 Basic apparatus used in the Electric Spacecraft experiments.

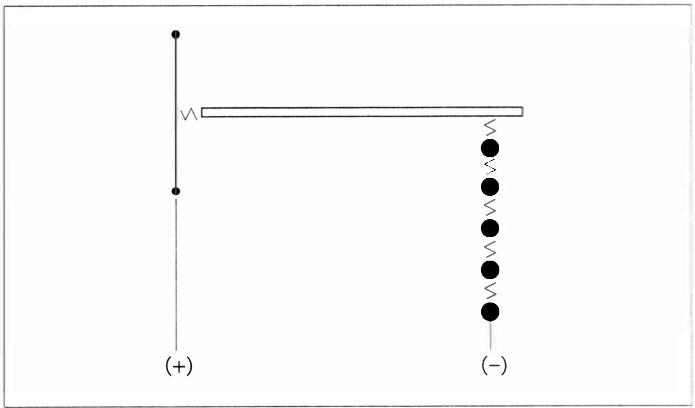


FIGURE 3 First spark gap array.

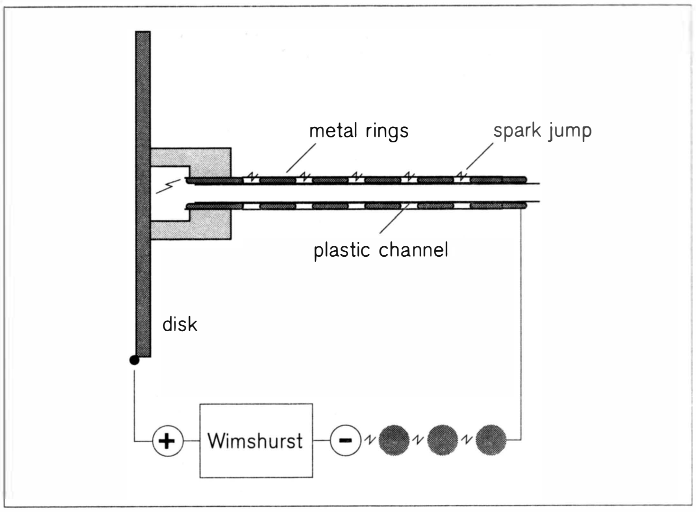


FIGURE 4 Second additional spark gap array.

the disk surface, the apparatus was clearly attracted, displacing by as much as ½" toward the hand, prior to sparking. Upon sparking, the attractive force was released, but the attraction would increase again as the potential on the rod would begin to increase.

With the hand removed from the disk vicinity, the displacement effect was reduced, but the same characteristic displacement in the positive (disk) direction and relaxation to zero force displacement occurred with each spark. Displacement in the positive direction increased as the potential buildup increased. It appears that the device is attracted to objects, or even air, near the disk's surface. Thus, a large surface area can increase the degree of attraction, or even vector its direction. The attraction is no doubt partially attributable to the polarization developed on nearby objects, perhaps air itself, and the lead-in electrode wires.

Placing a Teflon dielectric sheet between the hand and the disk increases the Coulomb attraction significantly. It is believed that the Coulomb force effect would be the same whether the disk was charged positively or negatively. It is thought that perhaps a sudden transfer of negative charge causes the disk to undergo a brief, net transient Coulomb attraction to the air in front of it. (The forward direction is taken to be the direction toward the steel plate.) The charge gradient on the back side of the plate would be more confined because of the nearby negatively charged rod. Motion could then be attributable to the asymmetric charge gradient.

POLARIZATION THEORY

Examining the surrounding air at different states of polarization might partially explain the forward thrust. Figure 5a illustrates the distribution of charge on the drive while it is statically charged, as well as the orientation of polarized air molecules in the surroundings. Figure 5b shows the instantaneous charging condition of the drive when the spark jumps the gap. In both these illustrations, the plate and rod are still connected to the Wimshurst generator.

When the spark transfers charge, it briefly renders the plate and tube electrostatically neutral. However, the surrounding polarized air molecules do not respond to the changed conditions at once. Therefore, for an instant, the now neutral disk might be attracted to the surrounding, polarized air. The plate's outer forward surface has far more free, isotropic surface area, so the majority of the attractive force might be exerted toward the plate.

A tangible ion wind blows off of the tail end of the tubular rod when statically charged. This wind ceases abruptly when sparking occurs. However, the Coulomb

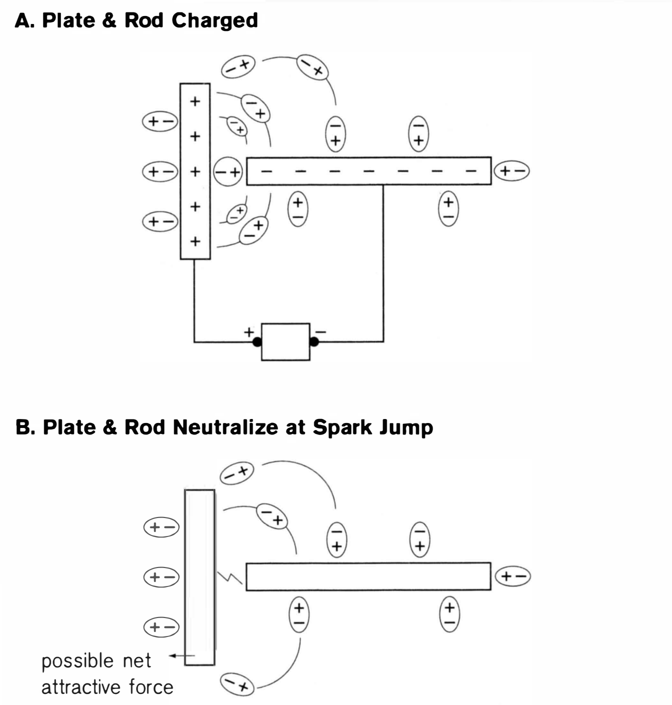


FIGURE 5 Charge distributions around apparatus (a) before sparking (b) during sparking.

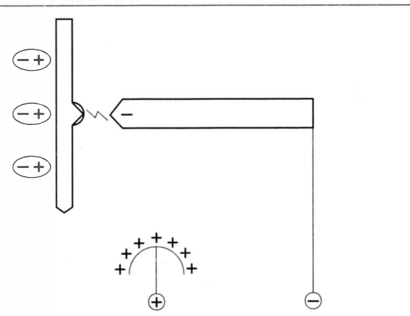


FIGURE 6 Setup with only one electrode charging the apparatus.

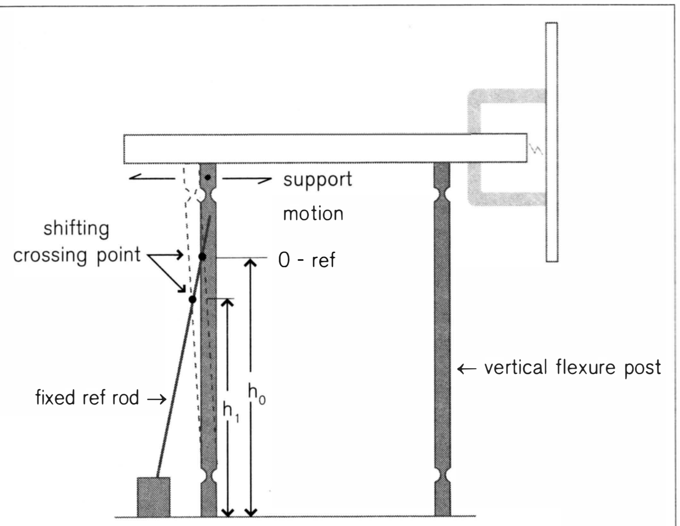


FIGURE 7 Reference rod used to detect right-left motion of apparatus.

attraction of the large-area disk is much stronger than the ion wind force.

In another experiment, only the rod was connected to the Wimshurst generator. The disk was left unconnected to the (+) pole of the Wimshurst. (See Fig. 6.) In this scenario, one might expect a sudden spark to jump from the tube to the plate. In actuality, however, 3" sparks arced at the generator electrodes, and although the device exhibited some pulsing motions, no significant displacements seemed to be occurring. Probably, the tube was leaking charge to the disk via corona such that these elements had very little potential difference.

SPRING LOADING AND RECOIL

The thruster device appears to jump forward with sparking. Actually, it moves slowly in the backward direction prior to sparking. Upon sparking, it simply returns toward the neutral position.

To investigate this more carefully, a fixed reference rod was attached to the base of the experimental apparatus so as to form a shallow angle with one of the support beams. (See Fig. 7.) With a fixed line of sight, the changes in the height at which the support appeared to cross the reference rod were observed under a magnifying glass to establish whether the drive was moving forward or backward.

Careful observations revealed that there was a gradual, downward motion of the apparent crossing point prior to each spark. This shows that the rod-disk assembly was slowly drawn in the backward direction prior to each spark jump. When the spark jumped, the apparent crossing point of the fixed reference rod and the vertical flexure post would move upward, indicating that the assembly had lurched forward. This created the illusion of a sudden, forward thrust with each spark. In other words, the illusion of a sudden forward thrust upon sparking was at least in part only the released spring force of the flexure.

The gradual backward force was attributable to Coulomb forces exerted upon the device by the **E**-fields of the lead-in conductors, which were predominantly on the back side of the assembly. The possibility that a minuscule thrusting force existed, therefore, could not be ruled out until the experimental apparatus could be isolated from these fields.

ISOLATION OF CONDUCTORS

In the next set of experiments, the negative electrode was extended five feet away from the generator, and the front plate was not connected (free-floating). With this setup, 4" sparks arced between the electrodes of the generator, and

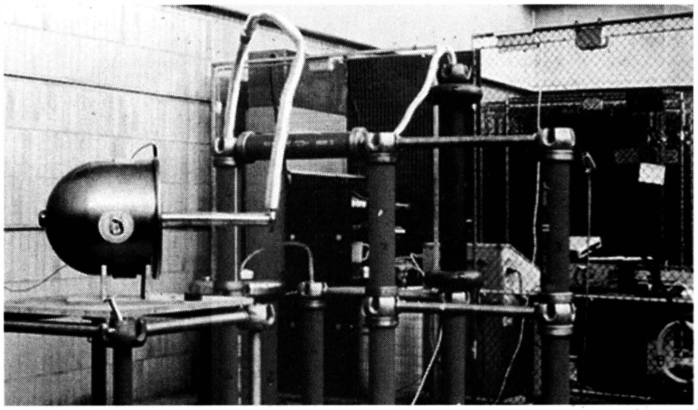
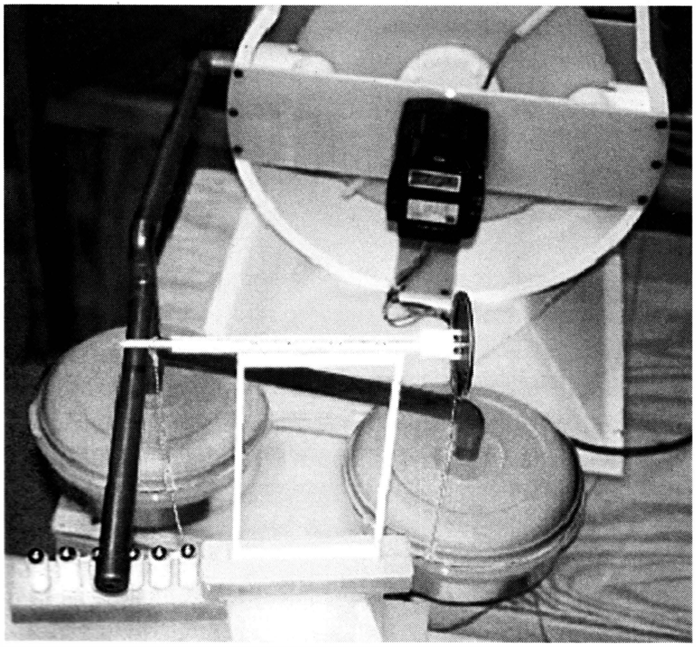


FIGURE 8 Curved electrode used in Klaus Schlecht's pulse device.

the assembly was observed to move slightly upon sparking. After insulating the 5' extension electrode and shielding it with a grounded envelope, making essentially a coaxial cable, very little movement of the assembly was detectable when the generator was sparking.



UNEXPLORED TERRITORY

The experiments presented here only represent preliminary investigations. Some design modifications came to mind while experimenting, but were not investigated. For instance, it was supposed that by increasing the disk size at the end of the aluminum tube, capacitance and other area-dependent effects might be amplified. It was also supposed that replacing the flat disk with a curved one would increase the observed deflections, since it would allow more charge to be transferred to the outer surface. (See Fig. 8.)

If this technology is going to be applied for propulsion, the design will probably utilize pulsed Coulomb forces, since these seem to be the predominant effective forces. Experiments at Electric Spacecraft for producing high voltages on a scaled, self-contained craft are being considered, as well as techniques for producing interactive, pulsing fields.

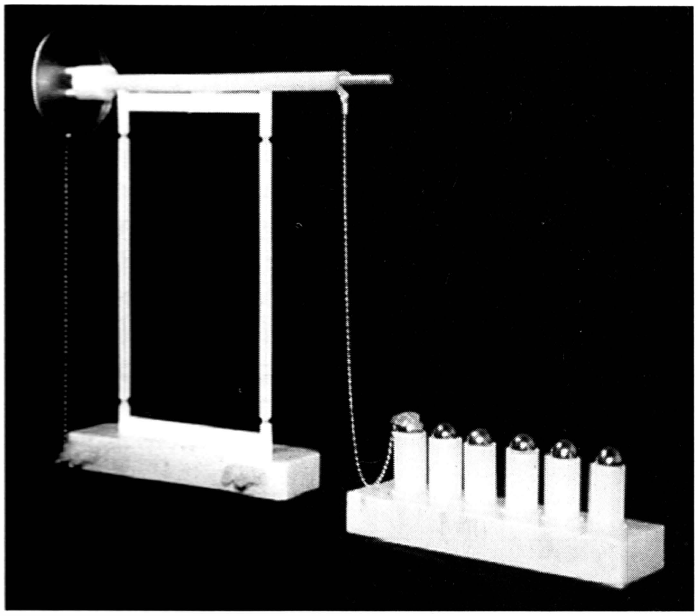


FIGURE 9 Electric Spacecraft experiment setup.

September 2, 1969, patent #3,464,207 Ernest C. Okress patented a quasi-corona aerodynamic vehicle, which would be propelled by means of electrical pulses of high amplitude and short duration. These properties, respectively, allow the ionization of molecules in an ambient dielectric gas without inducing electrical breakdown. The vehicle itself would utilize multiple asymmetric electrode pairs to generate a propulsive electric pressure differential.

The overall outputs of previously-researched DC and continuous-wave corona discharge techniques were limited by the applied DC voltage and atmospheric electrical breakdown. Means of generating electric wind were also inefficient. Because a periodically-pulsed ionizing field can sustain a high-potential system without electrical breakdown, quasi-corona techniques could intensify electric fields tenfold, while increasing aerodynamic pressures by a factor of twenty-five.

Operated with technology then available; 10 kHz, 2 ns, 100 kV pulses; the quasi-corona vehicle could have achieved aerostatic pressures of 30 lb/ft^2 (144 mm H_2O), which was well under the theoretical and practical limits of the technology. At the time Okress applied for the patent, a generator capable of generating 1-10 kHz, 1 ns pulses with amplitudes of 150 kV or more was under development.

1991. Bits and pieces. *Electric Spacecraft Journal* 1: 41.

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Morton Experiment : Report #2

Charles Morton has contributed additional thoughts and details about his thruster experiments. These are essentially printed verbatim in this summary of new material. Some statements are unclear in meaning and consistency of dimensional units. We have left it to the reader to pursue these discrepancies.

SEPTEMBER 23, 1999

I received a note from Jim McVey. I have never used toroids or ferrites on my modules but the principle is to get a capacitance between the hoop and the rod. Thrust depends on the size of charge stored in capacitance (pulsing doesn't help). But to show just how important capacitance is, when I walked up to my module while it was running, thrust jumped up to two or three pounds, but I discounted this as a false reading.

Thrust is based on charge size and frequency. I gave you the formula years ago. A one-coulomb charge at 1000 Hz would produce 100 million tons of thrust. The force produced by charges also depends on distance, which is not mentioned.

As for efficiency, the only model I tried to measure came out with about 1% efficiency, but this was the energy consumed by a tube-driven amplifier at about 30 watts. Actually, antenna-like devices operate above 90% efficiency.

As for negative mass, I did have the mechanism set up to produce pure negative mass, but I never got around to it. The device sounded like a 50 calibre machine gun and would disturb the neighbors, and I need mercury for the experiment.

FEBRUARY 28, 2000

In reference to your experiments on my drive: Thrust will rise, fall, and reverse depending on the position of the input wire. Again, the amount of dielectric material between the plate and rod determines thrust strength. Putting a ball on the end to suppress corona increases thrust. Of course, electrostatic forces cause the effect:

$$\text{Force} = \mathbf{E}q \pm \frac{d(\mathbf{E}q)}{dt},$$

but

$$\frac{d(\mathbf{E}q)}{dt}$$

is not exactly a coulombic force. It is an exchange of virtual photons (Newton's first law of motion). [Ed. note: The force ($\mathbf{E}q$) and the rate of change of force $d(\mathbf{E}q)/dt$ are not dimensionally additive as shown without further elaboration, although the terms are physically related and could combine their effects in a single force term.]

Wimshurst generators will not put out enough currents to run my drive because they require large capacitors as shown in Fig. 1. It is the size of charge q that determines thrust. I have built drives that didn't use a spark at all. In fact, the apparatus still undergoes thrust when the spark gap is as shown in Fig. 2. The advanced model I had in mind was one that would run off a Tesla coil or a RF coil without any spark. My experiments began in 1966.

Although the air may appear to move, it will go right through a tin can, with no obstruction at all, but glass slows the effect. In the absence of any kind of matter, it still requires energy to polarize space.

FEBRUARY 28, 2000

I can see that you're falling into the same pattern that stumped Brown and the government. Everybody has assumed that this kind of drive either moves the air or ions, and ion drives are impractical. At the level you're going at it, the physical evidence points in that direction. But as the drives get more complicated, it becomes obvious that neither ions nor air currents are feasible.

MARCH 2, 2000

1. Ion winds will not pass through a sheet of paper, and they react strongly to magnetic fields.
2. Longitudinal EM waves pass through solid matter and don't react to magnetic fields.
3. Spark oscillators are very inefficient, and any space drive based on them is not likely to get beyond the model stage. The shape of an oscillator will determine the standing wave pattern. (See Figs. 3 and 4.)

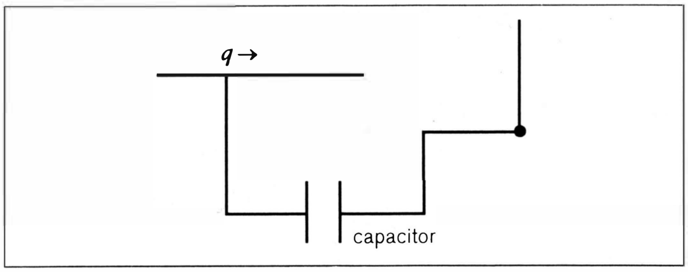

FIGURE 1

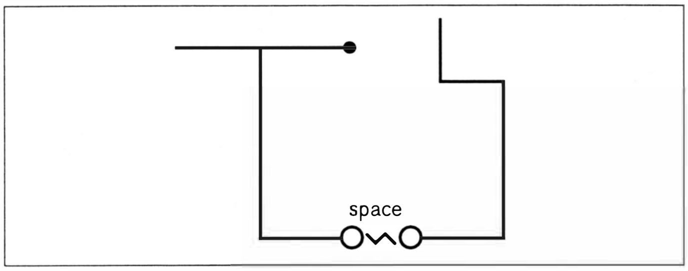

FIGURE 2

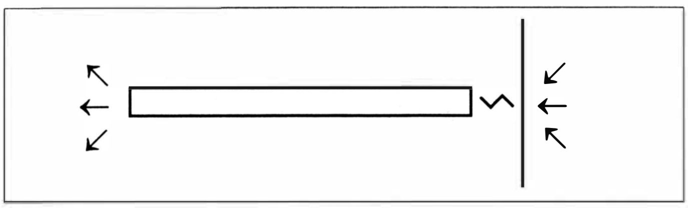

FIGURE 3

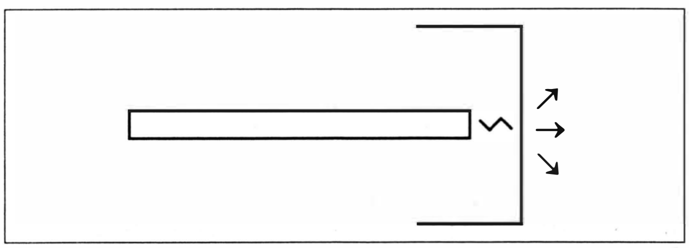

FIGURE 4

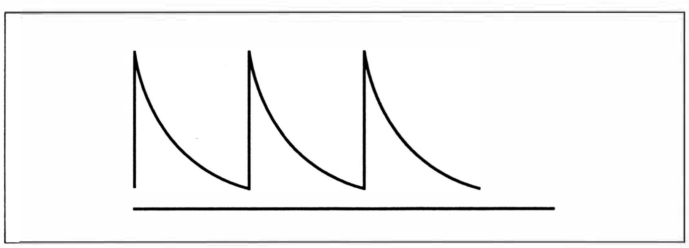

FIGURE 5

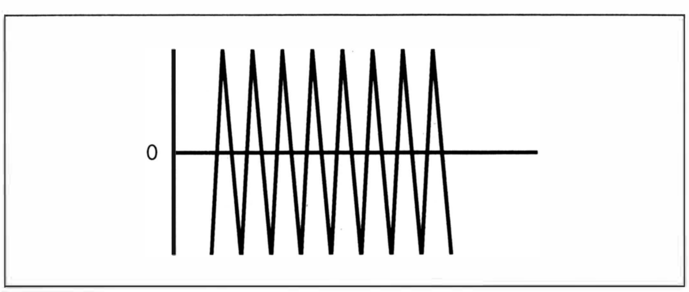

FIGURE 6

MARCH 17, 2000

You are so near the answer, yet you can't see it. Brown's device and mine are self-rectifying, with output as shown in Fig. 5. A typical output from a Tesla coil is shown in Fig. 6. The output from a spark coil is shown in Fig. 7. The spark coil will produce some thrust, but both the Tesla coil and the spark coil carry low currents.

If the output from a Tesla coil was fed into a half-wave antenna, it would produce thrust, but there is a problem in using spark oscillators. Spark oscillators produce a dozen frequencies. Which frequency should be used? A half-wave antenna has a semipermanent positive and negative pole. The voltage never reverses, although the current does reverse.

Now a radio frequency coil can obtain high voltages, but it has very low current levels. However, an antenna can carry a high current which builds up in time. Some of my models took five minutes to reach peak force.

A charge of 10-5 coulombs would produce enough force to move a spacecraft, but with DC, it would only produce a 30-kw spark. One UFO reported produced 5-MHz noise on the radio. At 5 MHz, a 10-5 coulomb charge wouldn't even penetrate your skin or jump a half-inch gap. That is how large charges are prevented from leaking off as corona discharge.

In this context, dE is defined as

$$E = \frac{q}{4\pi\varepsilon_0 r^2},$$

where q is the charge on the antenna and not the line voltage

$$q = E_L C.$$

One unanswered question is how much field the antenna adsorbs since q is used as a free charge. Too much capacitance adsorbs the field, and tight coils adsorb the field. It is the free charge that interacts with space and causes thrust.

A Tesla coil just can't carry a large charge on a small wire, so a low-resistance antenna is needed to carry a big charge. After that comes the problem of impedance matching.

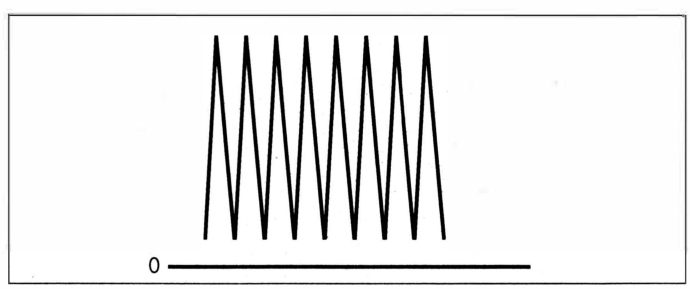

FIGURE 7