



Dr. Michael A. Minovitch, Inventor
Catalog of Published Patents

October 2024

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Gravity Thrust Engine

A trajectory design concept developed for in fields of the four Galilean is developed to show how revolutions between encounters

OCTOBER 2024

Dr. Michael Andrew Minovitch

CATALOG OF PUBLISHED PATENTS

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PUBLISHED PATENTS

Linear converging/diverging fusion reactor and operating method for achieving clean fusion reactions.
Patent number: US 2017/0062078..... 12-13

Closed-cycle cryogenic engine and operating method for propelling vehicles and generating electricity.
Patent number: US 2015/0369221 14-15

Closed-cycle cryogenic engine and operating method for propelling vehicles and generating electricity.
Patent number: US 9/334,854 16

Low temperature high efficiency condensing heat engine for propelling road vehicles.
Patent number: Patent number: US 2011/0277476 .. 17

Magnetic condensing system for cryogenic engines.
Patent number: US 6/739137..... 18-19

Magnetic condensing system for cryogenic engines.
Patent number: EP 1367340 A3 20

Magnetic condensing system for cryogenic engines.
Patent number: WO/2003/100330A1 21

Magnetic condensing system for cryogenic engines.
Patent number: EP 1367340 A2..... 22

Magnetic condensing system for cryogenic engines.
Patent number: US 2003/0218852 23

Magnetic propulsion system and operating method.
Patent number: US 6/193,194 24

Flash bulb cartridge for light guns.
Patent number: US 5/641,284 25

Light gun.
Patent number: US 5/641,222..... 26

Golf ball locating system and operating method.
Patent number: US 5/447,314..... 27

Condensing system and operating method.
Patent number: EP 0598723 A4..... 28

Condensing system and operating method.
Patent number: US 4/624,109 A 29

Light gun.
Patent number: WO/1993/025862A1 30

Automatic method and operating system for space construction. Patent number: US 5/271,583.....	31		
Light gun. Patent number: US 5/243,894	32		
Condensing system and operating method. Patent number: WO/1993/004325A1.....	33		
Ammunition reloading system and operating method. Patent number: US 5/103,712	34		
Electromagnetic ground to orbit propulsion method and operating system for high mass payloads. Patent number: US 5/093,313	35		
Electromagnetic ramjet. Patent number: US 5/052,638	36		
Condensing system and operating method. Patent number: US 5/040,373	37		
Electromagnetic ground to orbit propulsion method and operating system for high mass payload. Patent number: US 4/939,976	38		
Electromagnetic transportation system for manned space travel. Patent number: US 4/795,113	39		
Electromagnetic launching system for long-range guided munitions. Patent number: US 4/791,850	40		
Self-refueling space propulsion system and operating method. Patent number: US 4/754,601	41		
Condensing atmospheric engine and method. Patent number: EP 0267992A1.....	42		
Inflatable core orbital construction method and space station. Patent number: US 4/730,797	44		
Condensing atmospheric engine and method. Patent number: US 4/624,109	45		
Tubular conveyor system and operating method. Patent number: US 4/601,389.....	46-47		
		Tubular conveyor system and its operating method. Patent number: DE 3307361A1	48
		Automated road transportation system. Patent number: US 4/361,202	48-49
		Rapid transit system. Patent number: US 4/075,948	50
		Rapid transit system. Patent number: US 3/954,064	51
		High speed rapid transit system. Patent number: US 4/148,260.....	52-53
		Orbiting solar power station. Patent number: US 4/078,747	54
		Microwave powered reusable orbiting space tug. Patent number: US 3/891,160	55
		Laser Rocket. Patent number: US 3/825,211 A	56

Dr. Michael A. Minovitch, Inventor

About Dr. Michael A. Minovitch

Dr. Michael A. Minovitch spent his entire life developing and patenting undiscovered, breakthrough processes in the world of mathematics and science. Beginning with the first ever numerical solution to the famous Three Body Problem for motion through the solar system and then in 1961, as an intern, with his discovery of Gravity Assist - on his own time and not as an assignment from JPL - the process that has allowed all space programs worldwide to explore the solar system beyond our atmosphere, to his nomination for a Nobel prize for Physics, and his continued recognition for his scientific achievements, places him within an elite group of revolutionary scientists. His altruistic work has always been aimed and geared toward the betterment of mankind and the world that we live in.

Originally from Yonkers, New York, Minovitch came to California as a young child in 1945.

He earned his BA Degree in Mathematics with a minor in physics from UCLA in 1958. He then went on to graduate school at UCLA where he began studying for Ph.D. degrees in both mathematics and physics. He transferred to UC Berkeley in 1964 where he received his Ph.D. degree in Mathematics in 1970. His Ph.D. Dissertation was his solution to the problem of numerically computing his gravity propelled interplanetary trajectories in the real solar system where the vehicle moves under the gravitational fields of the Sun and all the planets acting simultaneously and continuously.

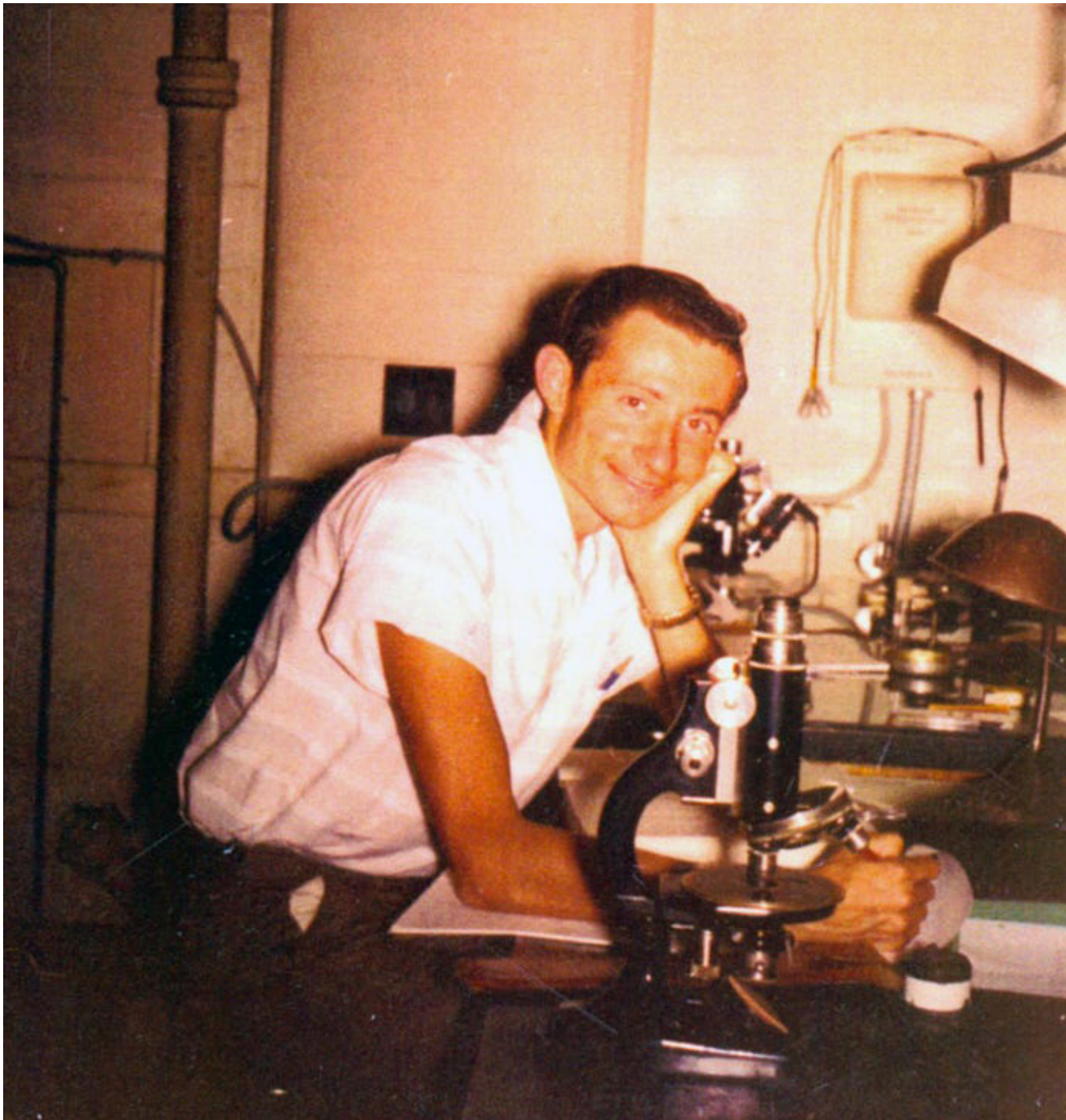
Dr. Minovitch began working at the Jet Propulsion Laboratory (JPL) during the summer of 1961 where he invented gravity propelled interplanetary space travel. He numerically investigated the invention at UCLA beginning January 1962 on their IBM 7090 computer where, on April 2, 1962, he was given the unusual privilege unlimited computer time that lasted through the end of September of 1964. He also received special permission to use both of JPL's IBM 7090 computers with unlimited computer time beginning June 1962 that also lasted through the end of September 1964.

It became one of the largest non-military numerical research projects at that time using three IBM 7090 and 7094 computers (the world's fastest and most powerful at that time). The details are described on the website www.gravityassist.com, and in the recent May 2010 Planetary Space Science paper.

Dr. Minovitch is widely recognized as one of the most important mathematicians of the 20th century. He has obtained more than fifty patents for his inventions and discoveries.

“The Voyager project emerged from the minds of planetary scientists in the 1960s. Michael Minovitch, and other scientists and engineers at the NASA Jet Propulsion Laboratory had discovered that once every 176 years, the giant planets on the outer reaches of the solar system all gather on one side of the Sun and such a configuration was due to occur in the late 1970s. It would be a tragedy, planetary scientists argued, not to take advantage of this opportunity. To do so, of course, would require a drawn-out planning, development, and construction process followed by a lengthy operational period. The Voyagers have so far spent forty-three plus years on their journey to the edge of the solar system and beyond.”¹
Voyager 1 is now in interstellar space, where it is expected to be joined by Voyager 2 within the next few years.

¹ Neufeld, Michael J. (2014). Milestones of Space: Eleven Iconic Objects from the Smithsonian National Air and Space Museum, Page 125. Zenith Press.



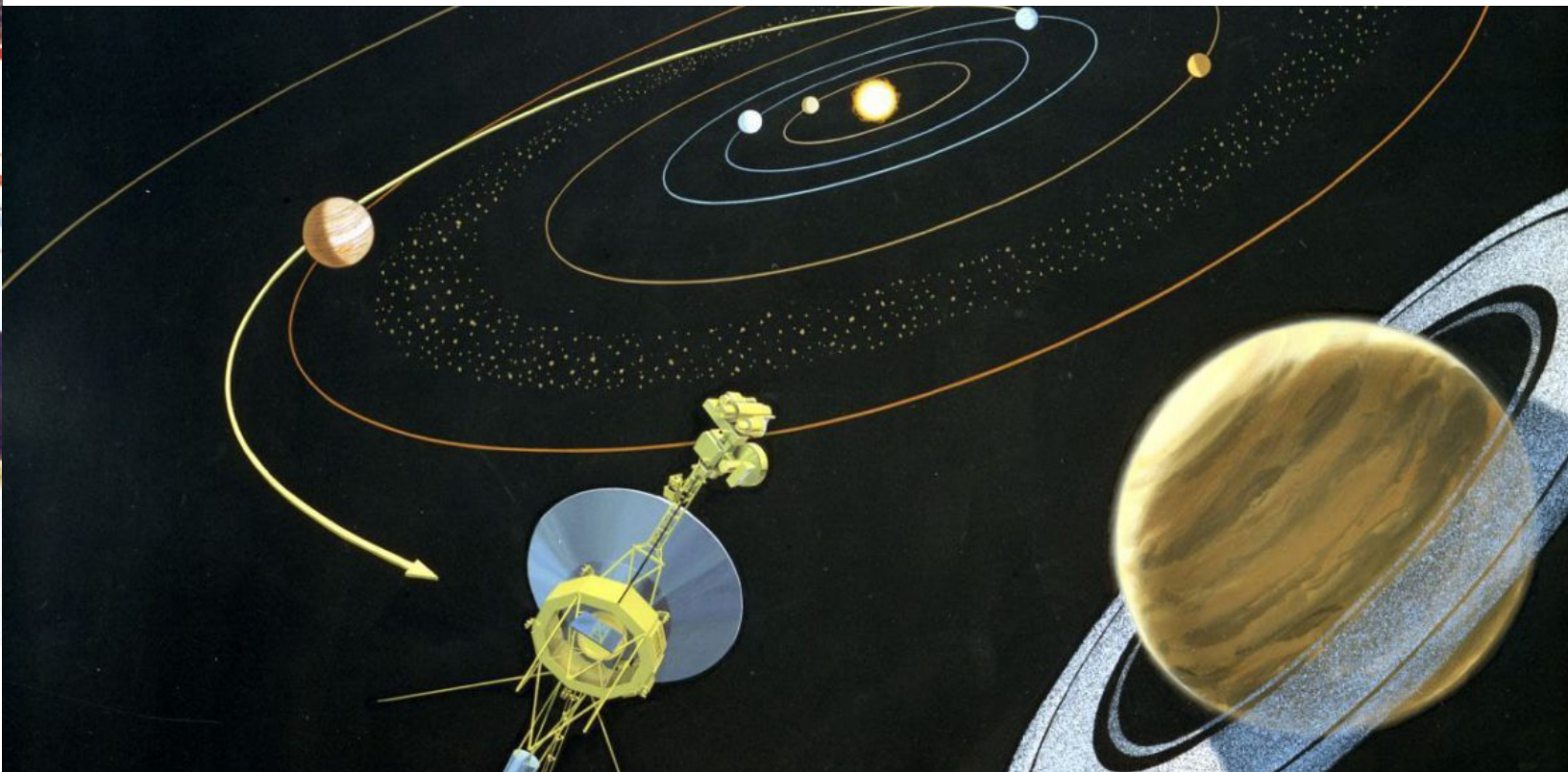
“NASA’s Voyager spacecraft have enthralled everyone with their exploits at the edge of the Solar System and with Voyager 1 now travelling in interstellar space, but their launch in 1977 was only possible because of some clever maths and the persistence of a PhD student who worked out how to slingshot probes into deep space.”

Dr. Michael A. Minovitch, Inventor



“The gravity assist technique was championed by Michael Minovitch in the early 1960s, while he was a UCLA graduate student working during the summers at JPL as an intern. Prior to the adoption of the gravity assist technique, it was believed that travel to the outer solar system would only be possible by developing extremely powerful launch vehicles using nuclear reactors to create tremendous thrust, and basically flying larger and larger Hohmann transfers.

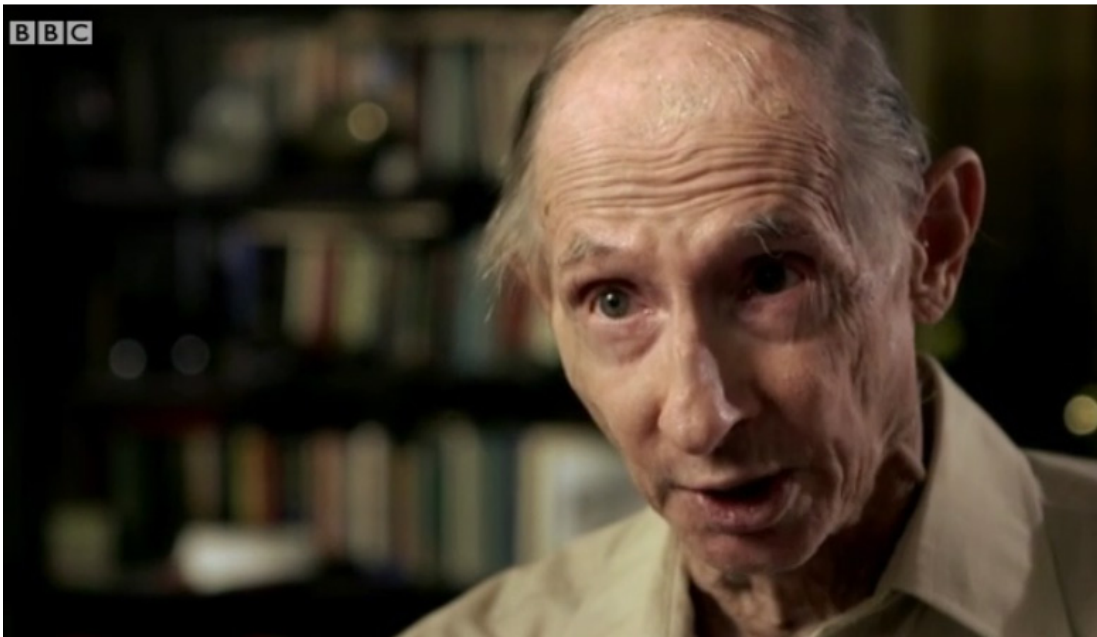
An interesting fact to consider is that even though a spacecraft may double its speed as the result of a gravity assist, it feels no acceleration at all. If you were aboard Voyager 2 when it more than doubled its speed with gravity assists in the outer solar system, you would feel only a continuous sense of falling. No acceleration. This is due to the balanced tradeoff of angular momentum brokered by the planet’s -- and the spacecraft’s -- gravitation.”¹



Gravity assist concept. Gravity assist is a space exploration technique that uses the gravitational force of celestial bodies to alter the velocity and trajectory of a spacecraft

¹ Chapter 4: Trajectories - NASA Science, <https://science.nasa.gov/learn/basics-of-space-flight/chapter4-1>.

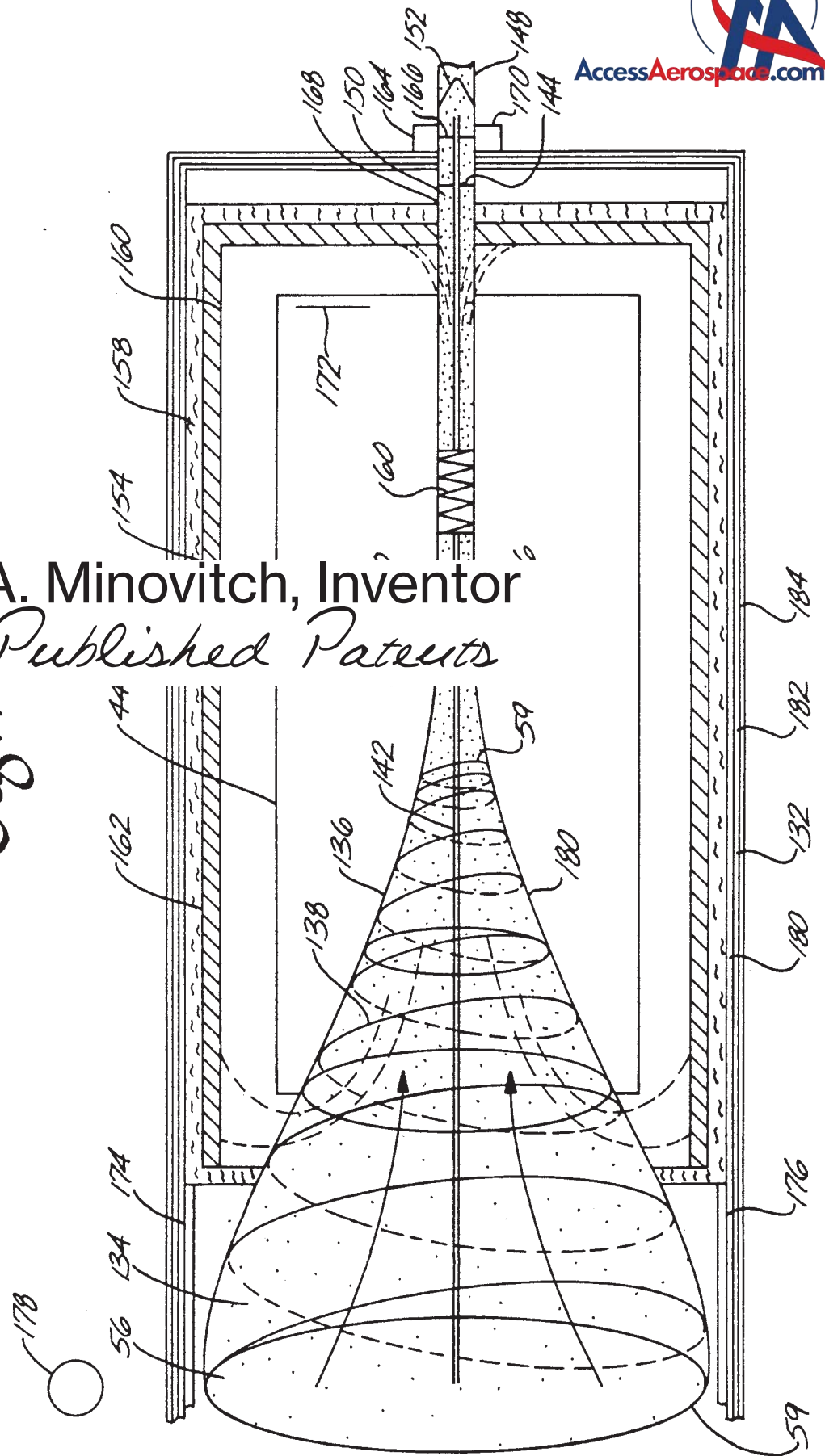
Dr. Michael A. Minovitch, Inventor

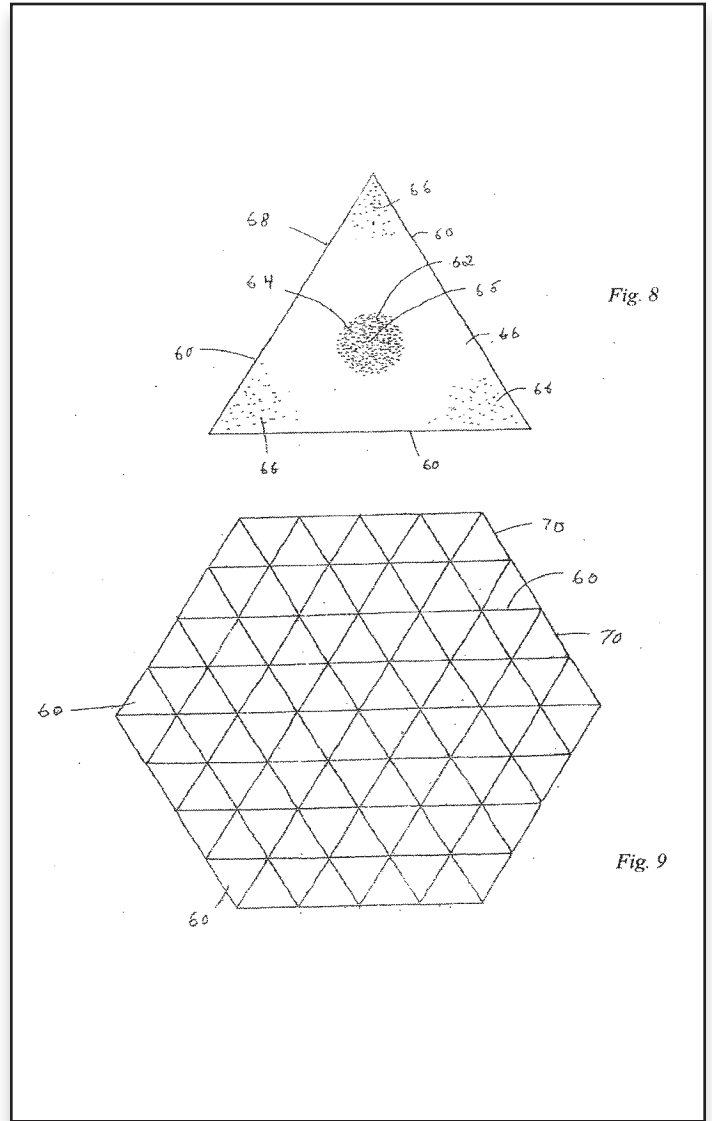
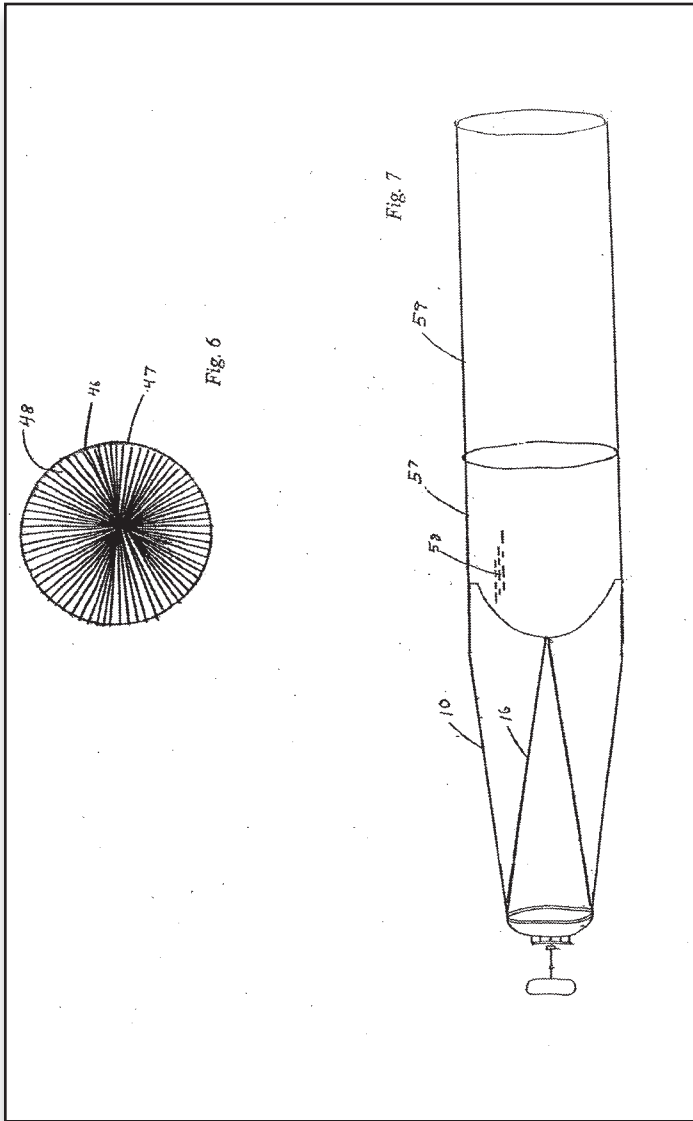


In 1991, Dr. Minovitch was officially nominated for the Nobel Prize in Physics for his invention of gravity propelled interplanetary space travel, and for numerically solving the famous unsolved Restricted Three Body Problem of celestial mechanics that made the invention possible.

Dr. Michael A. Minovitch, Inventor
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Fig. 7





US 2017/062,078 A1. FIG. 1, right, is a schematic longitudinal cross-section of the linear converging/diverging design of the fusion reactor showing its converging internal plasma flow duct and its diverging external magnetic confinement solenoid showing its increasing wall thickness for achieving an ultra high plasma density at the ignition point required for achieving a clean, neutron-free, fusion reaction; FIG. 6, above left, is a schematic transverse cross-section of the fusion reactor showing a belt of 72 pulsed laser generators that generate a pulse of 72 phase-coherent 50 KW laser beams that simultaneously impact and heat the magnetically compressed plasma at the ignition point at the same instant that triggers the fusion reaction and FIG. 7 is a schematic longitudinal cross-section of the converging/diverging fusion reactor, its magnetic deflecting nozzle mounted at the end of the reactor that focuses the charged fusion reaction particles into a directed beam moving at ultra high velocity through an evacuated cylinder that is fed into a high-efficiency superconducting MHD electric generator thereby converting nearly all of the fusion energy generated by the fusion reactor directly into clean electrical energy without generating any pollution or radioactive waste products. FIG. 8, above right, is an enlarged schematic transverse cross section of a single superconducting coil element of the reinforced superconducting cable used in the construction of the fusion reactor solenoid illustrating its interlocking triangular design and construction and FIG. 9 is a schematic transverse cross section of one superconducting cable composed of many individual interlocking triangular coil elements illustrating its external hexagonal cross-sectional shape.

Linear converging / diverging fusion reactor and operating method for achieving clean fusion reactions

Patent number: US 2017/062,078 A1

Abstract

A fusion reactor is provided for achieving ultra-high plasma densities required for achieving clean, neutron-free, fusion reactions. This is achieved by designating the reactor with a linear geometry containing an internal plasma flow duct that converges to a point along its central longitudinal axis surrounded by a diverging containment solenoid with increasing wall thickness that generates an increasing axial magnetic field. This field compresses the plasma to ultra high densities as it is magnetically pulled toward the fusion ignition point by the solenoid's magnetic field gradient. Ignition is achieved by a plurality of high power phased-coherent laser beams converging to the ignition point. A secondary solenoid is mounted around the ignition point that magnetically deflects and focuses the ionized reaction products into a directed beam of high energy charged particles which is fed into an MHD generator thereby converting the fusion power of the reactor directly into electric power.

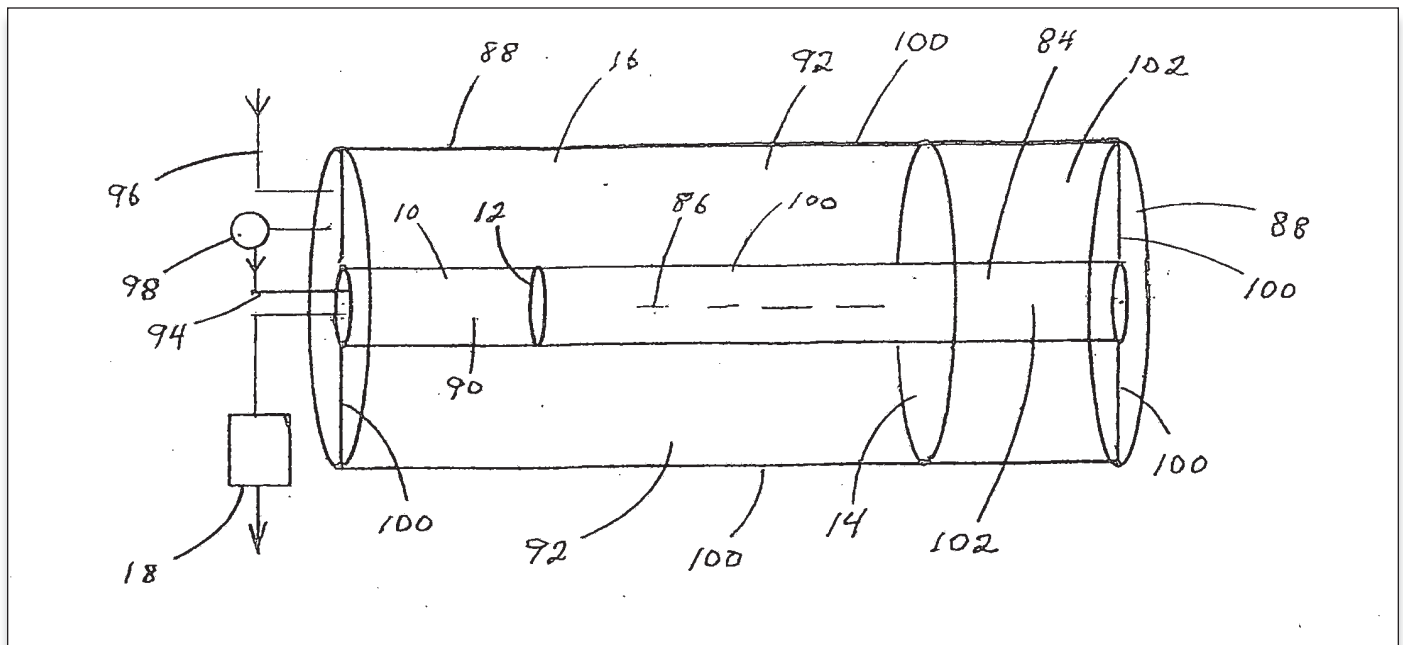
Inventor: Minovitch, Michael A.

Application US 14/756,291 events:

2015-08-24: Application filed by Individual

2015-08-24: Priority to US14/756,291

2017-03-02: Publication of US20170062078A1



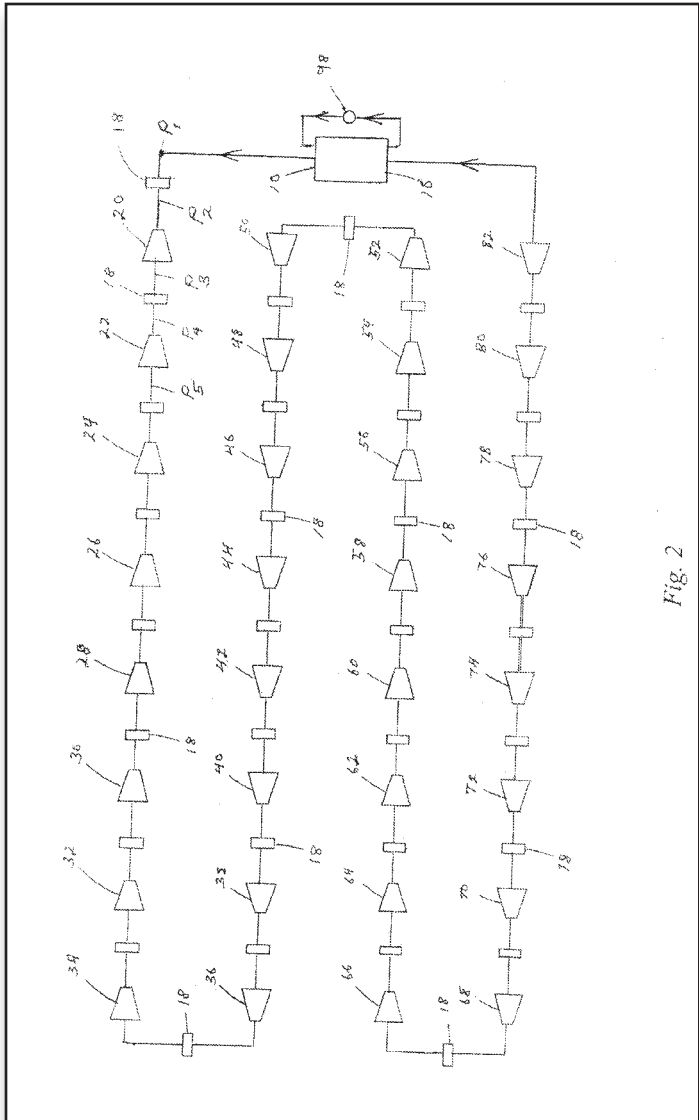


Fig. 2

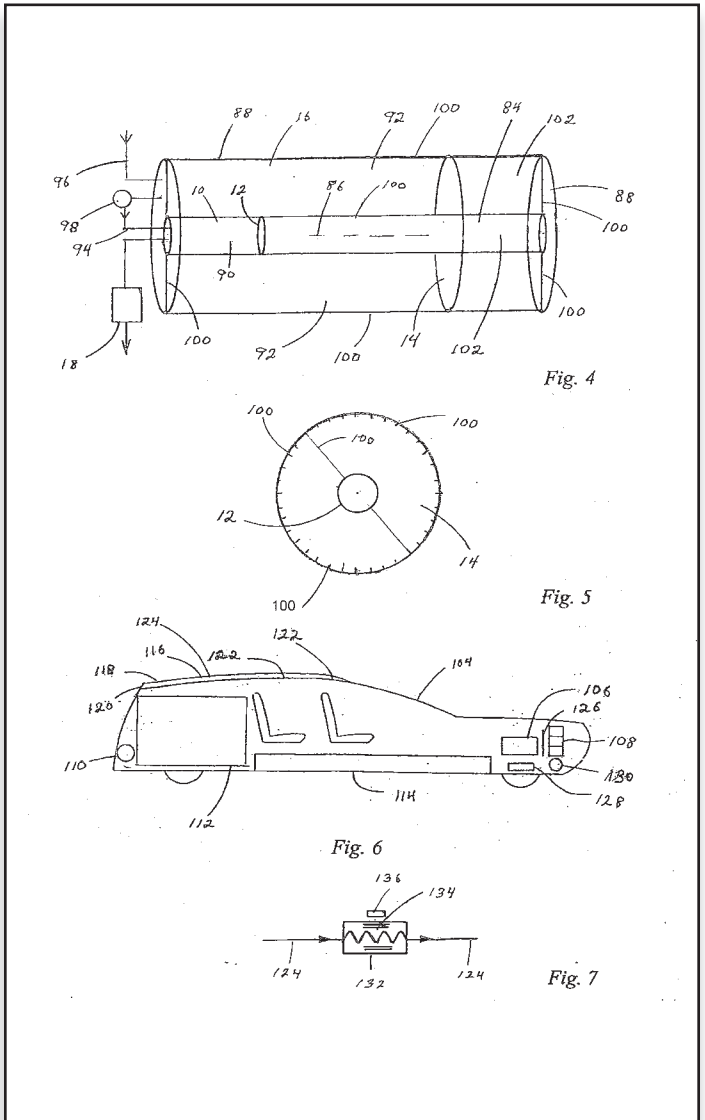


FIG. 2, above, is a schematic block diagram of the preferred embodiment of the closed cycle cryogenic engine illustrating its basic design and operating principles. Representative FIG. 4, right and above, is a longitudinal cross section through the high and low pressure, variable volume, compressed gas storage cylinders illustrating their design and operating principles; FIG. 5 is a transverse cross section through the variable-volume gas storage cylinders further illustrating their design and construction; FIG. 6 is a schematic longitudinal cross section of an automobile propelled by the closed cycle cryogenic engine illustrating the positions of the various engine components mounted inside the vehicle; and FIG. 7 is a schematic transverse cross section of a thermally insulated secondary heating system for heating the working fluid during rainy or very cold days.

Closed-cycle cryogenic engine and operating method for propelling vehicles and generating electricity

Publication number: US 2015/0369221 A1

Abstract

A closed-cycle cryogenic engine is provided for propelling vehicles or generating electricity at high power densities without consuming any working fluid. The engine comprises a working fluid having a high specific heat that remains in a gaseous phase. The high temperature heat reservoir is the natural environment and the low temperature heat reservoir is created artificially by evaporating water. By isothermally compressing the working fluid at low temperature by absorbing the heat of compression by evaporating water, it is possible to extract a large amount of natural heat energy from the environment and convert a large fraction of it into net output work. Since the latent heat of evaporating water is very high, very little water is consumed which represents the engine's only fuel.

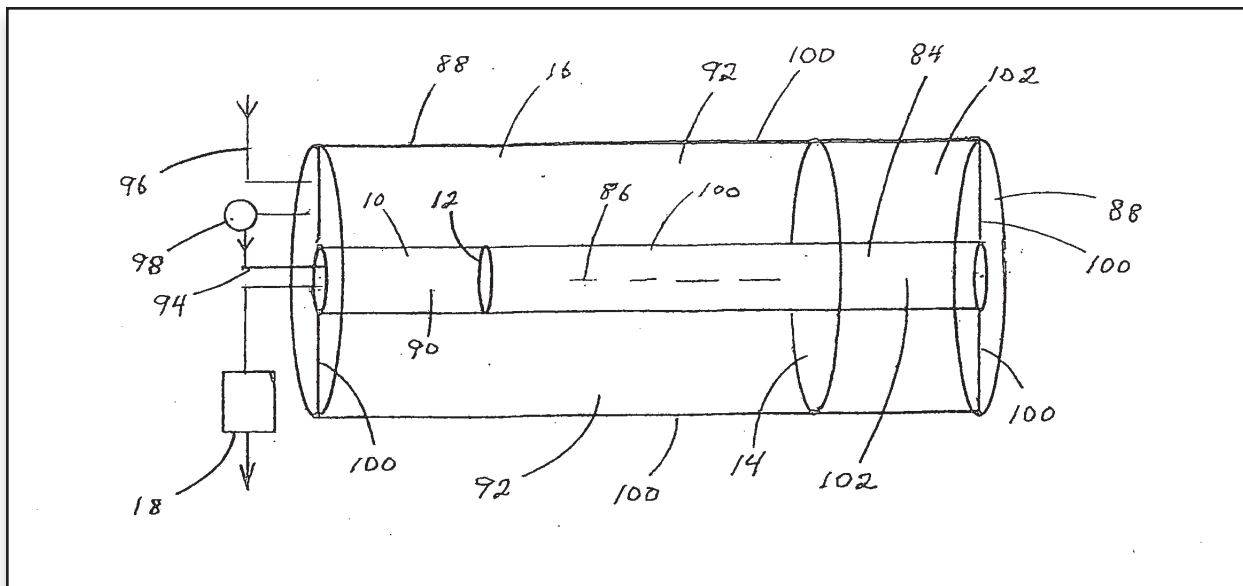
Type: Application

Filed: August 12, 1983

Date of Patent: August 24, 2015

Inventor: Michael A. Minovitch

Status: Active (2034-06-20 - Anticipated expiration)



Closed-cycle cryogenic engine and operating method for propelling vehicles and generating electricity

Publication number: US 9/334,854¹

Abstract

A closed-cycle cryogenic engine includes a high specific heat working fluid remaining in a gaseous phase. The high temperature heat reservoir is the natural environment and the low temperature heat reservoir is created artificially by evaporating water. Isothermally compressing the working fluid at low temperature by absorbing compression heat by evaporating water extracts heat energy from the environment, converting it into net output. A plurality of serially connected isentropic expanders is interposed with a like plurality of re-heating stages. The temperature difference between the high and low temperature heat reservoirs is a few degrees, allowing expansion operation with low expansion ratios, enabling a large number of expanding and reheating steps. Each engine cycle extracts natural heat energy from the environment, converting a large fraction into high density net output work. Very little water, the engine's only fuel, is consumed since evaporating water's latent heat is high.

Inventor: Minovitch, Michael, A.

2014-06-20 - Application filed by Individual

2014-06-20 - Priority to US14/120,711

2015-12-24 - Publication of US20150369221A1

2016-05-10 - Application granted

2016-05-10 - Publication of US9334854B2

2034-06-20 - Anticipated expiration

¹Having previously published pre-grant publication.

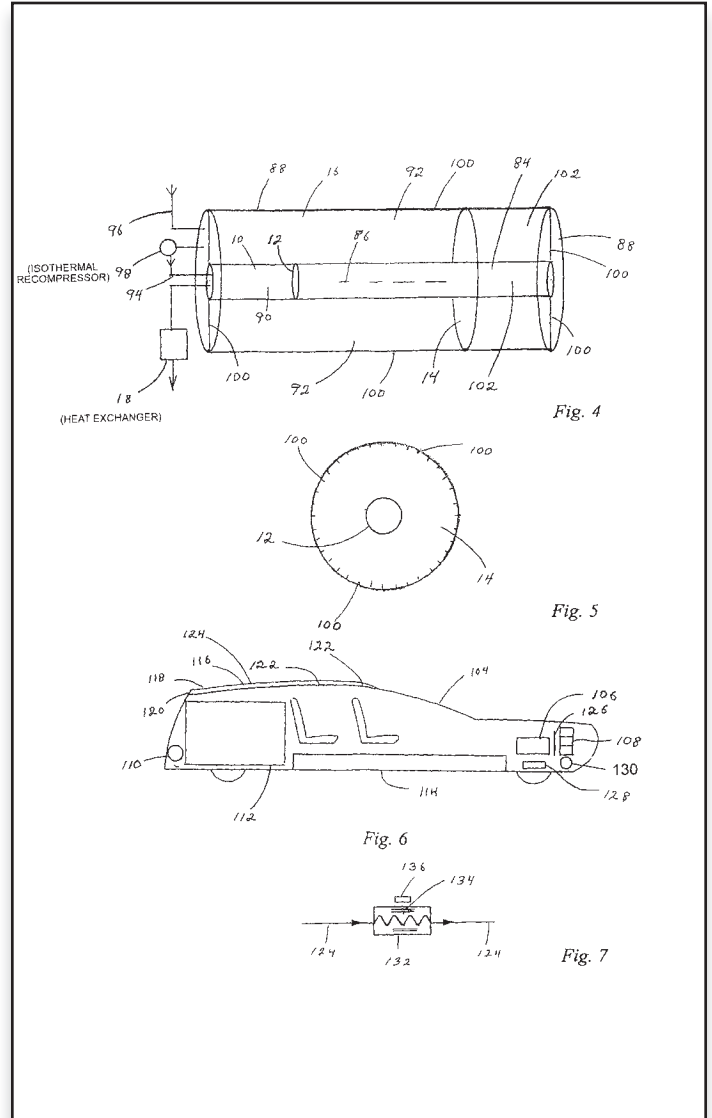


FIG. 4, above, is a longitudinal cross section through the high and low pressure, variable volume, compressed gas storage cylinders illustrating their design and operating principles; FIG. 5 is a transverse cross section through the variable-volume gas storage cylinders further illustrating their design and construction; FIG. 6 is a schematic longitudinal cross section of an automobile propelled by the closed cycle cryogenic engine illustrating the positions of the various engine components mounted inside the vehicle; and FIG. 7 is a schematic transverse cross section of a thermally insulated secondary heating system for heating the working fluid during rainy or very cold days.

Low temperature high efficiency condensing heat engine for propelling road vehicles

Publication number: US 2011/0277476 A1

Abstract:

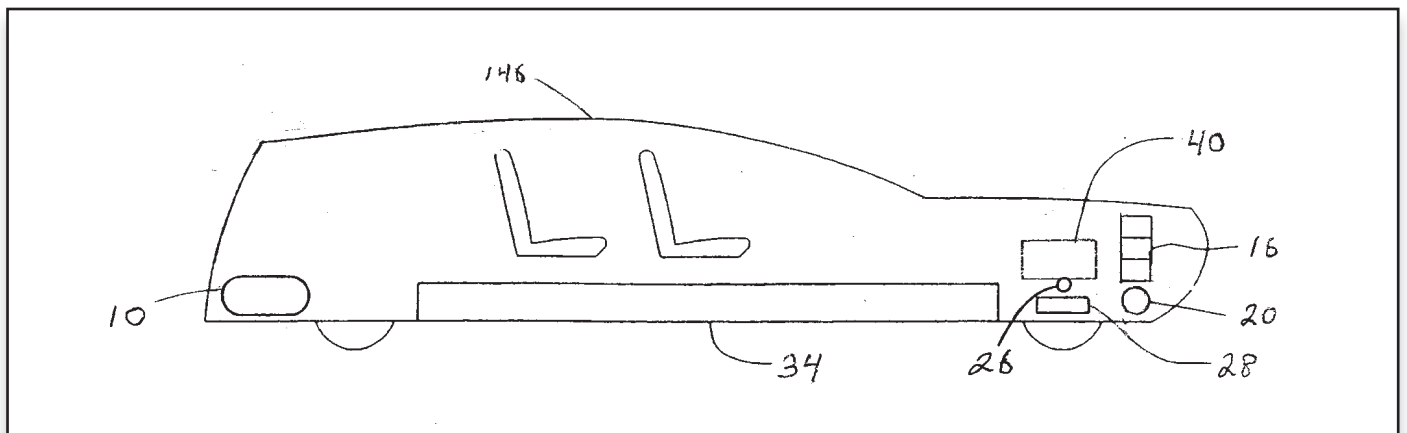
A non-polluting, closed-cycle condensing heat engine and operating method is provided for propelling road vehicles at high efficiencies and high power densities by using a phase-changing working fluid having a critical temperature close to the natural ambient temperature of the surrounding atmosphere and shifting the high temperature heat reservoir downward by several hundred degrees by creating an artificial low temperature heat reservoir below ambient temperature by evaporating water. By isentropically compressing the liquefied working fluid at sub-ambient temperatures to very high pressure utilizing the fact that water has an unusually high latent heat of evaporation, and heating it to a compressed gas at a relatively low temperature in the high temperature heat reservoir by burning small amounts of fuel, it is possible for the engine to operate at high power densities by expanding the compressed gas back to the initial sub-ambient temperature where it is re-condensed to propel road vehicles several hundred miles on a tank of water holding only 40 gallons using a small fraction of the amount of fuel used by vehicles propelled by conventional internal combustion engines.

Application US12/780,198 events

2010-05-14: Application filed by Individual

2010-05-14: Priority to US12/780,198

2011-11-17: Publication of US20110277476A1



US 2011/0277476: Representative figure, above, is a schematic longitudinal cross section of an automobile propelled by the invention illustrating the positions of the various engine components.

Magnetic condensing system for cryogenic engines

Publication number: US 6/739,137 B2

Abstract

A method and apparatus is provided for generating an artificial heat sink below ambient temperature for a cryogenic condenser by isothermally magnetizing a paramagnetic fluid and removing the magnetic field thereby creating a temperature drop in the fluid by the magnetocaloric effect. The heat of magnetization is converted into mechanical work by initially placing the fluid inside a sealed chamber with a door that opens to a conduit leading into the bore of a superconducting solenoid. When the solenoid is energized with current, it creates a strong axial magnetic field that exerts magnetic attractive forces on the fluid inside the chamber. When the fluid is released by opening the door, it is accelerated through the conduit toward the superconducting solenoid where it becomes magnetized by the increasing strength of the magnetic field. By mounting a non-magnetic turbine inside the conduit between the solenoid and the chamber, the kinetic energy of the accelerating flow stream, which is equal to the heat of magnetization, is converted into mechanical work thereby achieving isothermal magnetization. By removing the magnetic field after the fluid enters the bore of the solenoid, a temperature reduction is achieved thereby enabling the fluid to absorb heat in a cryogenic condenser.

2003-05-16: Priority to PL373079A
2003-05-16: Priority to JP2004507744A
2003-05-16: Priority to AU2003239545A
2003-05-16: Priority to RU2004137286/06A
2003-05-16: Priority to MXPA04011475A
2003-05-21: Priority to EP03011557A
2003-11-27: Publication of US20030218852A1
2004-05-25: Application granted
2004-05-25: Publication of US6739137B2

Inventor: Michael A. Minovitch

2002-05-21: Priority to US10/151,537

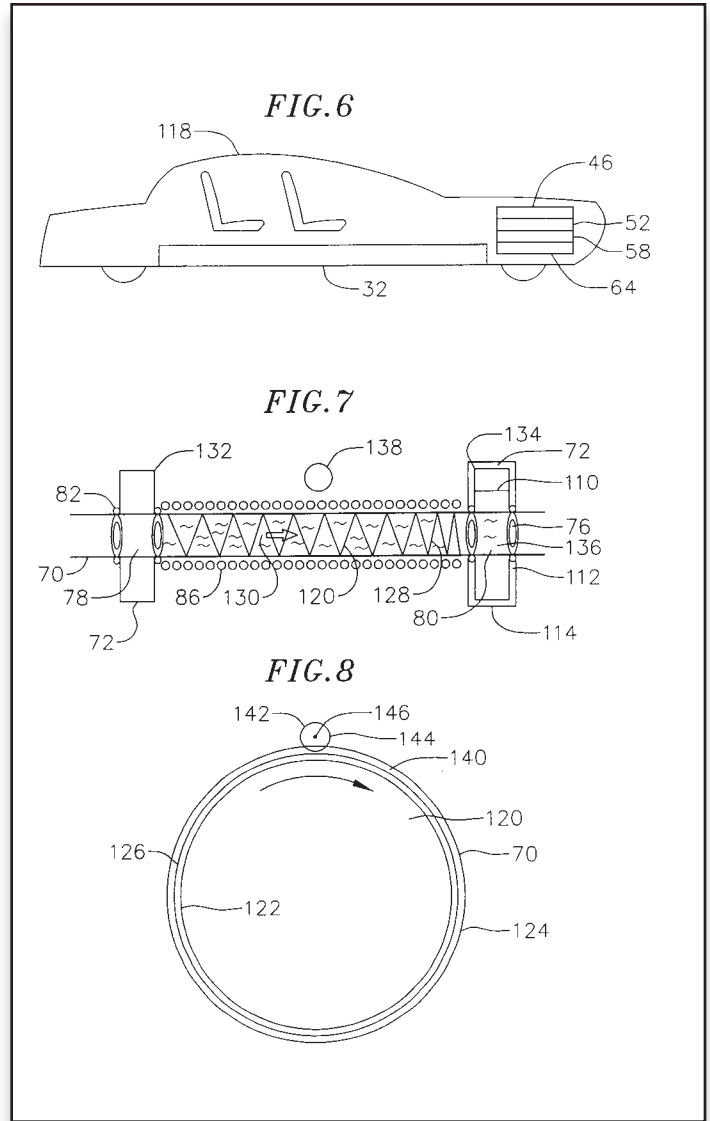
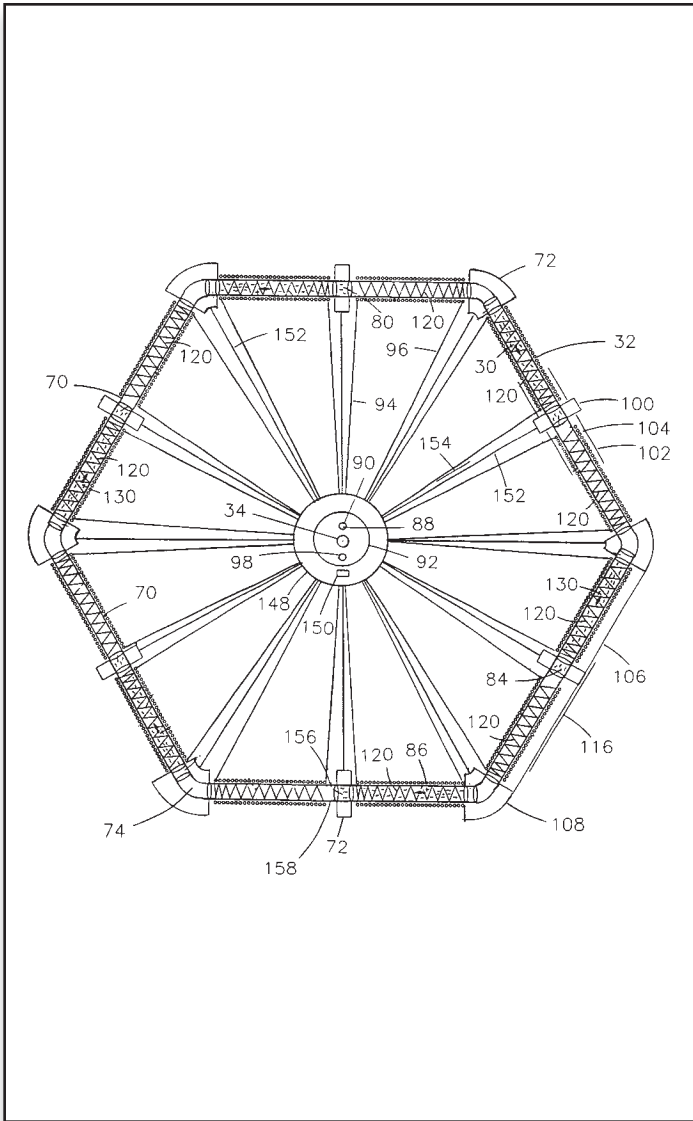
2002-05-21: Application filed by Individual

2003-05-16: Priority to KR10-2004-7018884A

2003-05-16: Priority to PCT/US2003/016063

2003-05-16: Priority to CA002486428A

2003-05-16: Priority to CN038146193A



US 6/739,137 B2 representative figure, above, is a perspective longitudinal cross-section of a non-magnetic conduit connected to the bore of a superconducting solenoid illustrating an accelerating flow stream of paramagnetic fluid accelerating through the conduit under magnetic attractive forces generated by the magnetic field of the superconducting solenoid. FIG. 6 is a schematic transverse cross section through the condenser that is maintained at sub-ambient temperatures by evaporating small amounts of water illustrating its basic design and construction; FIG. 7 is a schematic transverse cross section through a vapor condensing tube mounted inside the condenser illustrating its internal rectangular geometry and external water cooling pads; and FIG. 8 is a longitudinal cross section through the condensing tube and cooling pads further illustrating the condenser's design and construction.

Magnetic condensing system for cryogenic engines

Patent number: EP 1 367340 A3

Abstract

A method and apparatus is provided for generating an artificial heat sink below ambient temperature for a cryogenic condenser by isothermally magnetizing a paramagnetic fluid and removing the magnetic field thereby creating a temperature drop in the fluid by the magnetocaloric effect. The heat of magnetization is converted into mechanical work by initially placing the fluid (10) inside a sealed chamber (12) with a door that opens to a conduit (14) leading into the bore of a superconducting solenoid (18). When the solenoid (18) is energized with current, it creates a strong axial magnetic (20) field that exerts magnetic attractive forces on the fluid (10) inside the chamber (12). When the fluid (10) is released by opening the door, it is accelerated through the conduit (14) toward the superconducting solenoid (18) where it becomes magnetized by the increasing strength of the magnetic field (20). By mounting a nonmagnetic urbine inside the conduit (14) between the solenoid (18) and the chamber (12), the kinetic energy of the accelerating flow stream, which is equal to the heat of magnetization, is converted into mechanical work thereby achieving isothermal magnetization. By removing the magnetic field after the fluid enters the bore of the solenoid, a temperature reduction is achieved thereby enabling the fluid to absorb heat in a cryogenic condenser.

Publication Date: 09.10.2009

Publication Kind: A

IPC: F25B 19/00

Applicant: MICHAEL ANDREW MINOVITCH

Inventors: MICHAEL ANDREW MINOVITCH

Priority Data: 10151537 21.05.2002 US

Related patent documents: PH12004501883, US20030218852, left; CN1662780, CA2486428, AU2003239545, JP2005526947, WO/2003/100330. PL203224, EP1367340. MA/a/2004/011475, PH1-2004-501883, KR1020050007556, RU2004137286

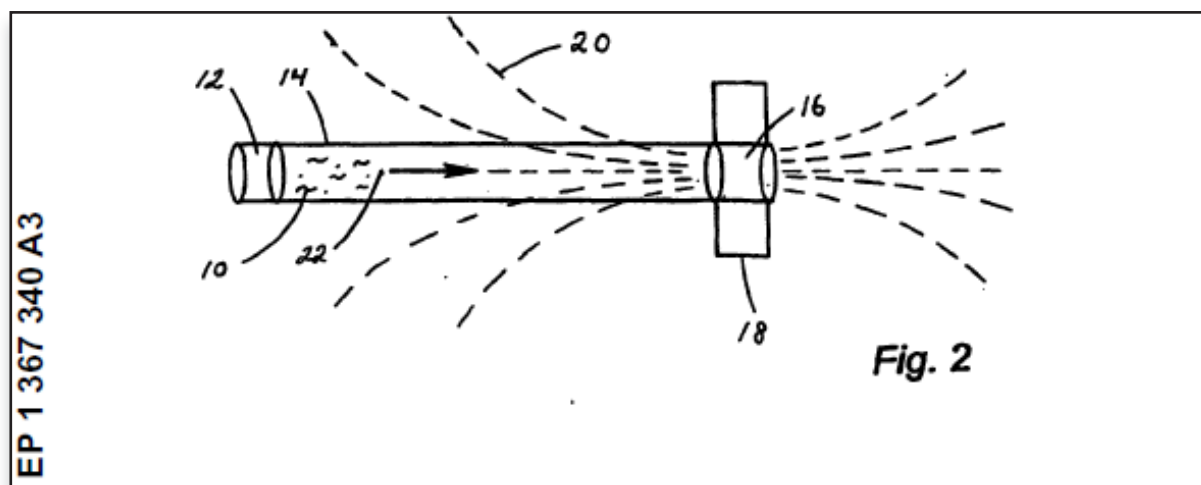


Fig. 2, above, represents the process described above in the patent abstract.

Magnetic condensing system for cryogenic engines

Patent number: WO/2003/100330A1

Abstract

A method and apparatus is provided for generating an artificial heat sink below ambient temperature for a cryogenic condenser (32) by isothermally magnetizing a paramagnetic fluid and removing the magnetic field, thereby creating a temperature drop in the fluid by the magnetocaloric effect. The heat of magnetization is converted into mechanical work by initially placing the fluid inside a sealed chamber (80) with a door (76) that opens to a conduit (70) leading into the bore of a superconducting solenoid (72). When the solenoid (72) is energized, it creates a strong axial magnetic field that exerts magnetic attractive forces on the fluid. When the fluid is released by opening the door (76), it is accelerated through the conduit (70) toward the superconducting solenoid where it becomes magnetized by the increasing strength of the magnetic field. By mounting a non-magnetic turbine (120) inside the conduit between the solenoid and the chamber, the kinetic energy of the accelerating flow stream, which is accelerating flow stream, which is equal to the heat of magnetization, is converted into mechanical work, thereby achieving isothermal magnetization. By removing the magnetic field after the fluid enters the bore of the solenoid, a temperature reduction is achieved thereby enabling the fluid to absorb heat in a cryogenic condenser.

Applicant and Inventor: Minovitch, Michael, A.

Agent: SEIBEL, Richard, D., LLP, Post Office Box 7068, Pasadena, CA 91109-7068 (US).

International Publication Date: 4 December 2003 (04.12.2003)

International Application Number: PCT/US03/16063

International Filing Date: 6 May 2003 (16.05.2003)

2003-05-16: Priority to AU2003239545A

2003-05-16: Priority to MXPA04011475A

2003-05-16: Priority to KR10-2004-7018884A

2003-05-16: Priority to CA002486428A

2003-05-16: Priority to JP2004507744A

2003-12-04: Publication of WO2003100330A1

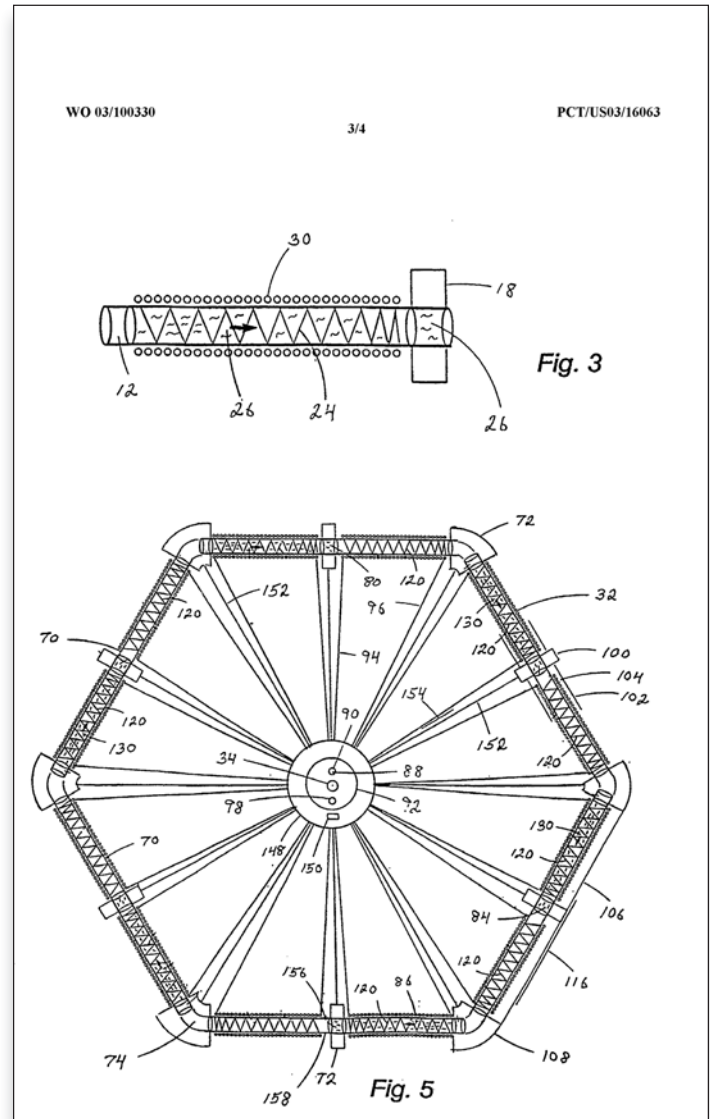


Fig. 3 is a perspective longitudinal cross-section of the non-magnetic conduit shown in Fig. 2 illustrating how the kinetic energy of the accelerating paramagnetic fluid is converted into mechanical work by mounting a non-magnetic rotating turbine in the flow stream inside the conduit and Fig. 5 is a schematic perspective plan view of the preferred embodiment of the magnetic condensing system illustrating its overall design and construction.

Magnetic condensing system for cryogenic engines

Patent number: EP 1 367 340 A2

Abstract

A method and apparatus is provided for generating an artificial heat sink below ambient temperature for a cryogenic condenser by isothermally magnetizing a paramagnetic fluid and removing the magnetic field thereby creating a temperature drop in the fluid by the magnetocaloric effect. The heat of magnetization is converted into mechanical work by initially placing the fluid (10) inside a sealed chamber (12) with a door that opens to a conduit (14) leading into the bore of a superconducting solenoid (18). When the solenoid (18) is energized with current, it creates a strong axial magnetic (20) field that exerts magnetic attractive forces on the fluid (10) inside the chamber (12). When the fluid (10) is released by opening the door, it is accelerated through the conduit (14) toward the superconducting solenoid (18) where it becomes magnetized by the increasing strength of the magnetic field (20). By mounting a non-magnetic turbine inside the conduit (14) between the solenoid (18) and the chamber (12), the kinetic energy of the accelerating flow stream, which is equal to the heat of magnetization, is converted into mechanical work thereby achieving isothermal magnetization. By removing the magnetic field after the fluid enters the bore of the solenoid, a temperature reduction is achieved thereby enabling the fluid to absorb heat in a cryogenic condenser.

Date of publication A3: 17.12.2003 Bulletin 2003/51

(43) Date of publication A2: 03.12.2003 Bulletin 2003/49

(21) Application number: 03011557.0

(22) Date of filing: 21.05.2003

(51) Int Cl.7: F25B 21/00, H01F 1/01

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HU IE IT LI LU MC NL PT RO SE SI SK TR

Designated Extension States: AL LT LV MK

(30) Priority: 21.05.2002 US 151537

(71) Applicant/Inventor: Minovitch, Michael Andrew

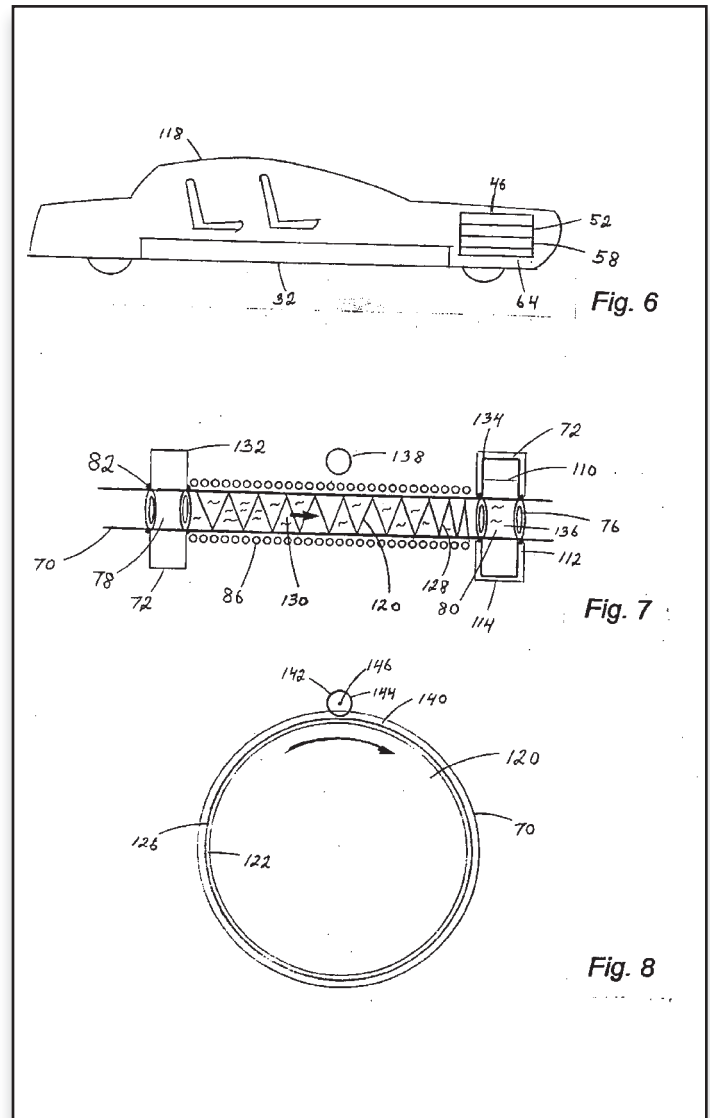


Fig. 4 is a block diagram of a cryogenic engine using the preferred embodiment of the magnetic condensing system

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Magnetic condensing system for cryogenic engines

Patent number: US 2003/0218852 A1

Abstract

A method and apparatus is provided for generating an artificial heat sink below ambient temperature for a cryogenic condenser by isothermally magnetizing a paramagnetic fluid and removing the magnetic field thereby creating a temperature drop in the fluid by the magnetocaloric effect. The heat of magnetization is converted into mechanical work by initially placing the fluid inside a sealed chamber with a door that opens to a conduit leading into the bore of a superconducting solenoid. When the solenoid is energized with current, it creates a strong axial magnetic field that exerts magnetic attractive forces on the fluid inside the chamber. When the fluid is released by opening the door, it is accelerated through the conduit toward the superconducting solenoid where it becomes magnetized by the increasing strength of the magnetic field. By mounting a non-magnetic turbine inside the conduit between the solenoid and the chamber, the kinetic energy of the accelerating flow stream, which is equal to the heat of magnetization, is converted into mechanical work thereby achieving isothermal magnetization. By removing the magnetic field after the fluid enters the bore of the solenoid, a temperature reduction is achieved thereby enabling the fluid to absorb heat in a cryogenic condenser.

Inventor: Minovitch, Michael, A.

2002-05-21: Priority to US10/151,537

2002-05-21: Application filed by Individual

2003-11-27: Publication of US20030218852A1

2004-05-25: Application granted

2004-05-25: Publication of US6739137B2

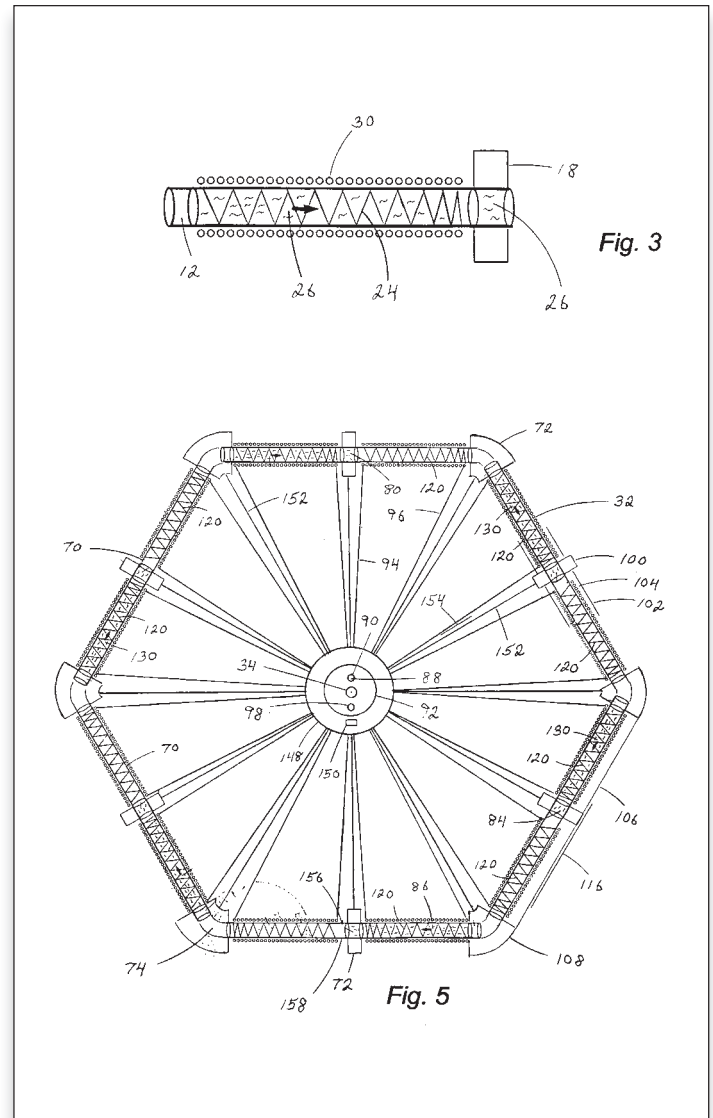


FIG. 3 is a perspective longitudinal cross-section of the non-magnetic conduit shown in FIG. 2 illustrating how the kinetic energy of the accelerating paramagnetic fluid is converted into mechanical work by mounting a non-magnetic rotating turbine in the flow stream inside the conduit; and; FIG. 5 is a schematic perspective plan view of the preferred embodiment of the magnetic condensing system illustrating its overall design and construction.

Magnetic propulsion system and operating method

Patent number: US 6/193,194

Abstract

A traveling-field, magnetic propulsion system and operating method is provided for achieving economical space travel. The system is based upon designing the vehicle in the form of a single-stage streamlined circular toroidal airfoil containing a thin-walled superconducting solenoid. It is initially launched vertically off the earth's surface into a vacuum environment at 125 km using conventional rocket propulsion. It is then accelerated along a high-inclination trajectory by a traveling repulsive magnetic field generated by ejecting an easily ionizable low-density gas cloud in the vehicle's magnetic field and transmitting a high-power, plane-polarized, microwave beam at the cloud tuned to the electron cyclotron resonant frequency. The transmitter is constructed horizontally on the earth's surface as an electronically-steered, phased array several hundred meters in diameter energized by a large superconducting energy storage system. The transmitter will be able to transmit a converging CW microwave beam at the vehicle with very high power to magnetically accelerate it over great distances without atmospheric breakdown. The method can be used as a general high-speed earth or space transportation system by catapulting suborbital or orbital payloads, or by catapulting multikiloton payloads to other celestial bodies with mass ratios below that of long-range aircraft.

Inventor: Minovitch, Michael, A.

Application US09/146,927 events:

1998-09-01: Application filed by Individual

1998-09-01: Priority to US09/146,927

2001-02-27: Application granted

2001-02-27: Publication of US6193194B1

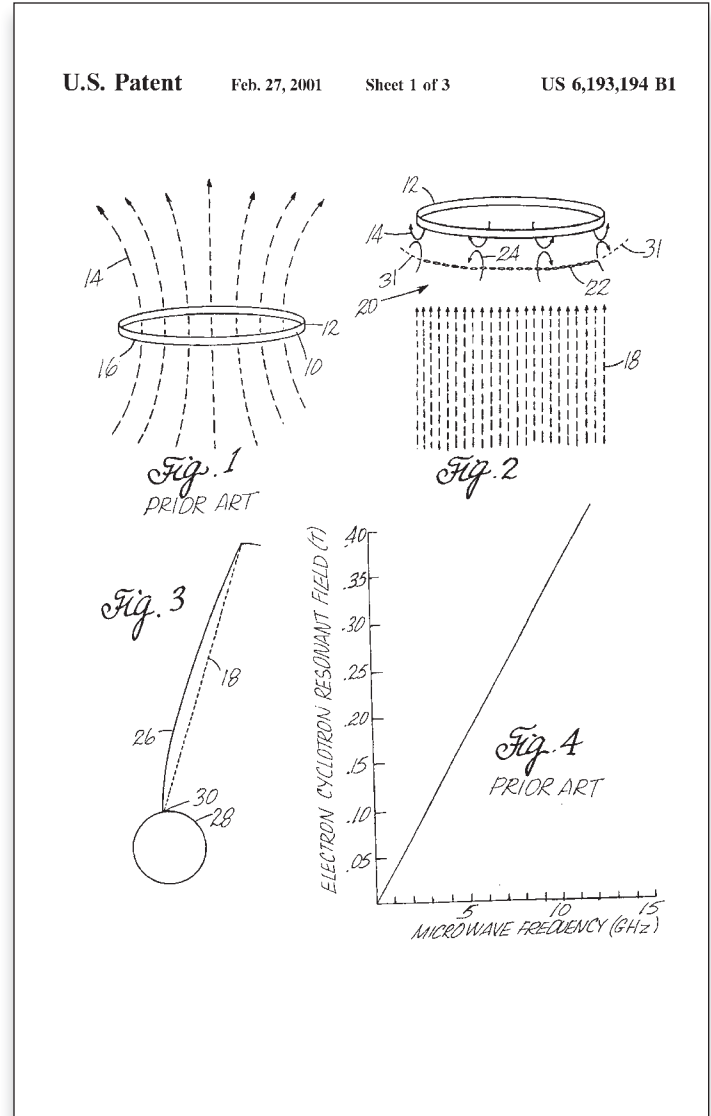


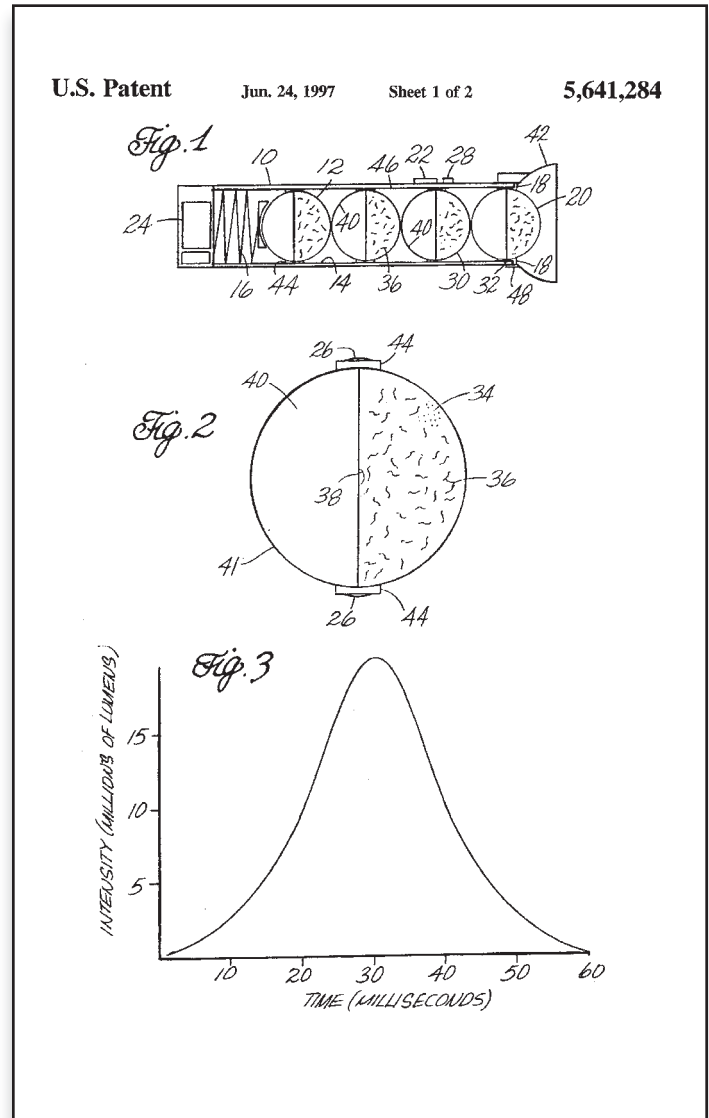
FIG. 1 is a perspective view illustrating the circular toroidal design of the vehicle containing a charged superconducting solenoid coil generating a static repulsive magnetic field; FIG. 2 is a perspective view illustrating how the traveling repulsive magnetic field is generated behind the vehicle by a microwave beam tuned to the solenoid's cyclotron's resonant frequency; FIG. 3 illustrates the vehicle's acceleration trajectory relative to the earth and transmitter; and FIG. 4 is a graph of magnetic field strength versus electron cyclotron resonant frequency of the microwave beam.

Flash bulb cartridge for light guns

Patent number: US 5/271,583

Abstract

An ultra high intensity flash cartridge is provided for light guns. The ultra high intensity of the flash is obtained by sealing fast burning filaments of magnesium inside a glass bulb containing pure oxygen gas under pressure. The flash is triggered by an electric current. The intensity is boosted by designing the rear surface of the bulb with a paraboloidal shape and coating it with a reflective surface so that all the light is projected and concentrated in the forward direction without requiring any external reflector. Guide flanges are built into the bulb to maintain proper orientation when loaded into a light gun. The cartridge is capable of generating a light flash several orders of magnitude brighter than the noon-day sun for temporarily blinding an assailant at a distance.



Inventor: Minovitch, Michael A.

Application US08/458,432 events:

1995-06-02: Application filed by Individual

1995-06-02: Priority to US08/458,432

1997-06-24: Application granted

1997-06-24: Publication of US5641284A

Light gun

Patent number: US 5/641,222 A

Abstract

A hand-held multiple-shot flash generator is presented for temporarily blinding an assailant at a distance. The light is generated by a plurality of ultra high intensity flash bulbs containing a fast-burning substance such as magnesium sealed in pressurized pure oxygen that is triggered by an electric current. A portion of the glass bulbs is coated with a reflective surface to concentrate and project the light flash in a forward direction. The intensity of the flash striking the eyes is sufficiently strong to cause temporary blindness, thereby rendering the assailant mobile. The flash bulbs are mounted in a cylindrical housing containing a battery and a bulb firing and ejection system designed to give repetitive operation.

Inventor: Minovitch, Michael, A.

Application US08/458,433 events:

1995-06-02: Application filed by Individual

1995-06-02: Priority to US08/458,433

1997-06-24: Application granted

1997-06-24: Publication of US5641222A

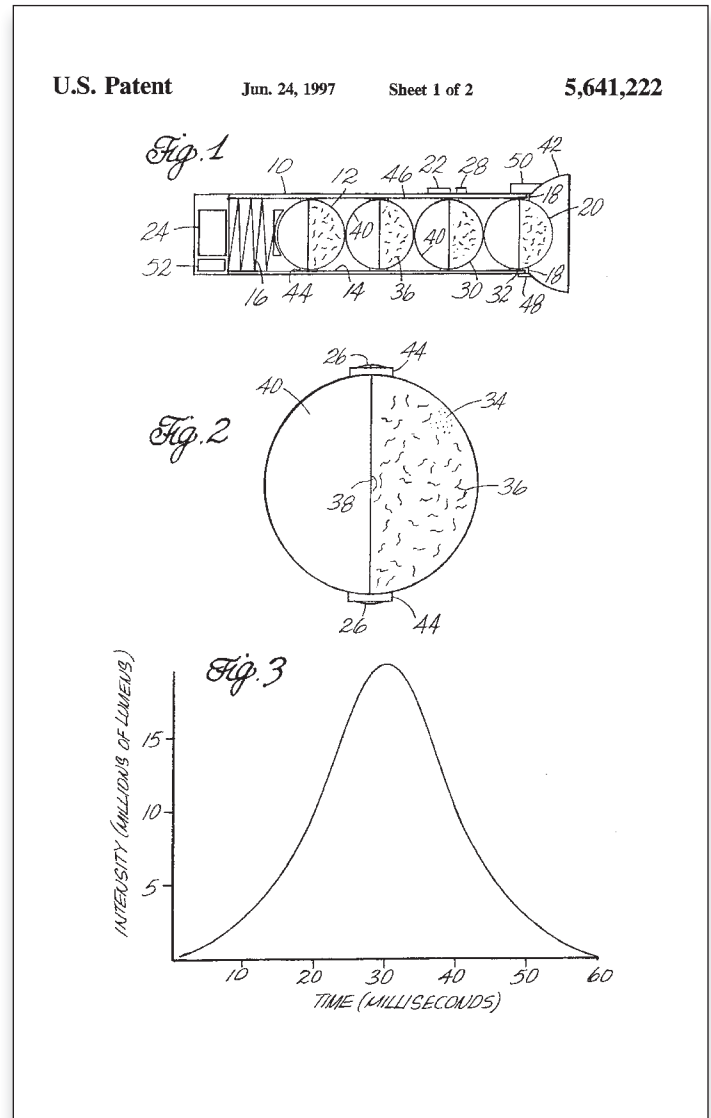


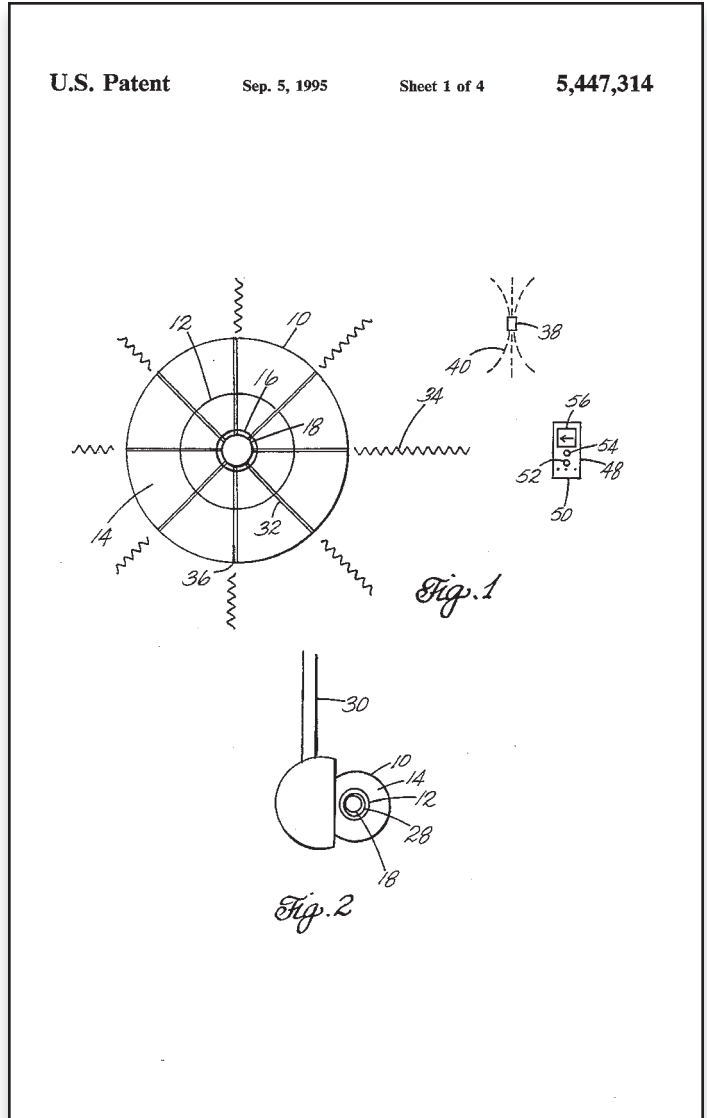
FIG. 1 is a schematic longitudinal cross-section illustrating the design and construction of the preferred embodiment of the invention; FIG. 2 is a schematic transverse cross-section illustrating the design and construction of the high intensity flash bulbs and FIG. 3 is a light curve illustrating the intensity of the light flash as a function time.

Golf ball locating system and operating method

Publication number: US 5/447,314

Abstract

A sound emitting golf ball is provided for locating a golf ball after it is struck by a golf club. The system comprises a miniaturized electronic, battery powered piezoelectric sound generator surrounded by a shock absorber that is embedded inside a golf ball. The sound generating system is constructed with very small, inexpensive shock resistant components and embedded at the center of the golf ball inside the shock absorber. The system can be designed to operate in the audible or ultrasonic range.



Type: Grant

Filed: December 27, 1993

Date of Patent: September 5, 1995

Inventors: Tsuyoshi Yamazaki, Michael A. Minovitch

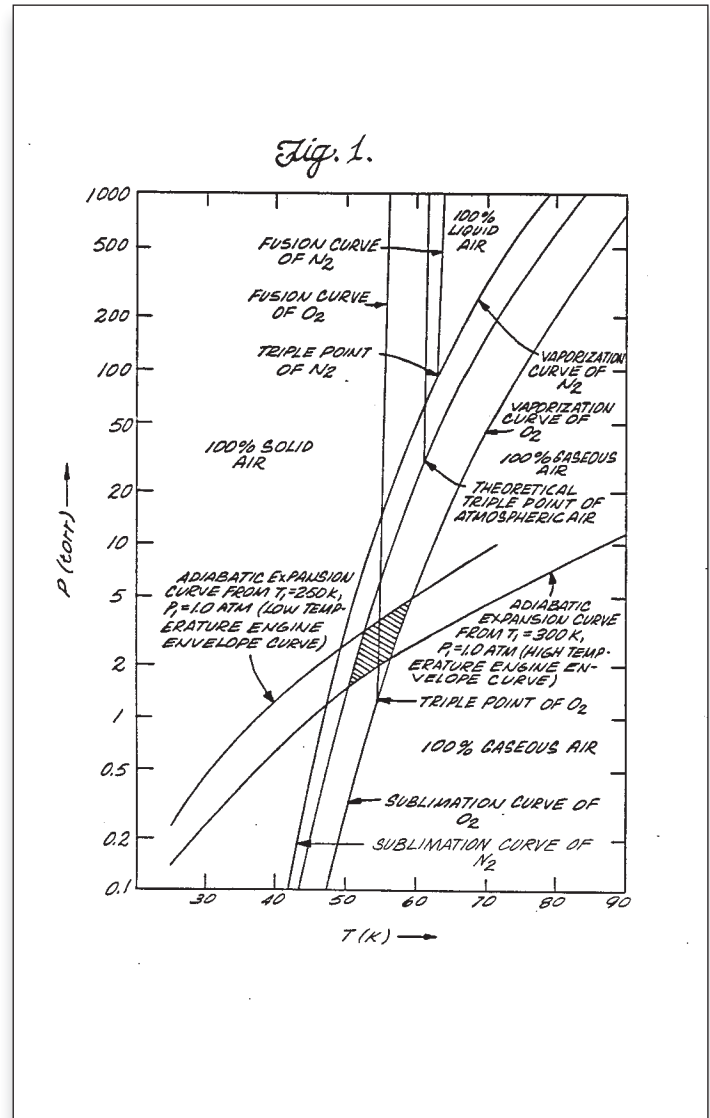
FIG. 1 is a schematic transverse cross-section of a sound emitting golf ball illustrating the design and construction of the preferred embodiment of the invention and FIG. 2 is a schematic transverse cross-section of a sound emitting golf ball at the instant it is struck by a golf club

Condensing system and operating method

Patent number: EP 0598723 A4

Abstract

A cryogenic condensing system is provided wherein the working fluid is paramagnetic and entropy reduction is accomplished by means of a magnetic field. Condensation is obtained by isentropically expanding partially compressed vapor into a thermally insulated condensing chamber (14) with a sufficiently large expansion ratio to supersaturate the vapor, a portion of which condenses spontaneously. That portion of the vapor which does not condense is drawn out of the condensing chamber (14) and into the bore of a superconducting solenoid (18) by magnetic attractive forces thereby maintaining the vacuum environment inside the chamber (14). The noncondensed vapor is magnetized and magnetically compressed inside the solenoid (18) thereby reducing its entropy. Heat of magnetization is extracted by a nonmagnetic turbine (32) which converts the kinetic energy of the gas stream pulled into the solenoid (18) into mechanical work.



Inventor: Minovitch, Michael A.

Application EP92902678A events:

1991-08-20: Application filed by Individual

1994-06-01: Publication of EP0598723A1

1995-08-02: Publication of EP0598723A4

FIG. 1 is a schematic longitudinal cross-section illustrating the design and construction of the preferred embodiment of the invention; FIG. 2 is a schematic transverse cross-section illustrating the design and construction of the high intensity flash bulbs and FIG. 3 is a light curve illustrating the intensity of the light flash as a function time.

Condensing atmospheric engine and method

Patent number: US 4/624,109 A

Abstract

A thermodynamic method and engine is provided for extracting natural thermal energy from ambient atmospheric air and converting it into mechanical work. The extraction process is accomplished by isentropically expanding ordinary air at atmospheric pressure into a thermally insulated vacuum chamber maintained at low pressure. By employing sufficiently high expansion ratios, a large portion of the air can be made to undergo a spontaneous phase transformation into the solid state at cryogenic temperature. This results in a substantial reduction of the specific volume of the condensed air which enables the vacuum environment of the chamber to be maintained by expending less mechanical work than that gained from the initial expansion. Thus, the net amount of mechanical work generated therefrom is positive. Substantial additional mechanical work is generated by harnessing the thermal potential difference between the low temperature condensed air and the ambient environment via additional cryogenic engine stages.

Inventor: Minovitch, Michael A.

1983-08-12: Application filed by Individual

1983-08-12: Priority to US06/522,847

1986-11-17: Priority claimed from EP86308942A

1986-11-25: Application granted

1986-11-25: Publication of US4624109A

U.S. Patent Nov. 25, 1986 Sheet 16 of 22 4,624,109

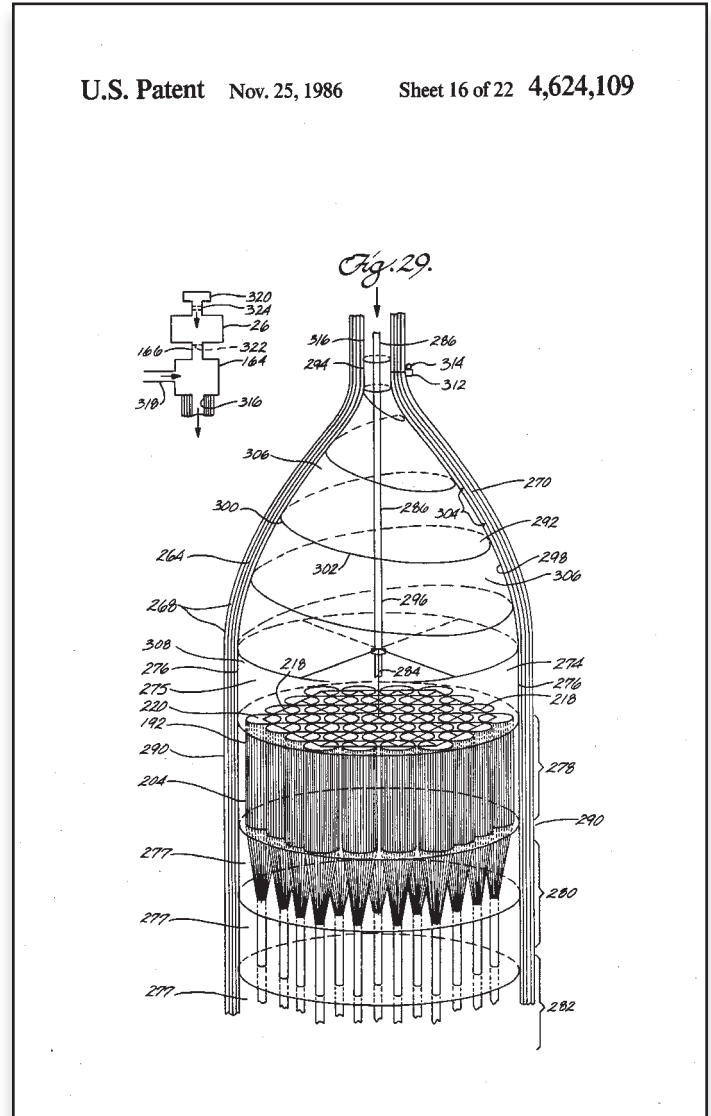


FIG. 16 is an enlarged schematic cross section through the recompression piston's transverse midplane inside the recompression cylinder further illustrating the mechanical drive train system.

Light gun

Publication number: WO/1993/025862 A1

Abstract:

A battery-operated hand-held multiflash light generator is provided for temporarily blinding an assailant at a distance. The light generator comprises a plurality of high energy storage capacitors (14), charged by a battery-operated high voltage power supply (18), and a high intensity flashtube (22). A high current electronic switch (20) discharges each capacitor (14) through the flashtube (22) thereby generating an intense flash of light. The flash is focused by a reflector (42) to form a concentrated beamed light flash which is aimed at an assailant's head. The intensity of the light flash is sufficiently strong to cause temporary blindness, thereby rendering the assailant immobile. By using discharge capacitors (14) with very high energy storage, and a high intensity flashtube (22) and a focusing reflector (42), it is possible to project a light flash several orders of magnitude brighter than the sun. A discharge timing means (45) is provided for controlling the brightness.

Inventor: Minovitch, Michael A.

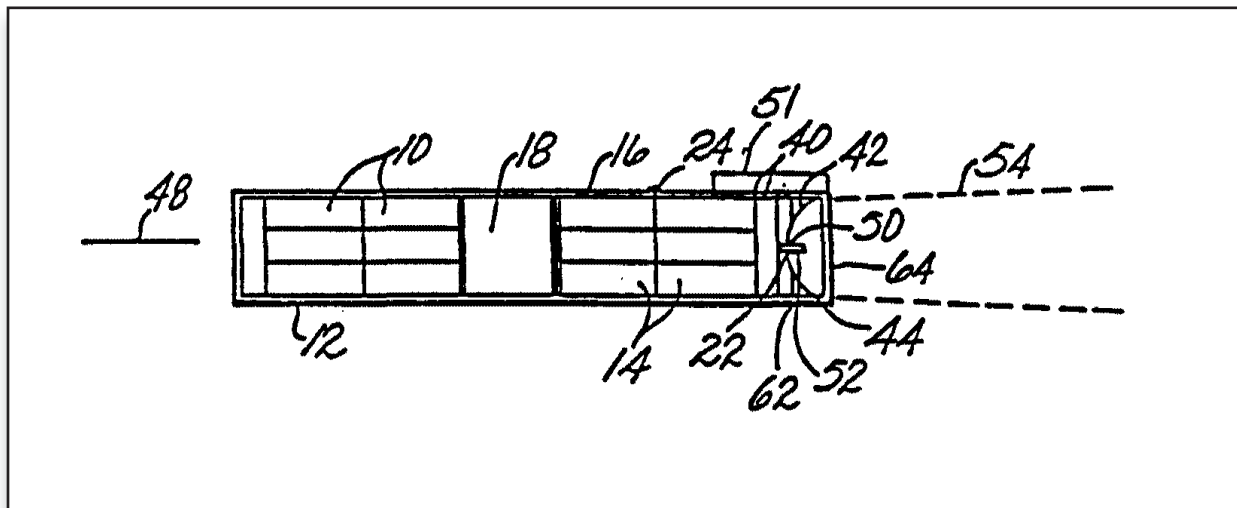
International Publication Number: WO 93/25862

International Publication Date: 23 December 1993
(23.12.93)

International Application Number: PCT/US92/04794

International Filing Date: 8 June 1992 (08.06.92)

Agents: SEIBEL, Richard, D. et al.; Christie, Parker & Hale, 350 W. Colorado Boulevard, Post Office Box 7068, Pasadena, CA 91109-7068 (US)



Representative figure, above, illustrates system described in the Abstract.

Automatic method and operating system for space construction

Patent number: US 5/271,583

Abstract

A high-speed automated method and operating system is disclosed for constructing continuous-walled tubular structures in space having unlimited dimensions. The system comprises a relatively short tubular conveyor with a flexible endless conveying surface sliding in a longitudinal direction around a smooth cylindrical inner guide tube, and a plurality of wrapping wheels containing wrapping material moving in transverse directions. By moving the conveyor and simultaneously moving the wrapping wheels around the conveyor, sheets of material are wrapped around the outer conveying surface made firm by the inner guide tube to continuously manufacture a rigid multi-layered laminated walled cylindrical structure with an inside diameter equal to the outside diameter of the tubular conveyor. By varying the conveyor speed-to-wrapping wheel speed ratio, any wall thickness is obtained. The wrapping material is rolled into spools, mounted inside cartridges, and loaded into the wrapping wheels for easy insertion and replacement. Thus, the manufacturing process can be continued indefinitely to obtain a tubular structure having any dimensions desired. Since the sheets of wrapping material are transported to orbit in rolls with very high packing density, the machine can construct huge structures in orbit with relatively few trips.

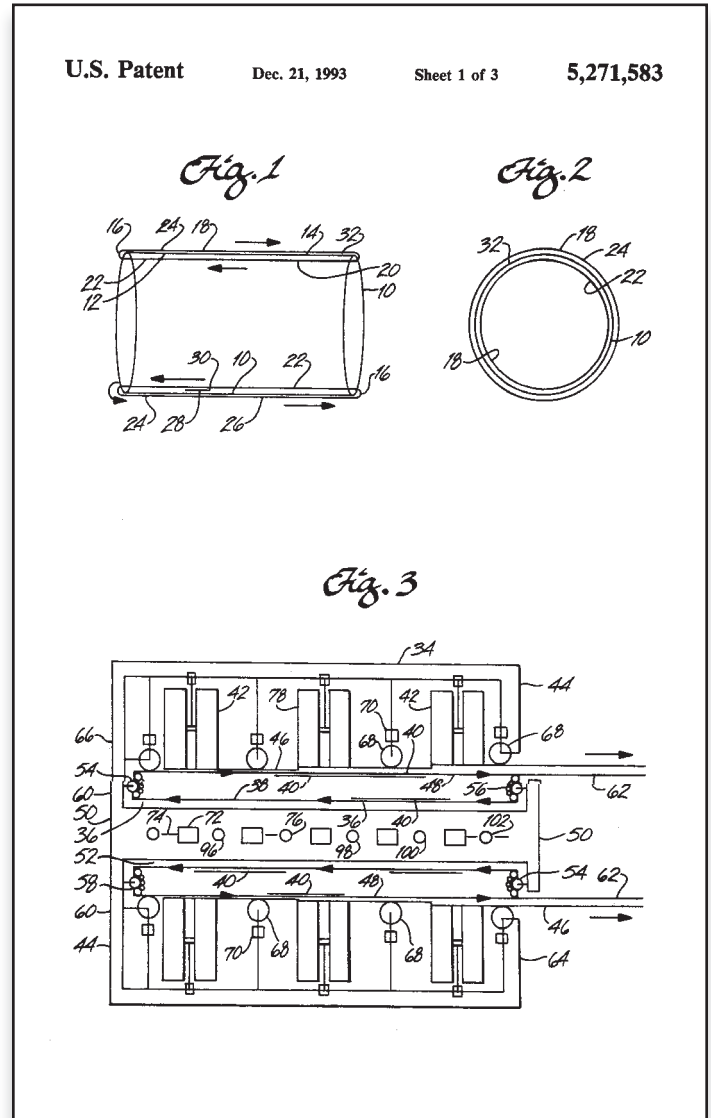


FIG. 1 is a schematic longitudinal cross-section illustrating the basic operating principles of a tubular conveyor; FIG. 2 is a schematic transverse cross-section of FIG. 1 and FIG. 3 is a schematic longitudinal cross-section illustrating the design and construction of the automatic construction machine.

Type: Grant

Filed: May 12, 1992

Date of Patent: December 21, 1993

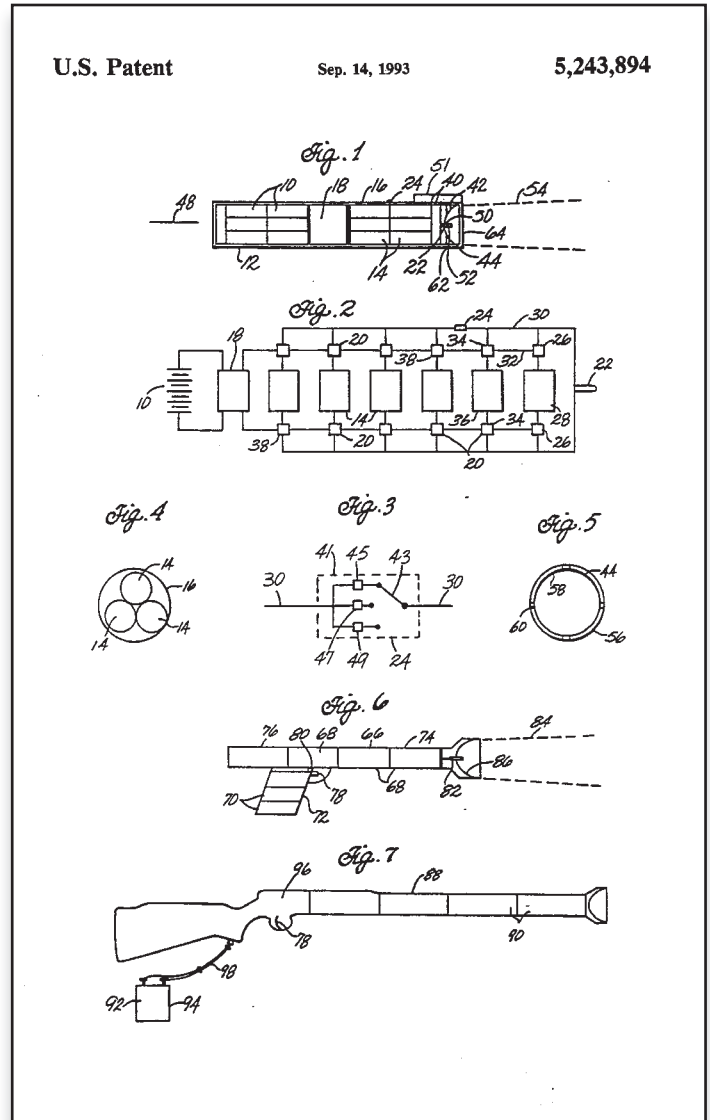
Inventor: Michael A. Minovitch

Light gun

Publication number: US 5/243,894

Abstract:

A battery-operated hand-held multiflash light generator is provided for temporarily blinding an assailant at a distance. The light generator comprises a plurality of high energy storage capacitors, charged by a battery-operated high voltage power supply, and a high intensity flashtube. A high current electronic switch discharges each capacitor through the flashtube thereby generating an intense flash of light. The flash is focused by a reflector to form a concentrated beamed light flash which is aimed at an assailant's head. The intensity of the light flash is sufficiently strong to cause temporary blindness, thereby rendering the assailant immobile. By using discharge capacitors with very high energy storage, and a high intensity flashtube, and a focusing reflector, it is possible to project a light flash several orders of magnitude brighter than the sun. A manual/automatic system is also provided for controlling the brightness. As soon as a capacitor is discharged by generating a light flash, it is automatically recharged a few seconds later. By utilizing a plurality of discharge capacitors, it is possible to project multiple light flashes in rapid fire operation without having to wait for any capacitor to be recharged.



Inventor: Minovitch, Michael A.

Application US07/893,730 events:

- 1992-06-05: Application filed by Individual
- 1992-06-05: Priority to US07/893,730
- 1992-06-08: Priority to AU22204/92A
- 1992-06-08: Priority to PCT/US1992/004794
- 1993-09-14: Application granted
- 1993-09-14: Publication of US5243894A

FIG. 1 is a schematic longitudinal cross-section illustrating the design and construction of the preferred embodiment of the invention; FIG. 2 is a schematic diagram illustrating the basic circuit design of the preferred embodiment of the invention with six storage capacitors; FIG. 3 is a schematic diagram illustrating the basic circuit design for manually controlling the brightness of each light flash; FIG. 4 is a schematic transverse cross-section through the capacitors further illustrating the design of the preferred embodiment; FIG. 5 is a schematic transverse cross-section through the parabolic reflector; FIG. 6 is a schematic longitudinal cross-section illustrating the design and construction of a "pistol" embodiment of the invention; and FIG. 7 is a schematic cross-section illustrating a "shotgun" embodiment of the invention.

Condensing system and operating method

Patent number: WO 1993 004325 A1

Abstract

A cryogenic condensing system is provided wherein the working fluid is paramagnetic and entropy reduction is accomplished by means of a magnetic field. Condensation is obtained by isentropically expanding partially compressed vapor into a thermally insulated condensing chamber (14) with a sufficiently large expansion ratio to supersaturate the vapor, a portion of which condenses spontaneously. That portion of the vapor which does not condense is drawn out of the condensing chamber (14) and into the bore of a superconducting solenoid (18) by magnetic attractive forces thereby maintaining the vacuum environment inside the chamber (14). The noncondensed vapor is magnetized and magnetically compressed inside the solenoid (18) thereby reducing its entropy. Heat of magnetization is extracted by a nonmagnetic turbine (32) which converts the kinetic energy of the gas stream pulled into the solenoid (18) into mechanical work.

International Publication Number: WO 93/04325

International Patent Classification: F25B 21/00, 19/00

International Filing Date: 20 August 1991 (20.08.91)

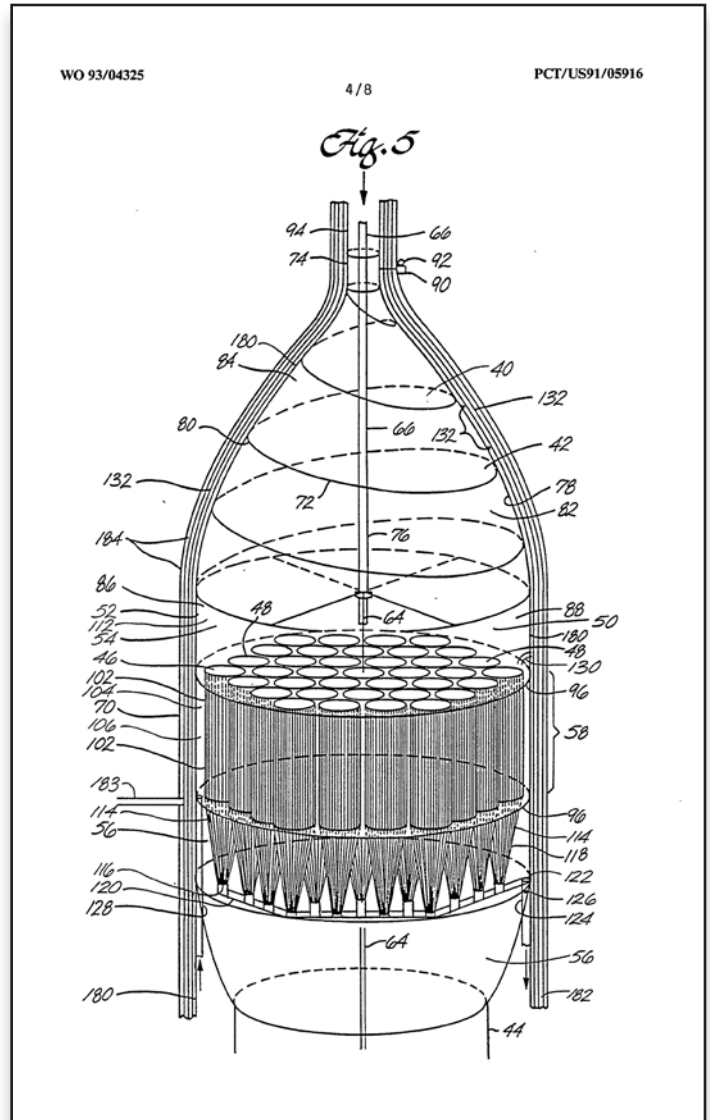
Publication Date: 4 March 1993 (04.03.93)

International Application Number: PCT/US91/05916

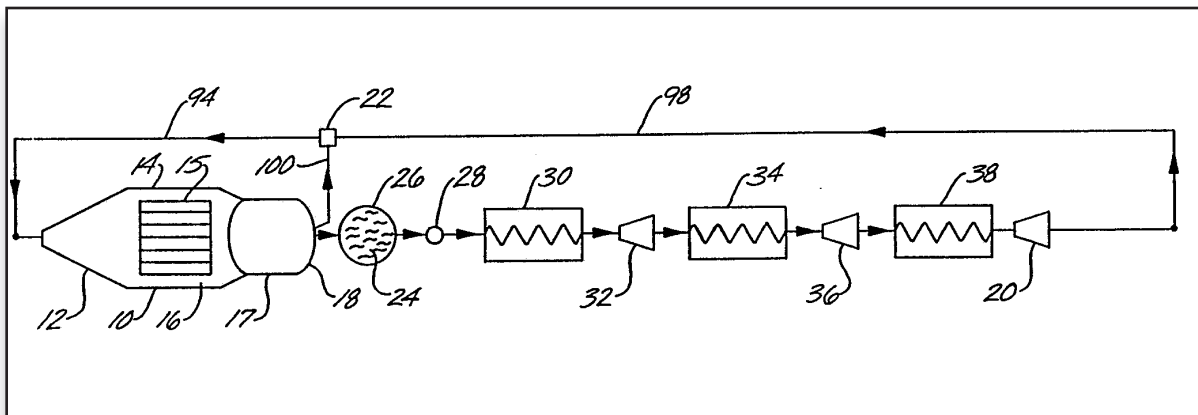
Applicant and Inventor: MINOVITCH, Michael, A.

Agent: SEIBEL, Richard, D.; Christie, Parker & Hale, Pasadena, CA 91109-7068 (US)

Designated States: AU, BR, CA, JP, SU, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LU, NL)



Representative drawing, below, is described in Abstract. Fig. 5, above, Fig. 5, above, is a schematic longitudinal perspective view illustrating the design, construction of the condensing expander and one of its spiraling expansion blades.



Ammunition reloading system and operating method

Publication number: US 5/103712

Abstract:

An aerial inflight reloading system and operating method is provided for military combat aircraft using cannon or machine gun ammunition. In this system, a large ammunition carrying aircraft is equipped with an enclosed conveyor fitted with aerodynamic lifting and control surfaces. A controller, positioned in a pod mounted under the rear portion of the aircraft's fuselage, maneuvers the conveyor via flight controls. The conveyor is guided by the controller to a combat receiver aircraft flying behind and somewhat below the supply aircraft, and is connected to a receptacle mounted on the receiver aircraft. After the connection is made, ammunition is transferred from the supply aircraft to the receiver aircraft via the conveyor. The system enables combat aircraft to be reloaded with ammunition while flying close to a combat zone instead of having to return to base to reload. By combining this system with aerial refueling, it will be possible for combat aircraft to spend significantly longer time periods firing on enemy targets before returning to base, thus significantly increasing their operational efficiency.

Inventor: Minovitch, Michael A.

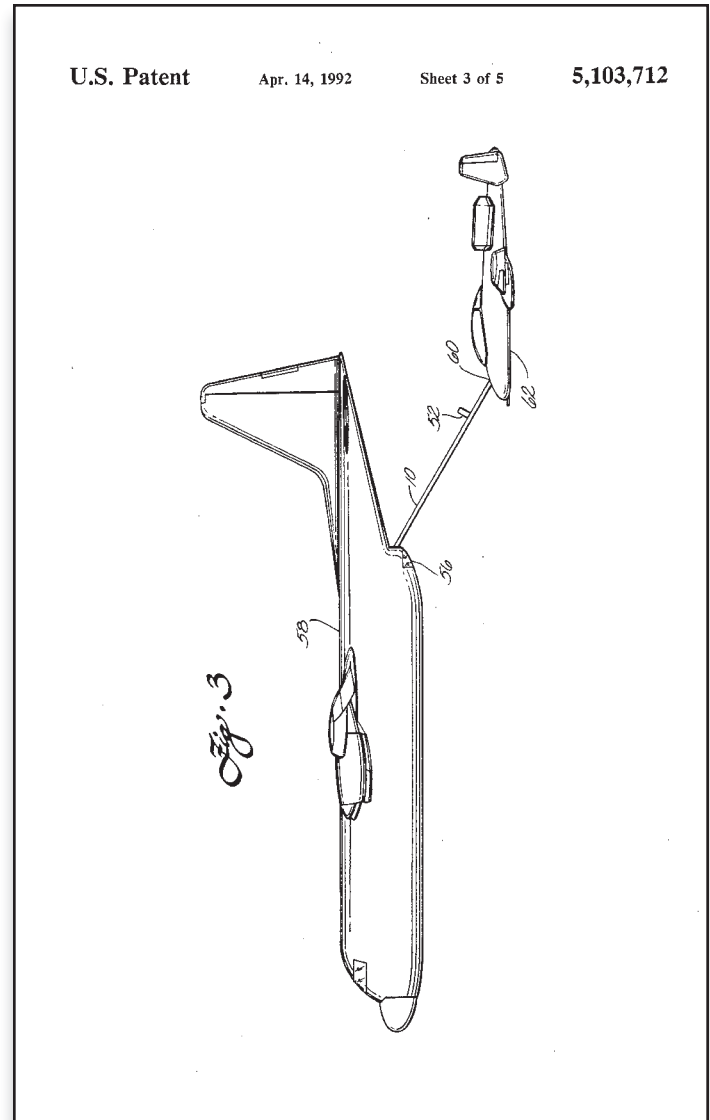
Application US07/688,853 events:

1991-04-22: Application filed by Individual

1991-04-22: Priority to US07/688,853

1992-04-14: Application granted

1992-04-14: Publication of US5103712A



Representative drawing FIG. 3, above, is a schematic view showing an ammunition supply aircraft feeding ammunition into a combat aircraft via the flying conveyor.

Electromagnetic ground to orbit propulsion method and operating system for high mass payloads

Patent number: US 5/093,313 A

Abstract:

TA reusable and regenerative electromagnetic propulsion method and operating system is provided for propelling high mass payloads to orbital velocities which does not require a vacuum environment. The propulsion system comprises a self supporting superconducting dipole coil several kilometers in diameter that is accelerated by magnetic repulsive forces generated by a plurality of giant superconducting field coils mounted in the underground tunnels. The propulsion dipole is mounted inside a circular hypersonic wing-like structure equipped with movable aerodynamic control surfaces for guidance. The propulsion system can accelerate a payload with any desired launch azimuth by accelerating along a line of magnetic induction generated by the field coils having the desired azimuth angle. The payload is attached to the propulsion system by a plurality of cables. After reaching orbital velocity, the payload is detached from the propulsion system and the propulsion system is decelerated back to the earth's surface by magnetic repulsive forces generated by the field coils. A large fraction of the orbital energy of the propulsion system is reconverted back into electrical energy by the inductive coupling between the magnetically decelerated propulsion coil and the field coils which is used to launch another payload.

Inventor: Minovitch, Michael A.

Application US07/550,385 events:

1988-04-01: Priority claimed from US07/176,679

1990-07-10: Application filed by Individual

1990-07-10: Priority to US07/550,385

1992-03-03: Application granted

1992-03-03: Publication of US5093313A

U.S. Patent Mar. 3, 1992 Sheet 2 of 12 5,093,313

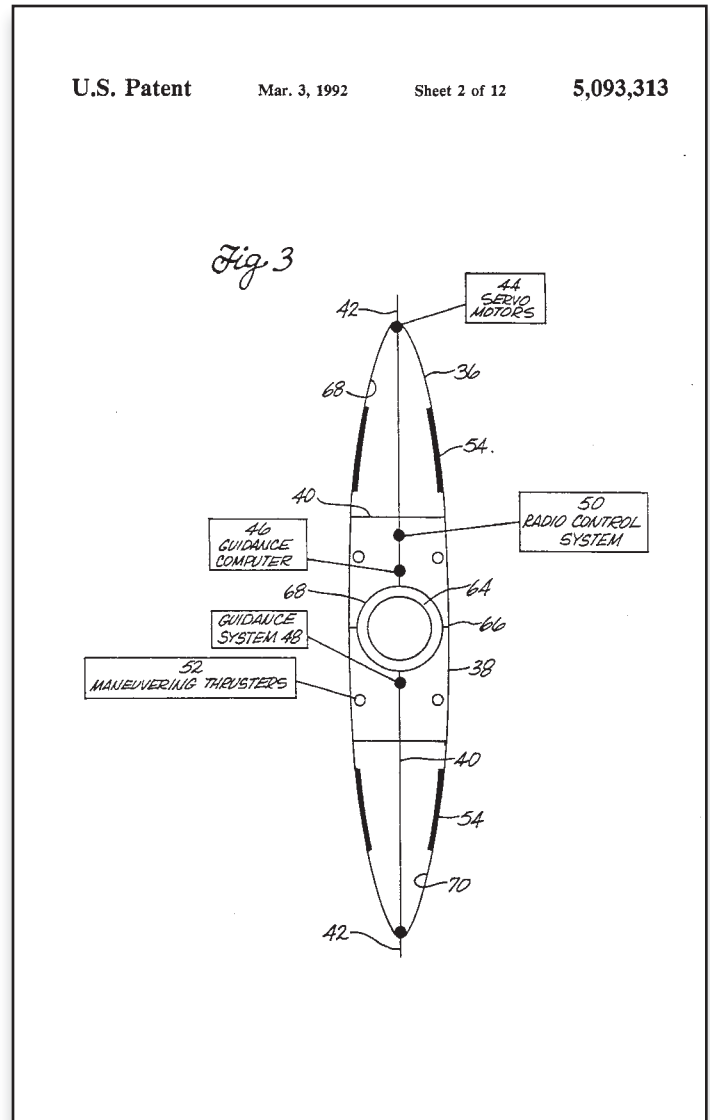


FIG. 3 is an enlarged transverse cross section through the minor axis of a propulsion coil illustrating the design and construction of a circular hypersonic wing-like airfoil mounted around the propulsion coil with movable aerodynamic control surfaces energy storage system using flywheels.

Electromagnetic ramjet

Patent number: US 5/052,638

Abstract

An electromagnetic ramjet propulsion system is provided for accelerating high mass payloads through the upper atmosphere at orbital velocities. The propulsion system comprises a plurality of coplaner self-supporting superconducting dipole coils several hundred meters in diameter that are initially accelerated to high altitude and supersonic speed by magnetic repulsive forces generated by a plurality of superconducting field coils several kilometers in diameter embedded beneath the earth's surface. The ramjet is accelerated to orbital velocities by a multigigawatt microwave beam that is transmitted from the earth's surface. A reflecting grid of conducting wires is mounted inside the inner dipole which shock ionizes the low density atmospheric gas passing through it. The frequency of the microwave beam is adjusted to produce electron cyclotron resonance with the free electrons passing through the magnetic field of the dipoles thereby accelerating them away from the dipoles by magnetic repulsive forces, taking the positively charged ions with them. The system becomes a giant hypervelocity ionospheric ramjet propelled by magnetic repulsive forces without any velocity limitations. By utilizing a plurality of microwave transmitters located along the ground track of the ramjet, it is possible to accelerate payloads of several thousand tons to orbit.

Type: Application

Filed: March 30, 1989

Date of Patent: October 1, 1991

Inventor: Michael A. Minovitch

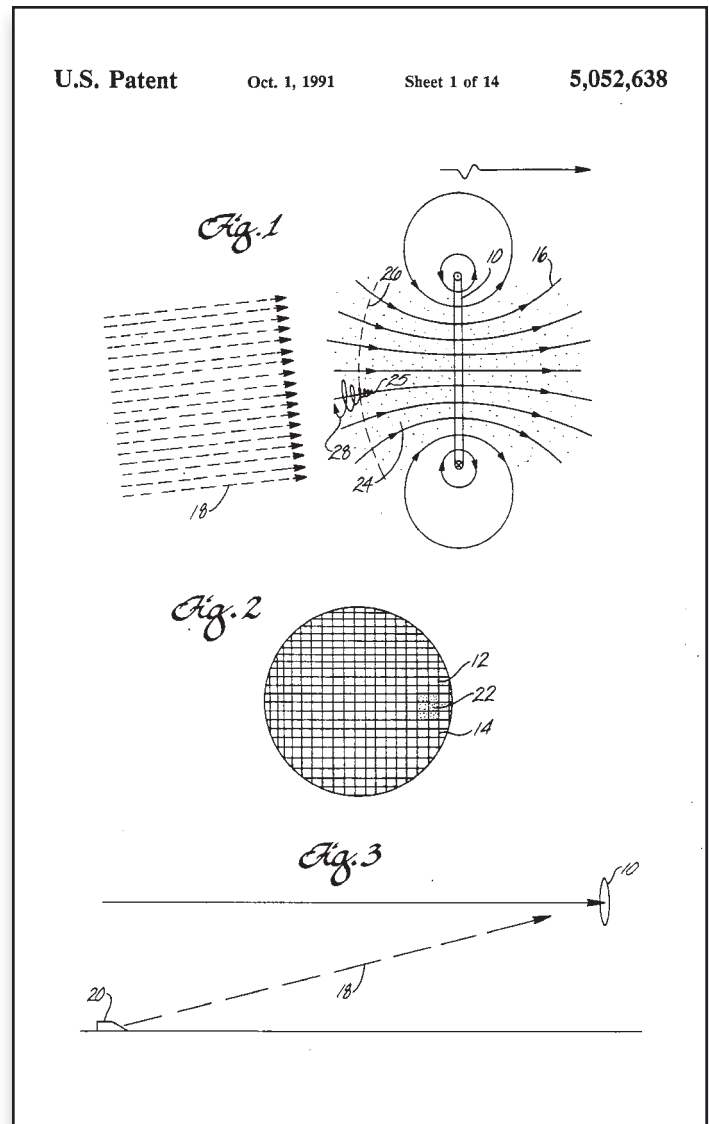


FIG. 1 is a schematic longitudinal cross section of an electromagnetic ramjet having a single superconducting dipole propulsion coil illustrating its basic operating principles; FIG. 2 is a schematic transverse cross section of a single coil electromagnetic ramjet illustrating its basic design features; and FIG. 3 is a schematic longitudinal perspective view illustrating a microwave transmitter on the earth's surface accelerating an electromagnetic ramjet by a high power microwave beam.

Condensing system and operating method

Patent number: US 5/040,373

Abstract

A cryogenic condensing system is provided wherein the working fluid is paramagnetic and entropy reduction is accomplished by means of a magnetic field. Condensation is obtained by isentropically expanding partially compressed vapor into a thermally insulated vacuum chamber with a sufficiently large expansion ratio to supersaturate the vapor, a portion of which condenses spontaneously. That portion of the vapor which does not condense is drawn out of the condensing chamber and into the bore of a superconducting solenoid by magnetic attractive forces thereby maintaining the vacuum environment inside the chamber. The noncondensed vapor is magnetized and magnetically compressed inside the solenoid thereby reducing its entropy. Heat of magnetization is extracted by a non-magnetic turbine which converts the kinetic energy of the gas stream pulled into the solenoid into mechanical work. The low entropy vapor is removed from the solenoid by a compressor mounted inside the bore such that its thermodynamic state is returned to the preexpanded state outside the magnetic field. This vapor is mixed with previously condensed vapor having the same thermodynamic state and recycled back through the condensing expander to produce a constant flow of condensed working fluid. The system could be used for cryogenic engines using oxygen.

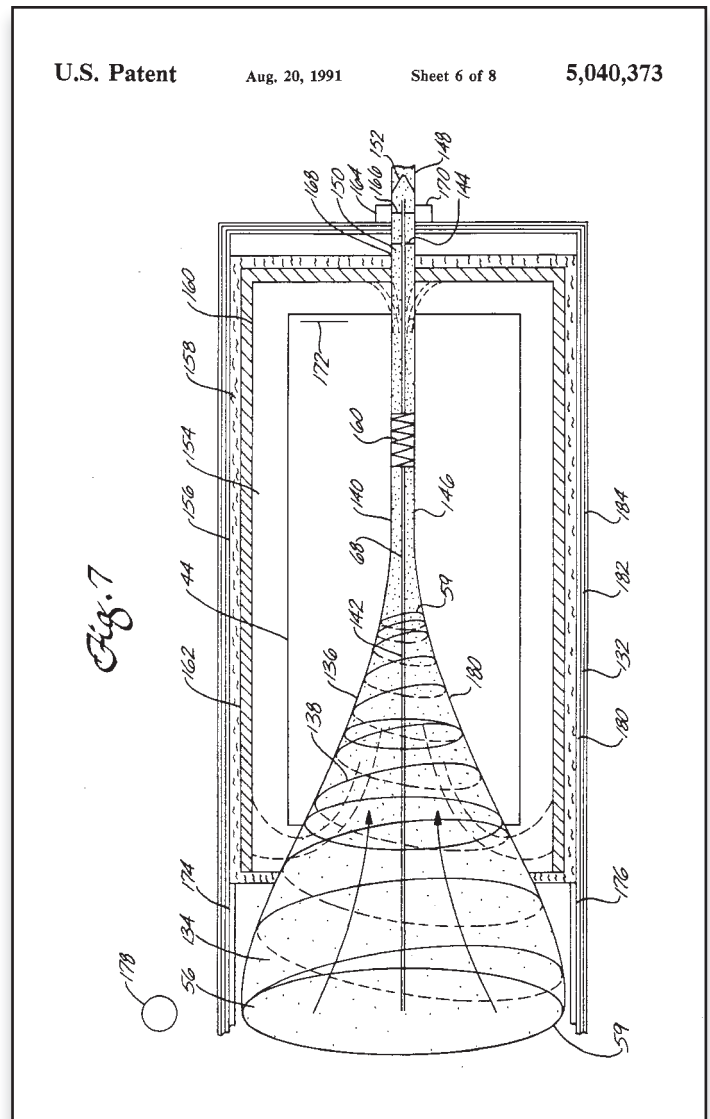


FIG. 7 is a schematic longitudinal perspective view illustrating the design and construction of the superconducting solenoid and magnetic energy turbine that is designed to removed and isothermally magnetize noncondensed oxygen vapor from the condensing chamber thereby maintaining the vacuum environment of the condensing chamber while simultaneously lowering the entropy of the noncondensed vapor.

Application US07/427,816 events :

- 1989-10-27: Application filed by Individual
- 1989-10-27: Priority to US07/427,816
- 1991-08-20: Application granted
- 1991-08-20: Priority to PCT/US1991/005916
- 1991-08-20: Priority to JP4502801A
- 1991-08-20: Priority to EP92902678A
- 1991-08-20: Publication of US5040373A

Electromagnetic ground to orbit propulsion method and operating system for high mass payloads

Patent number: US 4/939,976 A

Abstract

A reusable and regenerative electromagnetic propulsion method and operating system is provided for propelling high mass payloads to orbital velocities which does not require a vacuum environment. The propulsion system comprises a self supporting superconducting dipole coil several kilometers in diameter that is accelerated by magnetic repulsive forces generated by a plurality of giant superconducting field coils mounted in underground tunnels. The propulsion dipole is mounted inside a circular hypersonic wing-like structure equipped with movable aerodynamic control surfaces for guidance. The propulsion system can accelerate a payload with any desired launch azimuth by accelerating along a line of magnetic induction generated by the field coils having the desired azimuth angle. The payload is attached to the propulsion system by a plurality of cables. After reaching orbital velocity, the payload is detached from the propulsion system and the propulsion system is decelerated back to the earth's surface by magnetic repulsive forces generated by the field coils. A large fraction of the orbital energy of the propulsion system is reconverted back into electrical energy by the inductive coupling between the magnetically decelerated propulsion coil and the field coils which is used to launch another payload.

Inventor: Michael A. Minovitch

Application US07/176,679 events:

1988-04-0: Application filed by Individual

1988-04-01: Priority to US07/176,679

1990-07-10: Application granted

1990-07-10: Priority to US07/550,385

1990-07-10: Publication of US4939976A

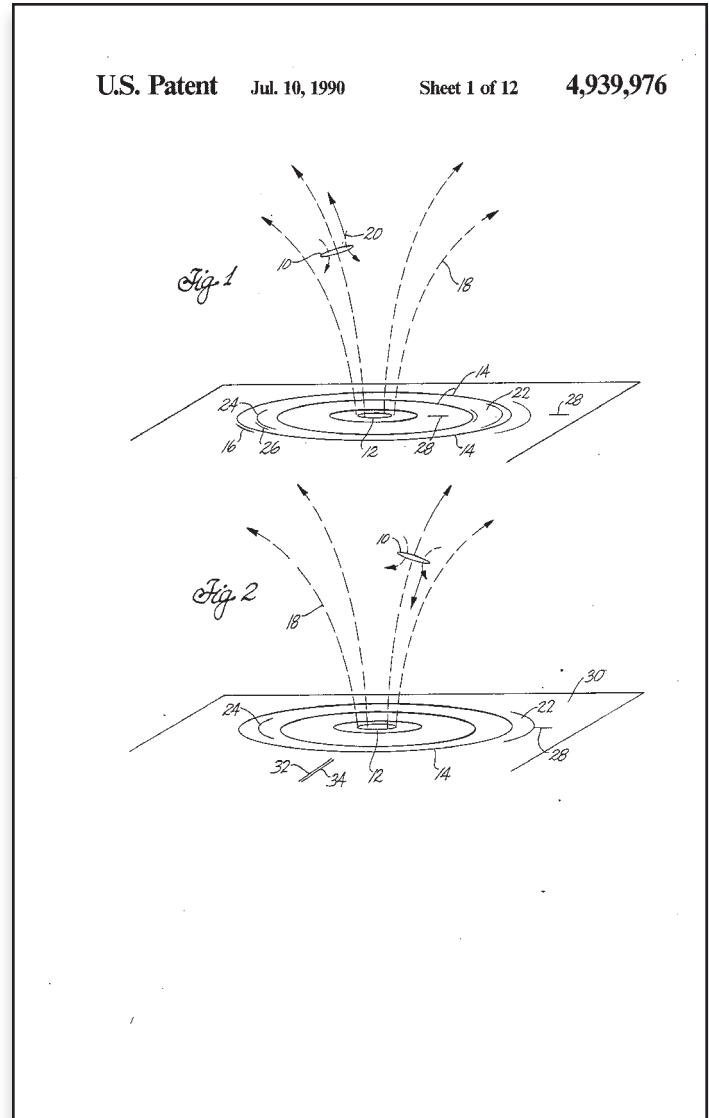


FIG. 1 is a schematic perspective view showing a superconducting propulsion dipole accelerating away from a plurality of coaxial field coils buried beneath the earth's surface illustrating the magnetic propulsion concept used in accelerating the payload and FIG. 2 is a schematic perspective view showing how a propulsion coil is magnetically decelerated from orbital velocity and returned to the launch site by an inductive coupling with the field coils thereby converting the potential and kinetic energy of the dipole back into electrical energy which is used to launch another payload.

Electromagnetic transportation system for manned space travel

Patent number: US US 4/795,113

Abstract

An electromagnetically propelled space transportation system is provided for transporting passengers and/or freight between the Earth's surface and orbiting spaceports via reusable spaceplanes. Each spaceplane is equipped with a plurality of superconducting propulsion coils extending along its fuselage and is accelerated to orbital velocities inside a vacuum tube by a 1,530 km long electromagnetic linear accelerator. The vacuum tube is evacuated by utilizing the accelerator as a giant vacuum pump wherein a free-moving, magnetically propelled, air-tight piston is driven through the entire tube at low speed thereby forcing the air directly out the end. The spaceplanes are equipped with movable wings and other aerodynamic surfaces that are retracted during launching and extended during landing. The accelerator is capable of launching spaceplanes directly to geosynchronous orbits or onto interplanetary trajectories. The accelerator is embedded deep underground with a maximum depth of 46 km and emerges near the summit of a high mountain. The system is powered by the Earth's gravitational field whereby natural hydro and geothermal energy is converted into electrical energy. Since substantially more electrical energy is generated than is used by the accelerator, the system produces vast amounts of clean renewable electrical energy.

Inventor: Michael A. Minovitch

Application US06/919,252 events:

1986-10-14: Application filed by Individual

1986-10-14: Priority to US06/919,252

1989-01-03: Application granted

1989-01-03: Publication of US4795113A

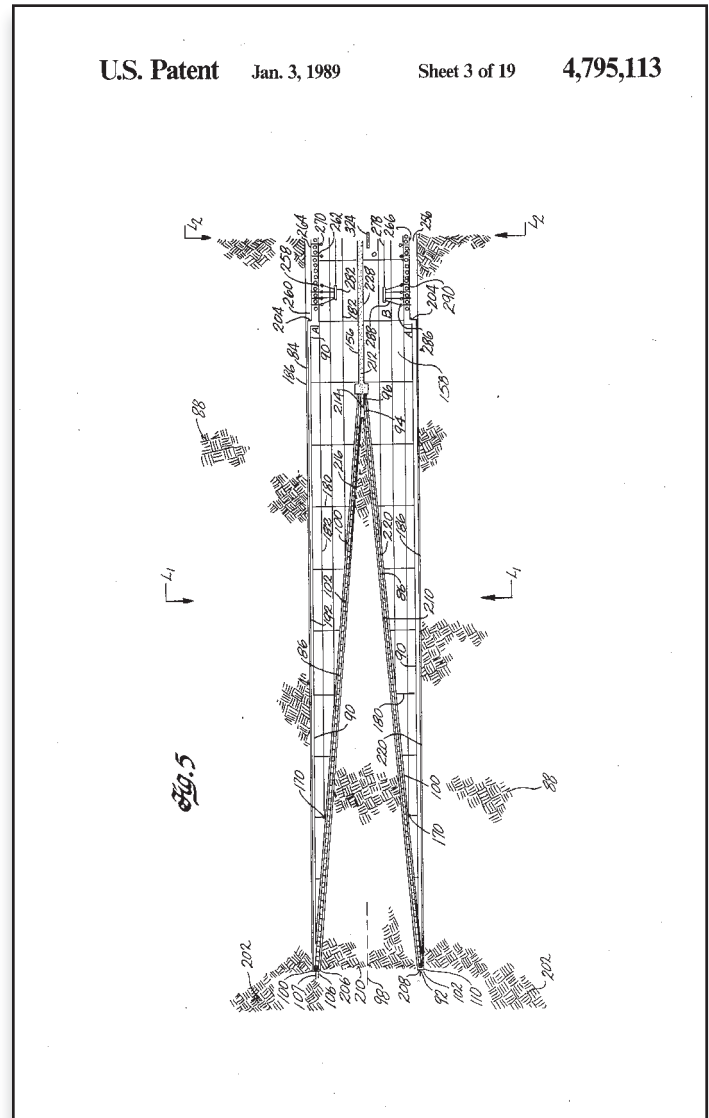


FIG. 5 is a schematic longitudinal cross section illustrating the design and construction of the forward portion of a deep Earth gravity powered hydraulic tunnel boring machine.

Electromagnetic launching system for long-range guided munitions

Patent number: US 4/939,976 A

Abstract

A reusable and regenerative electromagnetic propulsion method and operating system is provided for propelling high mass payloads to orbital velocities which does not require a vacuum environment. The propulsion system comprises a self supporting superconducting dipole coil several kilometers in diameter that is accelerated by magnetic repulsive forces generated by a plurality of giant superconducting field coils mounted in underground tunnels. The propulsion dipole is mounted inside a circular hypersonic wing-like structure equipped with movable aerodynamic control surfaces for guidance. The propulsion system can accelerate a payload with any desired launch azimuth by accelerating along a line of magnetic induction generated by the field coils having the desired azimuth angle. The payload is attached to the propulsion system by a plurality of cables. After reaching orbital velocity, the payload is detached from the propulsion system and the propulsion system is decelerated back to the earth's surface by magnetic repulsive forces generated by the field coils. A large fraction of the orbital energy of the propulsion system is reconverted back into electrical energy by the inductive coupling between the magnetically decelerated propulsion coil and the field coils which is used to launch another payload.

Inventor: Michael A. Minovitch

Application US07/176,679 events:

1988-04-0: Application filed by Individual

1988-04-01: Priority to US07/176,679

1990-07-10: Application granted

1990-07-10: Priority to US07/550,385

1990-07-10: Publication of US4939976A

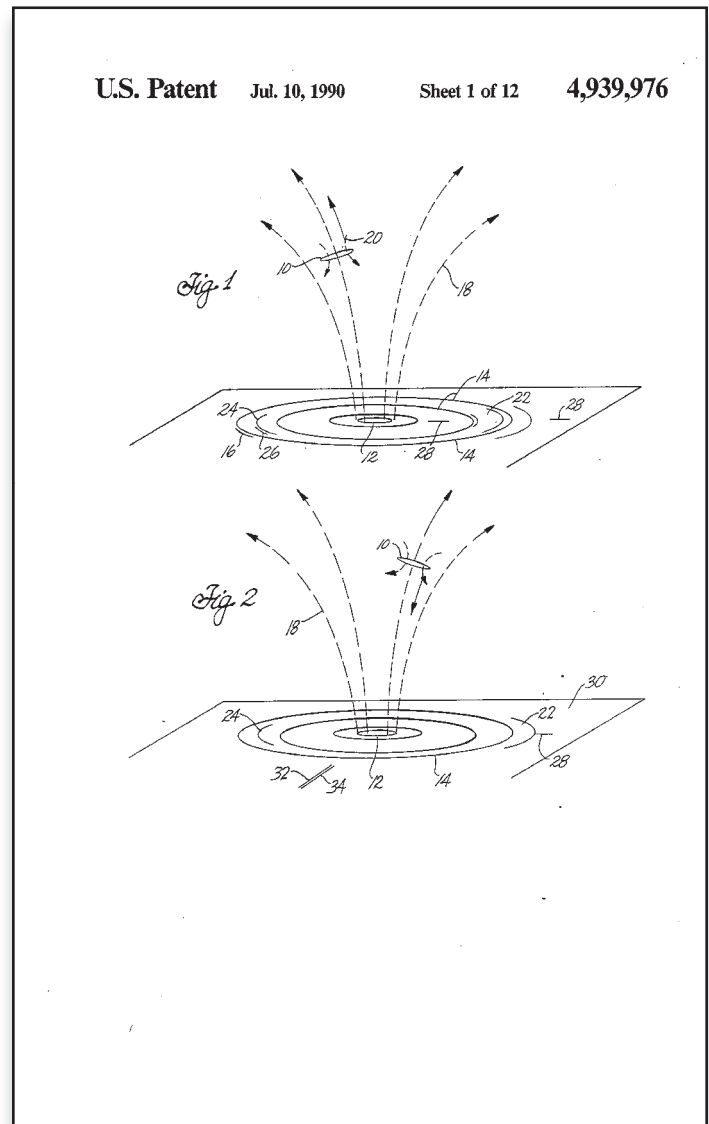


FIG. 1 is a schematic perspective view showing a superconducting propulsion dipole accelerating away from a plurality of coaxial field coils buried beneath the earth's surface illustrating the magnetic propulsion concept used in accelerating the payload and FIG. 2 is a schematic perspective view showing how a propulsion coil is magnetically decelerated from orbital velocity and returned to the launch site by an inductive coupling with the field coils thereby converting the potential and kinetic energy of the dipole back into electrical energy which is used to launch another payload.

Self-refueling space propulsion system and operating method

Patent number: US 4/754,601

Abstract

A propulsion system for reusable space-based vehicles is presented wherein the propulsive working fluid is atmospheric gas. Acceleration or deceleration propulsion is obtained by expelling or ingesting atmospheric gas respectively. Consequently, propulsive working fluid expelled during accelerating forward propulsive maneuvers is automatically replenished during decelerating retro propulsive maneuvers. The refueling retro thrust is generated by a large diameter hypervelocity inlet diffuser mounted at the front of the vehicle which scoops up atmospheric gas while traversing through the tenuous upper regions of a planet's atmosphere. The vehicle thereby transfers a portion of its momentum to the collected gas which was initially at rest in the atmosphere. This transfer of momentum generates a decelerating retro thrust by a reverse application of the theory of classical rocket propulsion.

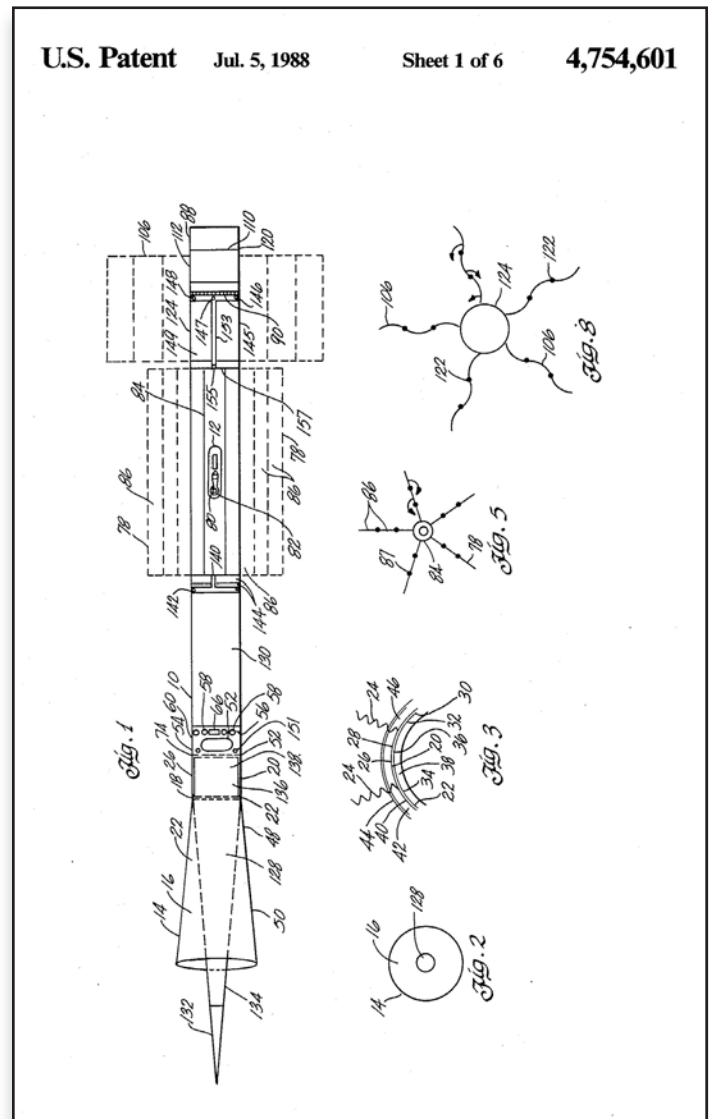


FIG. 1 is a schematic longitudinal cross-section illustrating the design and construction of the preferred embodiment of a self-refueling propulsion system mounted inside a space vehicle; FIG. 2 is a transverse cross-section of the intake diffuser shown in FIG. 1; FIG. 3 is an enlarged schematic transverse cross-section through a portion of the annular hot gas radiation chamber of the inlet diffuser; FIG. 5 is a schematic transverse cross-section illustrating the design and construction of a plurality of fold-out high temperature radiator panels for the nuclear-electric power plant; FIG. 8 is a schematic cross-section through FIG. 1, illustrating the design and construction of a plurality of swing-out low temperature space radiators for the high power microwave generators.

Inventor: Michael A. Minovitch

Application US06/683,039 events:

1984-12-18: Application filed by Individual

1984-12-18: Priority to US06/683,039

1988-07-05: Application granted

1988-07-05: Publication of US4754601A

Condensing atmospheric engine and method

Patent number: EP 0267992A1

Abstract

A thermodynamic method and engine is provided for extracting heat energy from the natural environment at ambient temperature and converting it into mechanical work. The extraction and conversion process is accomplished by compressing liquefied air at cryogenic temperature to very high pressure and feeding it through a plurality of serially connected heat exchangers (62,66,70) maintained in thermal contact with the natural environment, and a like plurality of expanders (64,68,72) interposed between adjacent heat exchangers. Each expander converts the natural heat energy absorbed in the preceding heat exchanger into mechanical work. Condensation is obtained by isentropically expanding cold, partially compressed vapor discharged from the last expander (72) into a thermally insulated vacuum chamber (30). By employing sufficiently high expansion ratios, a large fraction of the vapor can be made to undergo spontaneous condensation into the solid phase. The solidified air is withdrawn from the vacuum chamber, melted, recompressed and recycled back through the ambient heat exchangers to extract more natural heat energy for conversion into more mechanical work. The high entropy non-condensed vapor is removed from the vacuum chamber, replaced with lower entropy air taken from the atmosphere and recycled back through the condensing expander such that the amount of air condensed remains unchanged.

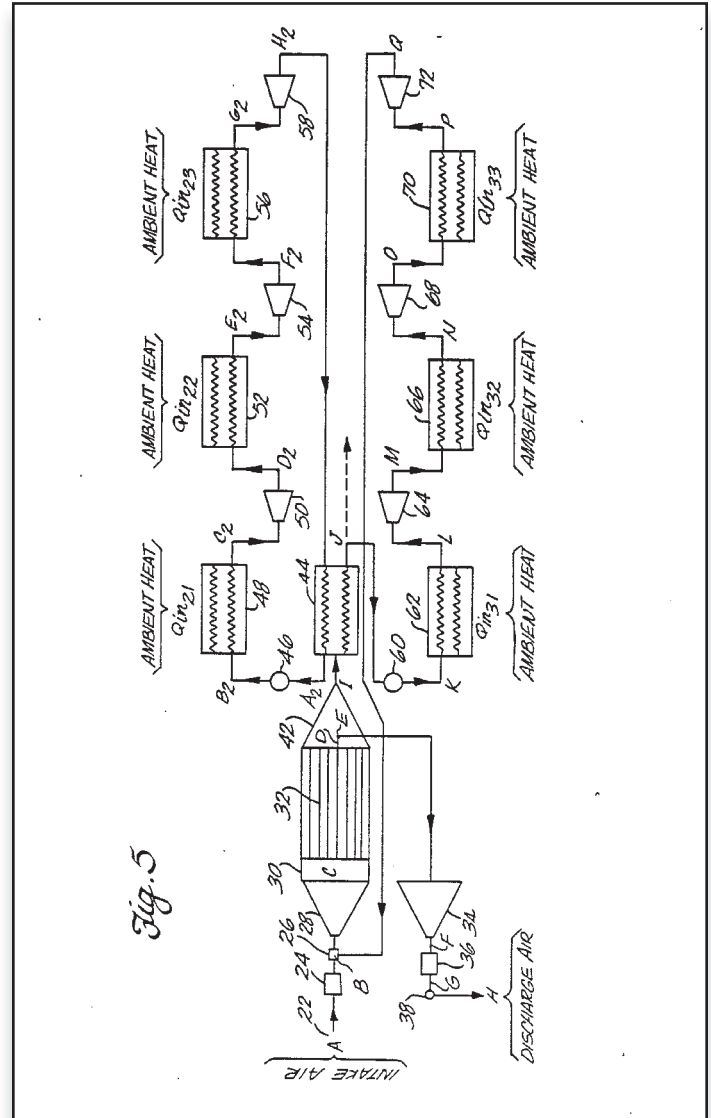


Fig. 5, above, is a block diagram of a multiple stage air-powered condensing atmospheric engine corresponding to one embodiment of the present invention.

Inventor: Michael A. Minovitch

Application EP86308942A events:

1983-08-12: Priority to US06/522,847

1986-11-17: Application filed by Individual

1986-11-17: Priority to EP86308942A

1988-05-25: Publication of EP0267992A1

Inflatable core orbital construction method and space station

Patent number: US 4/730,797

Abstract

An economical method for constructing large continuous-walled structures in orbit is presented. In this method a lightweight, non-elastic, topologically closed inflatable surface with thin flexible walls is transported to orbit where it is inflated to form a semi-rigid surface. This inflated surface is then used as a guide for constructing the hull of the structure by wrapping the surface with long sheets of high strength material until the desired wall thickness and rigidity is obtained. The wrapping process is accomplished automatically by a wrapping machine. Since the inflatable surface can be packaged into a small volume, and since the sheets of wrapping material can be rolled into spools with very high packing density, it is possible to construct large continuous-walled pressurized structures in orbit using robotics with relatively few Shuttle flights. The method is used to construct a large permanently manned orbiting space station that provides an artificial gravity environment for the living quarters and connecting variable gravity environments for research and materials processing. The basic structural design of the space station consists of a rotating torus with three connecting spoke cylinders and two Earth-fixed column cylinders extending along the rotation axis mounted on each side of the torus' hub.

Inventor: Minovitch, Michael A.

Application US06/764,713 events:

1985-08-12: Application filed by Individual

1985-08-12: Priority to US06/764,713

1988-03-15: Application granted

1988-03-15: Publication of US4730797A

U.S. Patent Mar. 15, 1988 Sheet 1 of 7 4,730,797

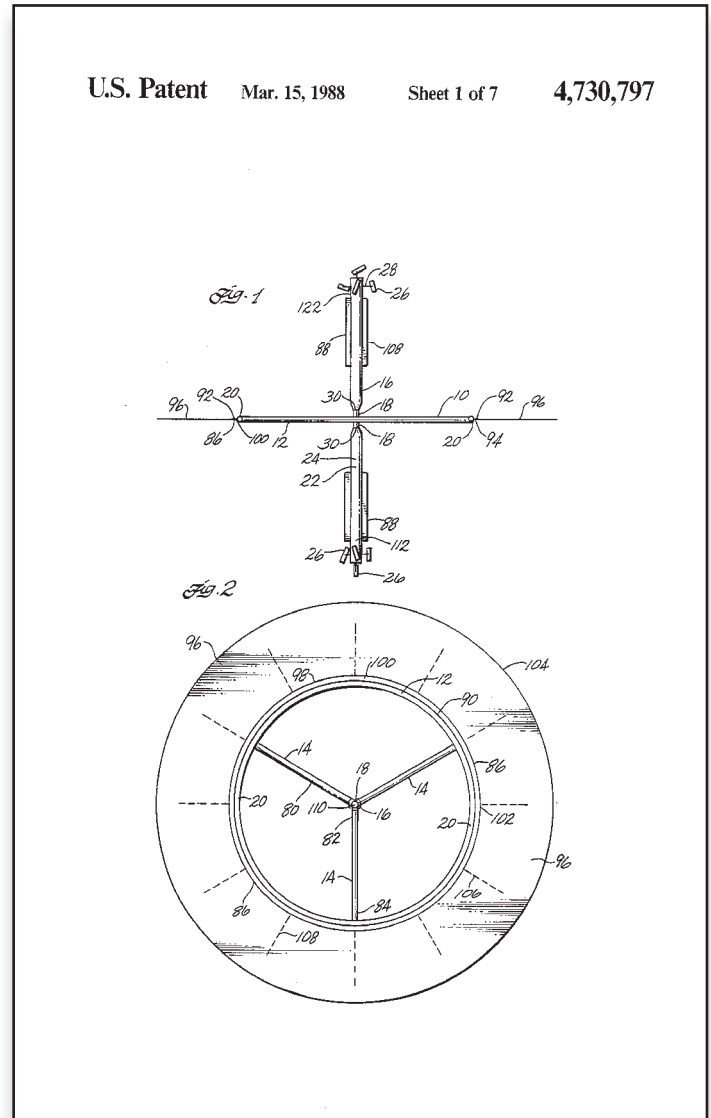


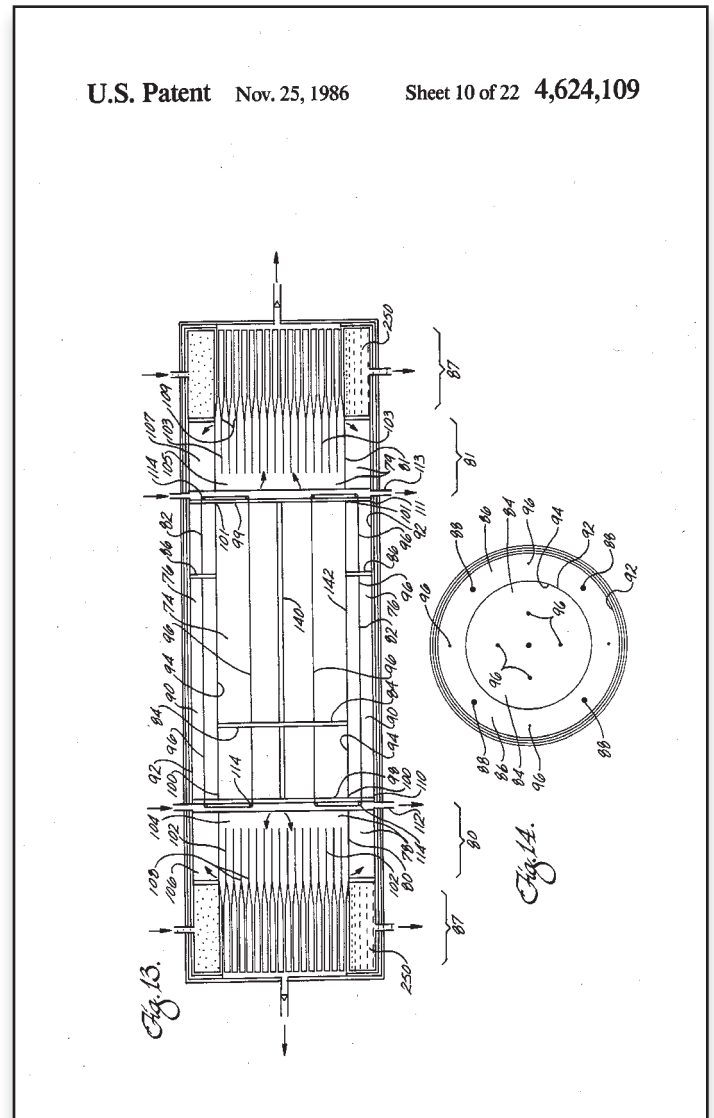
FIG. 1 is a schematic cross-section of the space station taken in the plane of the station's spin axis and FIG. 2 is a schematic cross-section of the space station taken through the mid-plane of the torus perpendicular to the spin axis.

Condensing atmospheric engine and method

Patent number: US 4,624,109

Abstract

A thermodynamic method and engine is provided for extracting natural thermal energy from ambient atmospheric air and converting it into mechanical work. The extraction process is accomplished by isentropically expanding ordinary air at atmospheric pressure into a thermally insulated vacuum chamber maintained at low pressure. By employing sufficiently high expansion ratios, a large portion of the air can be made to undergo a spontaneous phase transformation into the solid state at cryogenic temperature. This results in a substantial reduction of the specific volume of the condensed air which enables the vacuum environment of the chamber to be maintained by expending less mechanical work than that gained from the initial expansion. Thus, the net amount of mechanical work generated therefrom is positive. Substantial additional mechanical work is generated by harnessing the thermal potential difference between the low temperature condensed air and the ambient environment via additional cryogenic engine stages.



Inventor: Minovitch, Michael A.

Application US06/522,847 events:

1983-08-12: Application filed by Individual

1983-08-12: Priority to US06/522,847

1986-11-17: Priority claimed from EP86308942A

1986-11-25: Application granted

1986-11-25: Publication of US4624109A

Fig. 13, above, is a schematic longitudinal cross section of a piston driven ambient air expansion/recompression system including dual vacuum chambers, solid phase condensers and second stage condensers illustrating their design and construction and FIG. 14 is a schematic transverse cross section of a piston driven ambient air expansion/recompression system including dual vacuum chambers, solid phase condensers and second stage condensers illustrating their design and construction.

Tubular conveyor system and operating method

Patent number: US 4/601,389 A

Abstract

An enclosed tubular continuous mechanical conveying system and method are provided for transporting bulk material or passengers at high speed along straight, curved or twisting paths with unlimited length in three-dimensional space. The conveying medium is a moving endless flexible toroidal surface that is elongated along the direction of motion. The inner surface of the toroid forms a moving enclosed duct that comprises the carrying portion of the surface while the outer portion forms another duct that moves in the opposite direction which encloses the inner duct and comprises the return run of the surface. A rigid, duct-like structure, is mounted inside the moving surface to maintain its shape. The surface is constructed with an elastic material to enable it to move around the rigid inner duct without tearing. The moving surface is mounted inside a rigid protective outer duct which completely encloses the conveyor. Driving means is provided for continuously moving the conveying surface around the inner duct structure. The carrying surface can be supported by a cushion of air trapped inside the toroidal surface or by a magnetic suspension system or by a slider-bed or roller-bed suspension system attached to the rigid inner duct.

Inventor: Minovitch, Michael A.

Application US06/652,146 events:

1984-09-17: Application filed by Individual

1984-09-17: Priority to US06/652,146

1986-07-22: Application granted

1986-07-22: Publication of US4601389A

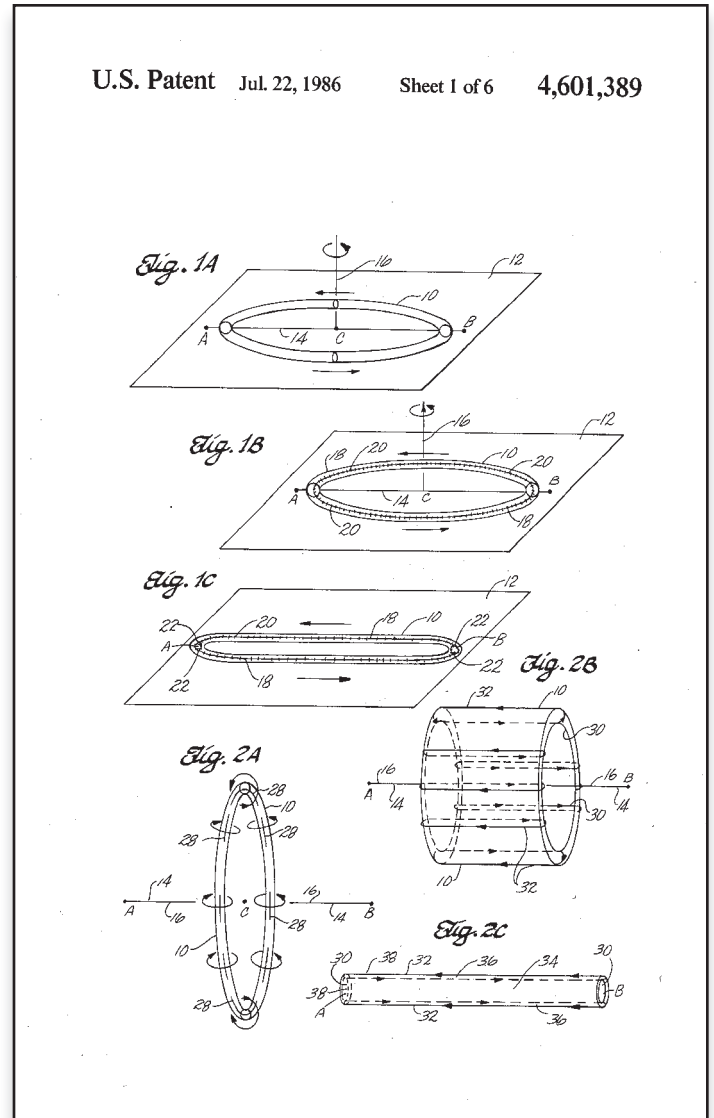
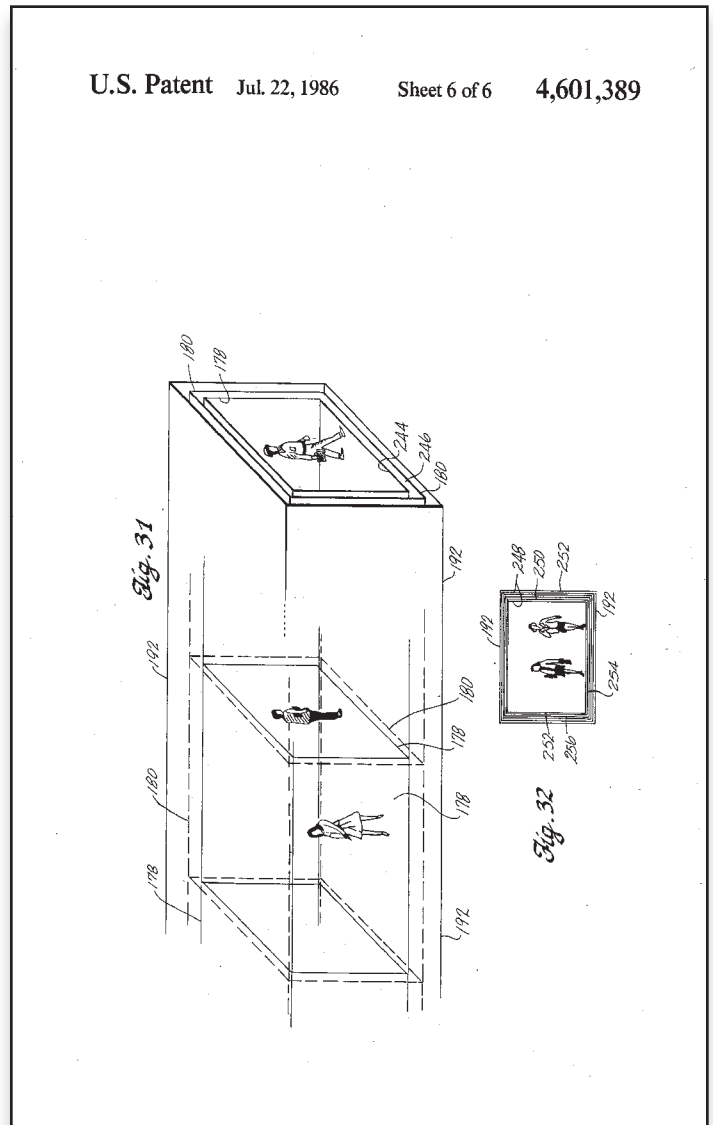
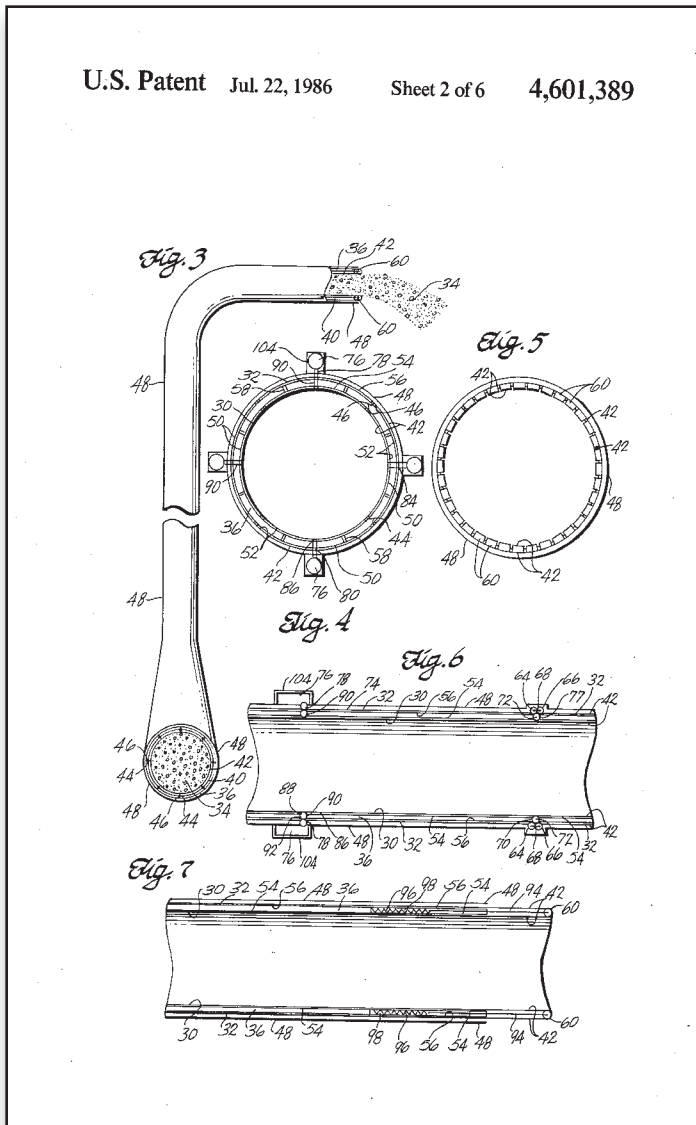


FIG. 1A illustrates the fundamental tubular conveyor problem where a closed tubular conveying surface is continuously moved around a circular endless path between a loading point and an unloading point; FIG. 1B illustrates the prior art solution of the tubular conveyor problem which involves cutting a continuous slit around the closed tubular conveying surface and attaching zipper-like teeth which mesh together on each edge; FIG. 1C illustrates the basic topological aspects of the prior art closed belt tubular conveyor system with mechanical zipper mechanisms for continuously opening and closing the moving tubular conveying surface at the loading and unloading points.



Patent US 4/601,389 A, FIG. 2A, previous page, illustrates how a new solution to the tubular conveyor problem can be obtained by rotating the toroidal surface shown in FIG. 1A 90° and twisting it around its minor axis instead of rotating it about its major axis; FIG. 2B illustrates the same moving toroidal surface of FIG. 2A at some intermediate point while it is shrunk toward and stretched along its major axis and FIG. 2C illustrates the same moving toroidal surface of FIG. 2A after it has been shrunk toward and stretched along its major axis which represents a fundamentally new tubular conveying surface and a fundamentally new solution of the tubular conveyor problem on which the present invention is based. FIG. 3, above, illustrates a perspective, cut-away view of one embodiment of the tubular conveyor having a rigid inner guide tube mounted inside the moving toroidal conveying surface and a rigid outer tube cover; FIG. 4 is an enlarged transverse cross-section of one embodiment of the tubular conveyor with a rigid inner guide tube and a rigid outer tube cover; FIG. 5 is a transverse cross-section of the conveyor shown in FIG. 4 through one of its ends illustrating the circumferential end rollers; FIG. 6 is a longitudinal cross-section of the tubular conveyor shown in FIG. 4 illustrating the moving toroidal conveying surface and the rigid inner guide tube and rigid outer tube cover and FIG. 7 is a longitudinal cross-section of the tubular conveyor shown in FIG. 4 illustrating the take-up mechanism mounted at each end. FIG. 31 is a cut-away perspective view of a rigid high speed tubular conveyor with rectangular cross-section for transporting passengers and FIG. 32 is a transverse cross-section of an ultra high speed tubular passenger conveyor with a non-contacting, magnetic suspension system.

Tubular conveyor system and its operating procedures

Patent number: DE 3307361 A1

Abstract

An enclosed tubular continuous mechanical conveying system and method are provided for transporting bulk material or passengers at high speed along straight, curved or twisting paths with unlimited length in three-dimensional space. The conveying medium is a moving endless flexible toroidal surface that is elongated along the direction of motion. The inner surface of the toroid forms a moving enclosed duct that comprises the carrying portion of the surface while the outer portion forms another duct that moves in the opposite direction which encloses the inner duct and comprises the return run of the surface. A rigid, duct-like structure, is mounted inside the moving surface to maintain its shape. The surface is constructed with an elastic material to enable it to move around the rigid inner duct without tearing. The moving surface is mounted inside a rigid protective outer duct which completely encloses the conveyor. Driving means is provided for continuously moving the conveying surface around the inner duct structure. The carrying surface can be supported by a cushion of air trapped inside the toroidal surface or by a magnetic suspension system or by a slider-bed or roller-bed suspension system attached to the rigid inner duct.

Applicant / Inventor: Minovitch, Michael A. [US]

Classifications: IPC - B65G15/08; B65G15/60; B65G21/08; B65G54/00; B66B21/10; (IPC1-7): B65G15/08;

CPC - B65G15/08 (EP); B65G15/60 (EP); B66B21/10 (EP); B65G2201/04 (EP);

Priorities: US35475482A:1982-03-04

Application: DE3307361A:1983-03-02

Publication: DE3307361A1:1983-09-08

Published as: CA1208595A;DE3307361A1;GB2116138A;GB-2116138B;JPH0258166B2;JPS58188212A

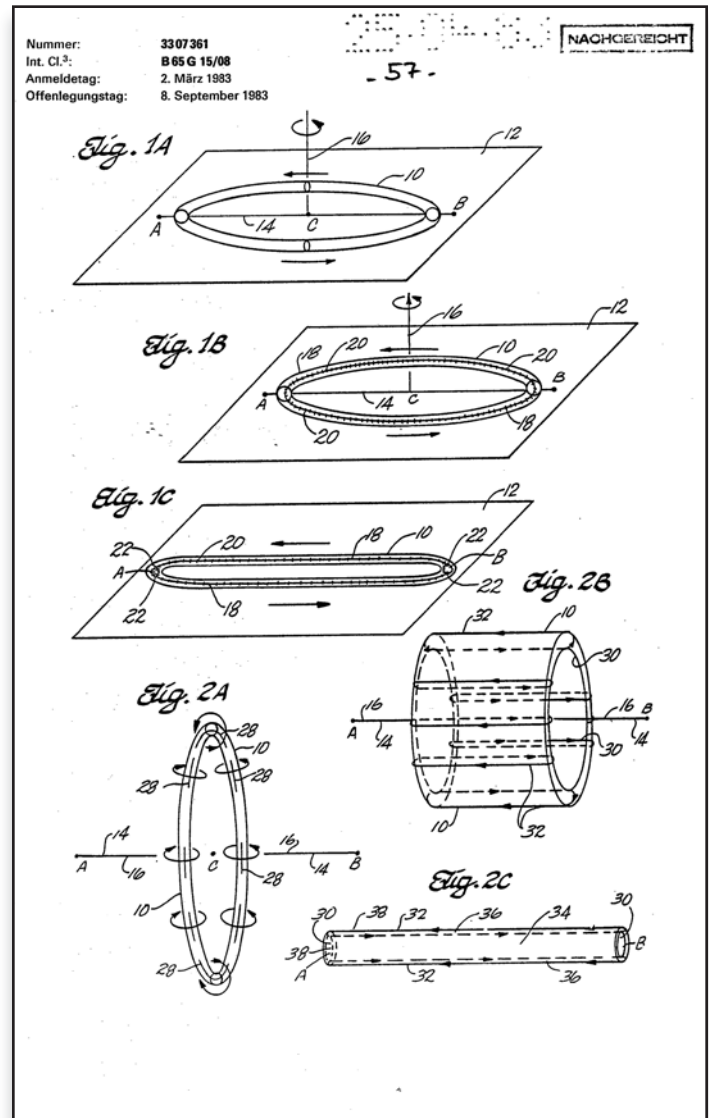


Fig.1A illustrates the basic problem of the tube-like conveyor. A closed tube-shaped bottle moves continuously on a circular endless path between a loading point and an unloading point; Fig.1B illustrates the previous solution to the problem of a tube-shaped conveyor, in which a slit is cut into the closed tube-shaped conveyor flange and both resulting edges are provided with teeth that interlock like a zipper and Fig.1C illustrates the basic topology aspects of the previous closed-belt tube-shaped conveyor, in which a mechanical zipper is used to continuously separate and unlock the tube-shaped 2" conveyor area at the loading and unloading point. Fig.2A illustrates how to get a new solution to the problem of the tube-like conveyor by using the toroida.; Fig.2C shows the same moving toroidal surface from Fig.2A, after it has been pulled along the torus axis and stretched along the torus axis. This represents a fundamentally new type of tube-like conveyor and a fundamentally new solution to the problem of the tube-like conveyor on which this invention is based.

Automated road transportation system

Patent number: US 4/361,202 A

Abstract

An automated transportation system for vehicular travel along a roadway is presented. The roadway can be any hard surface that contains an embedded metallic guiderail along its center. A proximity transducer (metal detector) installed under the vehicle, senses the metallic guiderail and sends steering commands to the vehicle's steering actuators to keep the vehicle moving in the center of the roadway directly over the guiderail. Transponders are embedded along the guiderail at selected points for automatic roadway identification, position determination and automatic speed, headway and route selection and automatic traffic control. The system also provides automatic branching and lane changing. The vehicle's control system includes sensors, signal processors, a microprocessor and various power actuators that are connected to the vehicle's steering, braking and accelerator systems. An on-board collision avoidance system using sonic or radar detection means is also provided. The vehicle can be programmed to automatically follow a pre-selected route by inserting route instructions into the microprocessor's memory where it can be retrieved and used any number of times. Magnetometer sensors are also embedded along the roadway to detect the presence and speed of all vehicles, thereby allowing ordinary, manually-controlled vehicles to use the same roadways as the automatically controlled vehicles for a mixed traffic flow. The guiderails and transponders can be embedded in essentially all existing streets and highways to provide an economical comprehensive fully automated road transportation system for private and commercial vehicles.

Type: Grant

Filed: Jun 15, 1979

Date of Patent: Nov 30, 1982

Inventor: Michael Minovitch (Los Angeles, CA)

Primary Examiner: David M. Mitchell

Law Firm: Christie, Parker & Hale

Application Number: 6/48,715

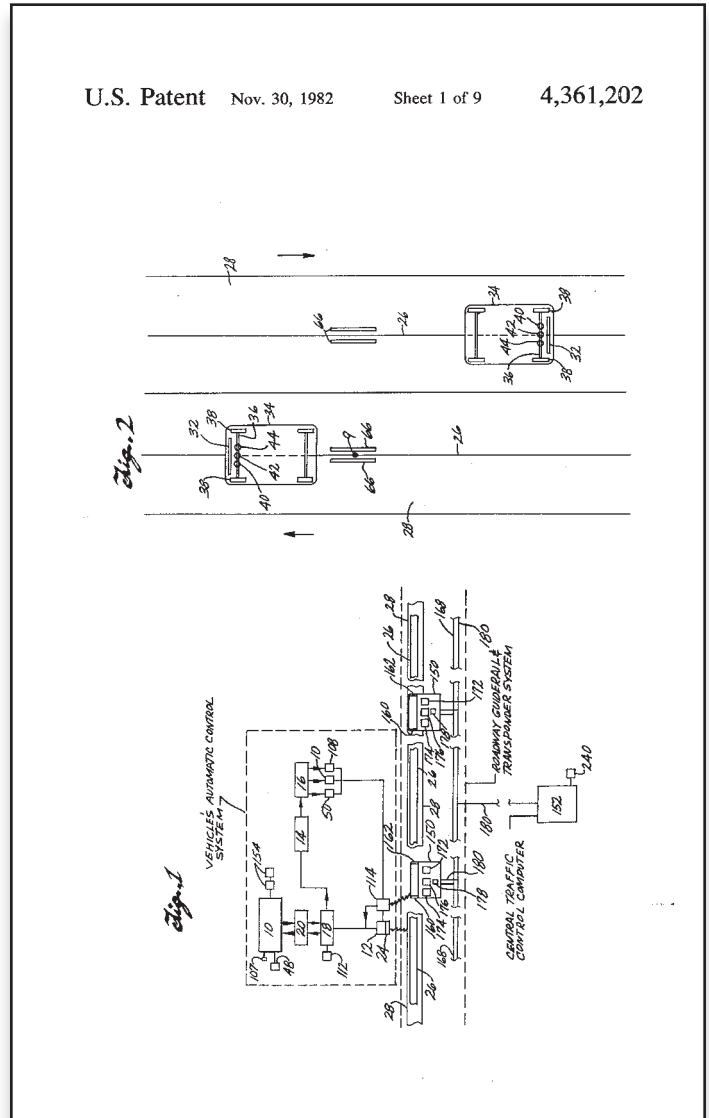
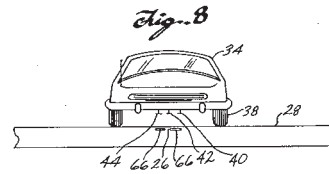
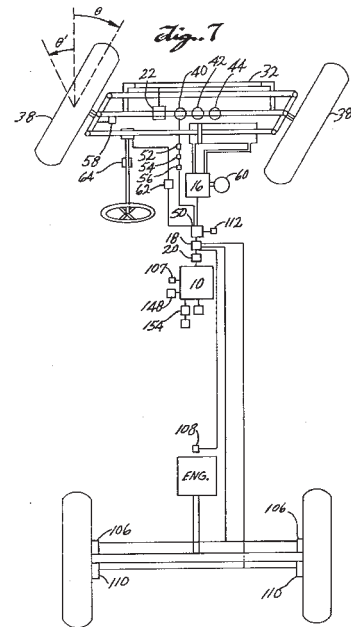
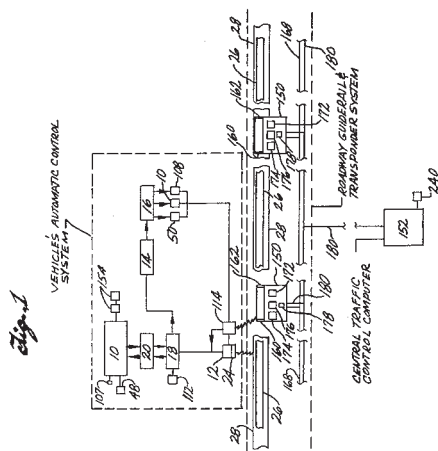
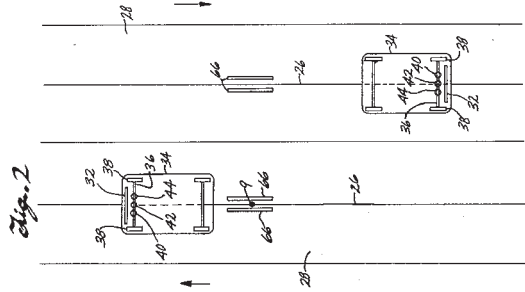


FIG. 1 illustrates a vertical longitudinal cross-section of a representative underground tunnel path connecting two adjacent stations S1 and S2 and FIG. 2 is a transverse cross-section of the outer tunnel and inner, split-level vacuum tunnel mounted inside and containing upper and lower level cars.



US 4/361,202 A : FIG1 illustrates a schematic block diagram of a vehicle's automatic control system including a schematic block diagram of a portion of automated roadway and remote central traffic control computer; FIG. 2 illustrates a horizontal projection of two automatically controlled vehicles moving in opposite directions over a guiderail equipped roadway with various electronic guidance and control sensors shown schematically; FIG. 8 illustrates a vertical transverse view of an automatically controlled vehicle moving over a guiderail equipped roadway and a pair of control transponders; and FIG. 9 is a cut-away, three-dimensional perspective view of a typical passive control transponder illustrating its interior construction.

Rapid transit system

Patent number: US 4,075,948

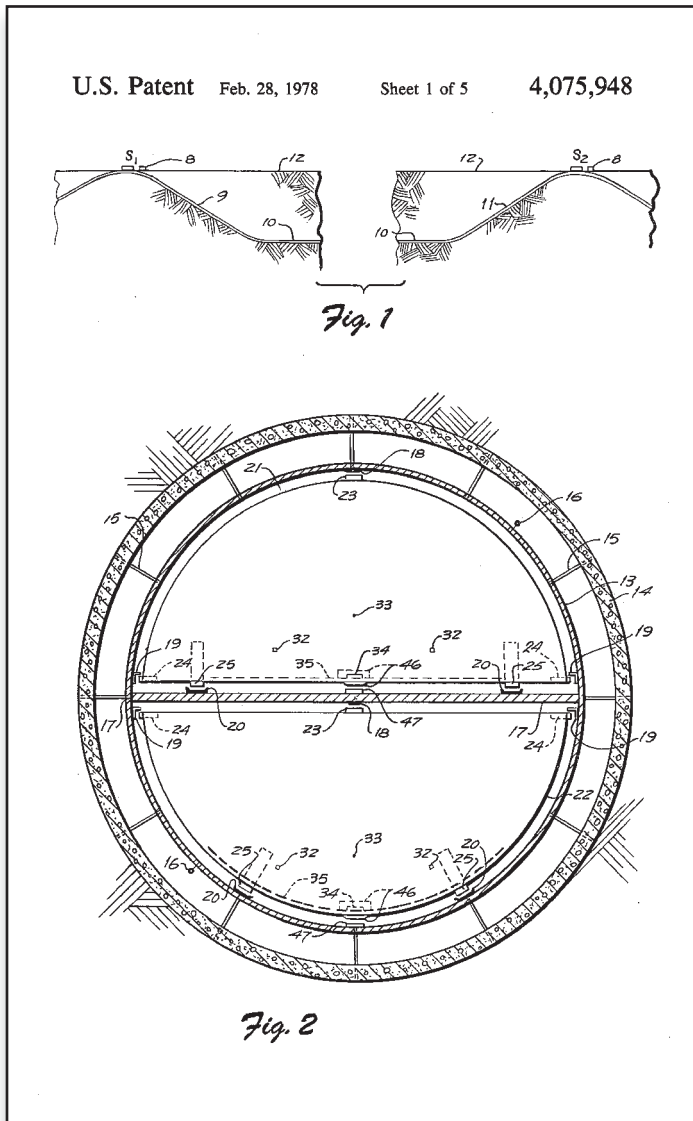


FIG. 1 illustrates a vertical longitudinal cross-section of a representative underground tunnel path connecting two adjacent stations S1 and S2 and FIG. 2 is a transverse cross-section of the outer tunnel and inner, split-level vacuum tunnel mounted inside and containing upper and lower level cars.

Abstract

A rapid transit system in which a vehicle, typically consisting of a train of detachably coupled cars, is suspended in a vacuum tunnel with at least two sloping reaches from a ferromagnetic monorail of high resistivity by magnetic attraction and propelled by gravity. Servo-controlled electromagnets allow the vehicle to be suspended from the rail without actually being in contact with it or any other part of the tunnel. Propulsion by gravity from one station to the next is accomplished by allowing the vehicle to coast frictionlessly down one sloping reach of the tunnel during which time it is automatically accelerated, leveling off at the horizontal reach at some cruising depth where it coasts along at an essentially constant maximum speed, and then moving up the next sloping reach toward the second station during which time it is automatically decelerated, and finally stopping at the station where the original elevation is reached.

Type: Grant

Filed: January 31, 1974

Date of Patent: February 28, 1978

Inventor: Michael A. Minovitch

Rapid transit system

Patent number: US 3/954,064 A

Abstract

A rapid transit system in which a vehicle, typically comprising a train of detachably coupled cars, is suspended in an underground vacuum tunnel by permanent magnetic rails of high coercivity and propelled by gravity. For closely spaced stations, such as in urban areas, the connecting tunnel paths are smooth continuous curves, lying essentially in the vertical planes connecting adjacent stations. For widely separated stations, such as in inter-city transit systems, the tunnel paths have horizontal reaches at their maximum depth, joined at the ends by smooth paths which arc up towards each station. The magnetic suspension and the vacuum environment enables the vehicle to move frictionlessly at high speeds without contacting the rails or any other part of the tunnel. Gravity propulsion from one station to the next is accomplished by allowing the vehicle to move frictionlessly down the decending arc of the tunnel, during which time it is accelerated by gravity, and decelerating by gravitational braking while moving along the tunnel's ascending arc. Thus, the trip is accomplished by transforming the vehicle's gravitational potential energy into kinetic energy and back into gravitational potential energy. Excess kinetic energy arising from moving between stations having different elevations is supplied or absorbed by onboard linear motor/generators that provide supplementary propulsion or regenerative braking. These linear motor/generators draw and return energy to on-board flywheel energy storage units. While moving along very long straight tunnel paths the vehicle's gravitational coasting speed is boosted by flywheel energy which is recovered by regenerative braking. Since the motion is essentially without friction and since the linear motor/generator-flywheel motor/alternator system can be designed with very high efficiencies, the principle of conservation of energy applies and very little input energy is required. In the ideal case, no input energy would be required since the vehicle's total energy remains constant even while moving between two stations at high speed. When the vehicle is at rest at stations having different elevations, the differences in its gravitational potential energy are balanced essentially by equal differences in its stored flywheel inertial energy. Except for a small amount of electrical energy expended for life support systems and to make up for losses due to energy conversion inefficiencies, no energy is used or required for the actual trips between stations.

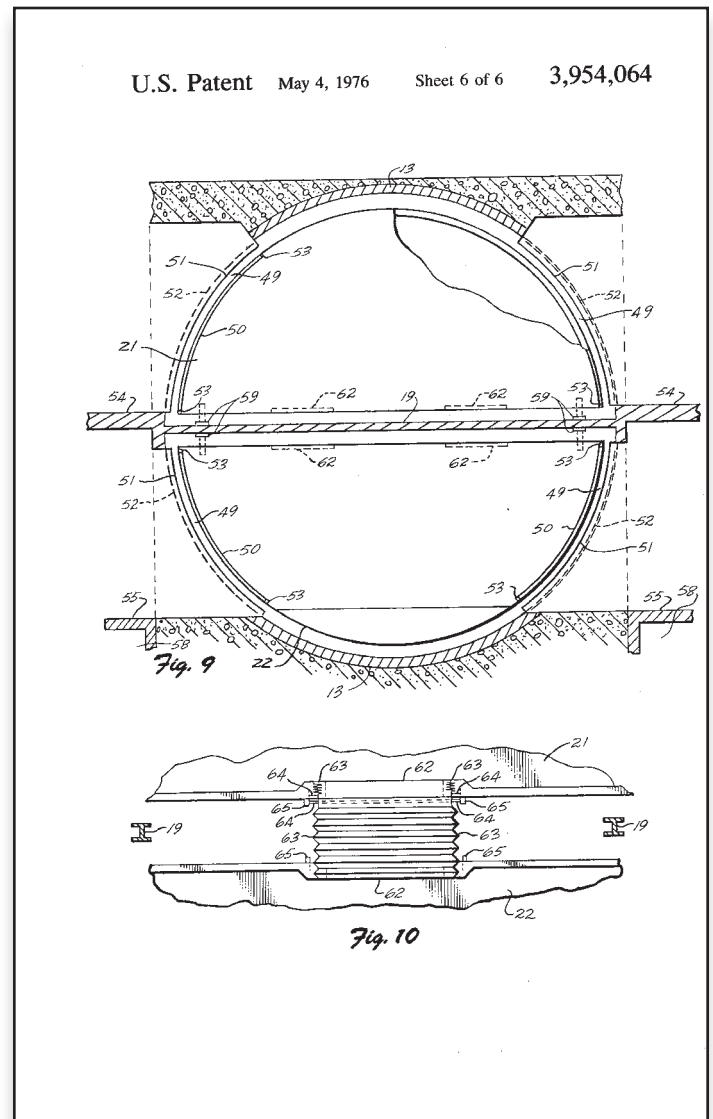


FIG. 9 is a transverse vertical tunnel cross-section illustrating the air-locks that permit direct passage between a car's interior and a station platform while the car remains in a hard vacuum environment; and FIG. 10 illustrates an emergency escape air-lock system.

1974-01-31: Priority to US05/438,230

1974-05-03: Application filed by GRAVITY TRANSIT Co

1974-05-03: Priority to US05/466,609

1976-04-30: Priority to US05/682,085

1976-05-04: Application granted

1976-05-04: Publication of US3954064A

High speed rapid transit system

Patent number: US 4/148,260

Abstract

A high speed ground transportation system, is suspended in an underground vacuum tube by a frictionless magnetic suspension system and propelled by gravity. The tubes are suspended inside deep underground tunnels from anchor points near each adjacent station and follow smooth catenary curves similar to the main suspension cables of a suspension bridge. Gravity propulsion is accomplished by allowing the vehicle to coast down the descending arc of the tube, during which time it is accelerated by gravity, and decelerating by gravitational braking while coasting up the tube's ascending arc. Thus, the trip is accomplished by transforming the vehicle's gravitational potential energy at one station into kinetic energy and back into gravitational potential energy at the next station. Excess kinetic energy arising from coasting between stations having different elevations is supplied or absorbed by on-board linear motor/generators that provide supplementary propulsion or regenerative braking. These linear motor/generators draw and return energy to an on-board flywheel kinetic energy storage system. Passenger and cargo transfer between the vehicle's interior and station is made without removing the vacuum environment of the vehicle, by providing air-locks through the tube walls at the station.

Type: Grant

Filed: April 30, 1976

Date of Patent: April 10, 1979

Inventor: Michael A. Minovitch

U.S. Patent Apr. 10, 1979 Sheet 2 of 11 4,148,260

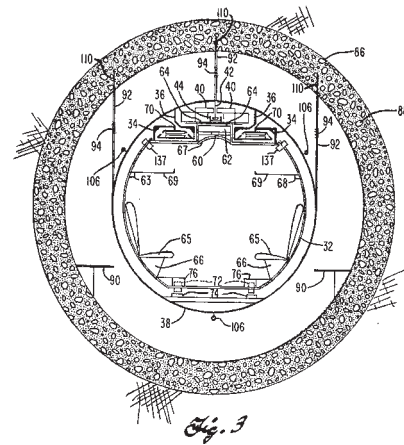
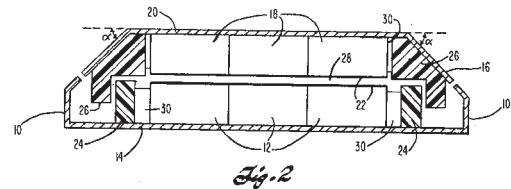
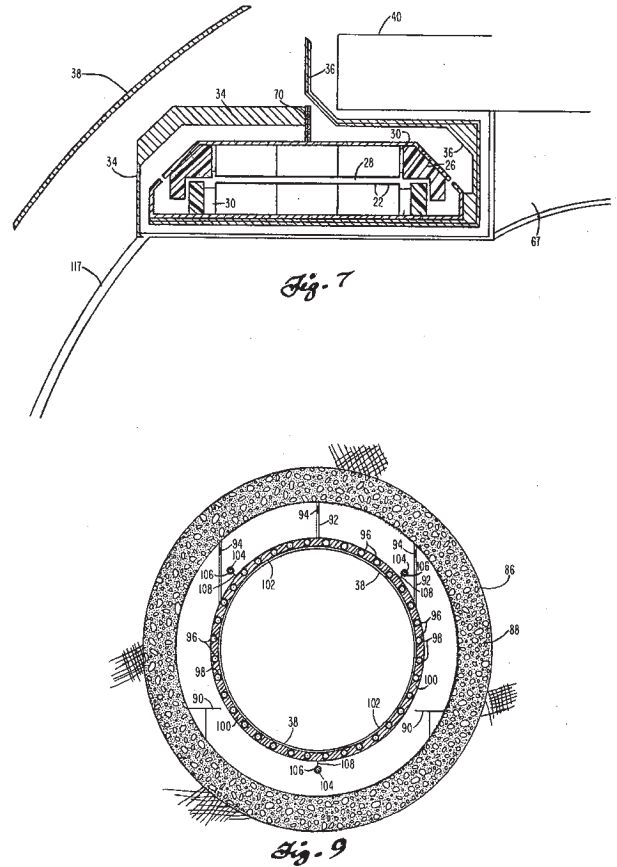
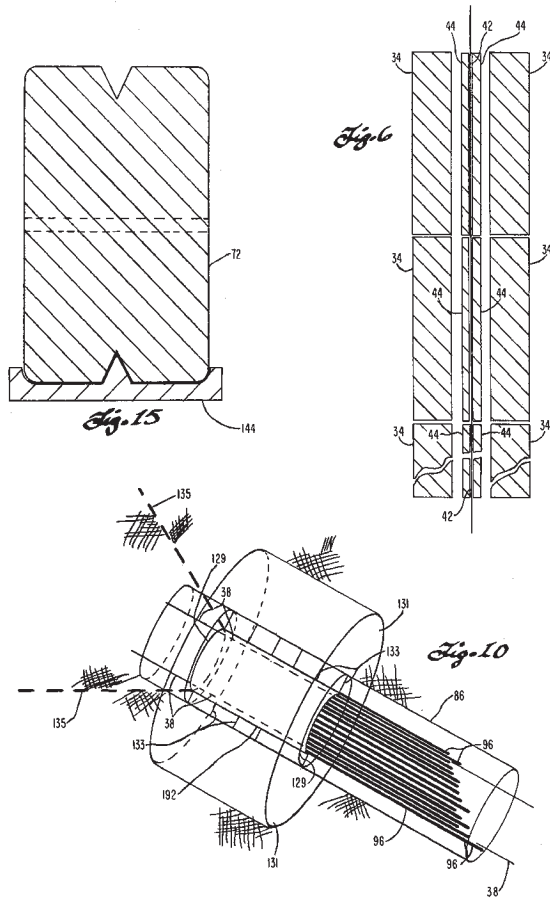


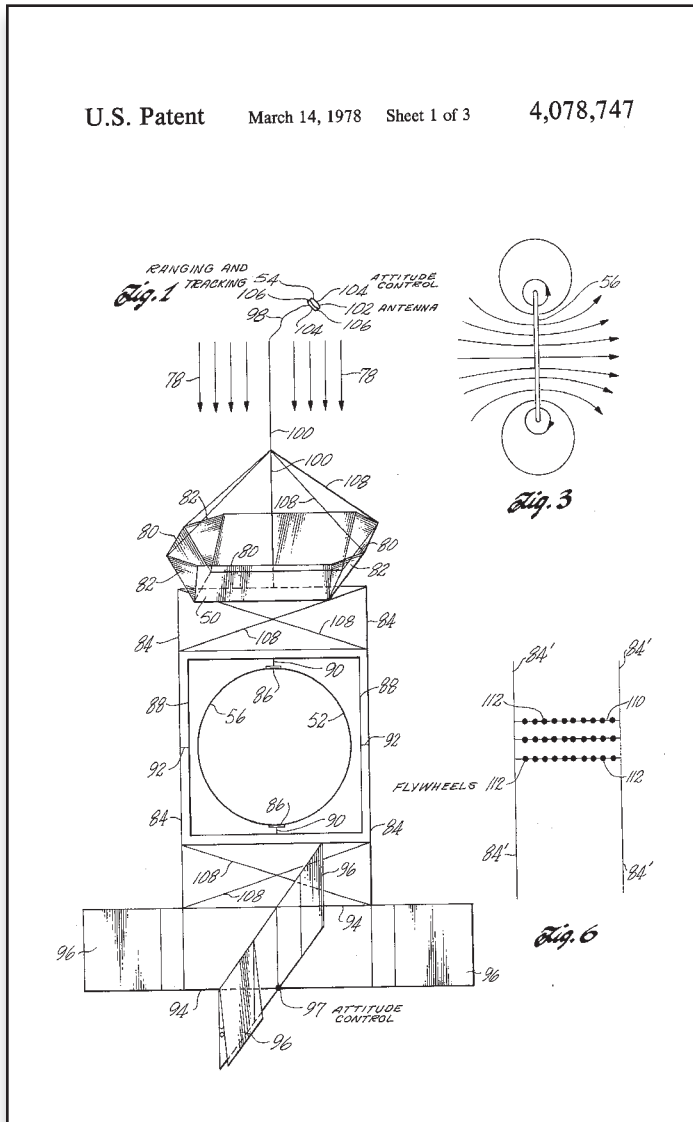
FIG. 2, above, is a transverse vertical cross-section of the frictionless, self-stabilizing permanent magnet vehicle suspension rail which is suspended over the permanent magnet guideway rail by magnetic repulsion forces and FIG. 3 is a transverse vertical cross-section of the magnetically suspended vehicle inside the vacuum tube which is suspended inside the tunnel.



US 4/148,260. FIG. 6 is a transverse horizontal cross-section of the car's independent suspension system; FIG. 7 is an enlarged section of FIG. 3 illustrating the vehicle's suspension system and FIG. 9 is a transverse vertical cross-section of the vacuum tube guideway suspended inside the tunnel by main suspension cables and vertical support cables; FIG. 10 is a schematic cutaway perspective view of a cable anchoring structure that anchors the tube's main suspension cables; and FIG. 15 is a vertical cross-section of a grooved guide wheel and flanged guide rail.

Orbiting solar power station

Patent number: US 4,078,747



Abstract:

The invention described herein is an orbiting solar powered, energy collecting, storage and transmitting station. Initially, a large array of solar cells collects and transforms radiant solar energy into moderate amounts of electrical current. This electrical current is fed into a large superconducting coil where it is gradually built up to very high values. The electrical energy is thereby converted and stored in the resulting magnetic field. This magnetic energy is extracted by drawing off the current at very high rates and used to energize a laser or microwave generator for wireless power transmission. Since the discharge of the superconducting coil can proceed at rates many times greater than the charging rate, the resulting beamed power can, over short time intervals, be many times greater than the rate of solar radiation falling on the solar array. Alternatively, the energy can be stored gradually in rotating flywheels for fast rate beaming.

Type: Grant

Filed: June 2, 1975

Date of Patent: March 14, 1978

Assignee: Phaser Telepropulsion, Inc.

Inventor: Michael A. Minovitch

Microwave powered reusable orbiting space tug

Patent number: US3891160A

Abstract

A battery-operated hand-held multiflash light generator This space vehicle is used as a “tugboat” for propelling other space vehicles. The tug has a pair of propulsion nozzles to which a propulsion fluid is fed by way of an absorption chamber. A large microwave antenna is mounted on the space tug for receiving and concentrating a microwave beam which may come from the earth’s surface. The nozzles and antenna are pivotable relative to each other. Large but short wave guides lead from the feed horn of the antenna through the pivot trunnions for conveying the concentrated microwave beam to the absorption chambers. The beam, which to this point has travelled through a vacuum, is nearly quantitatively absorbed by the propulsion fluid which is thereby heated to a plasma. The plasma is directed to the propulsion nozzle by a magnetic field. A single component propulsion fluid is contained in replaceable tanks and energy is imparted to the fluid by way of the microwave beam rather than by chemical reaction. A phased array of antennas permits focusing at high orbital altitudes.

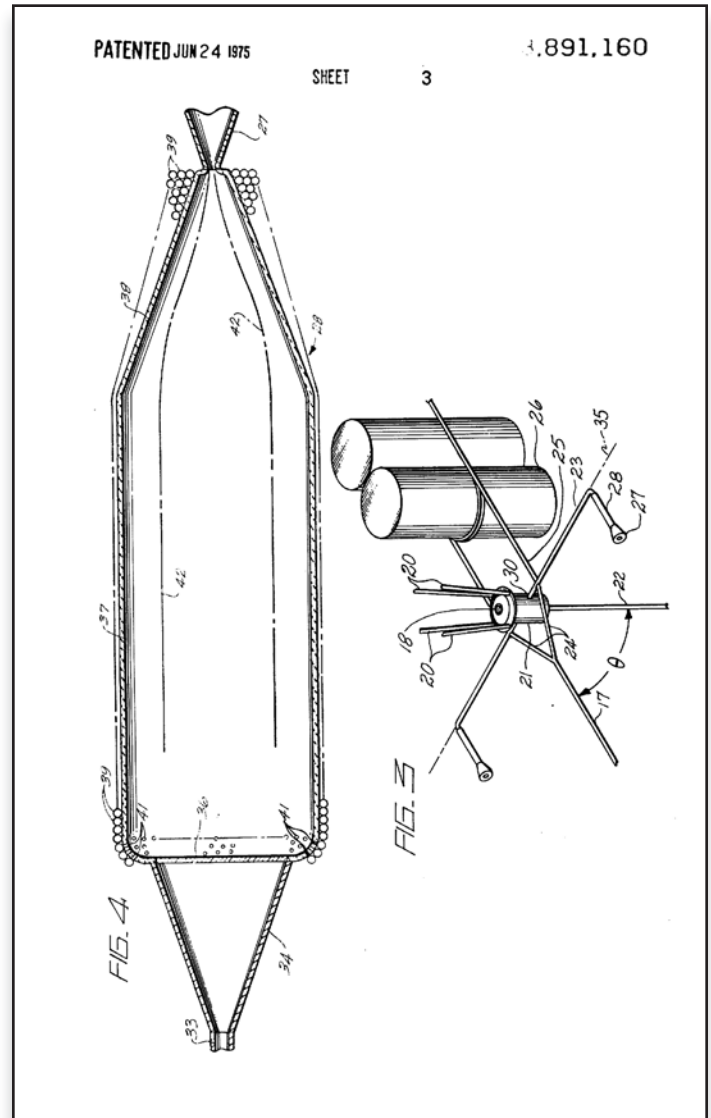


FIG. 3, above, is a fragmentary view of the central support structure of the vehicle and FIG. 4 is a longitudinal cross section through an absorption chamber on the space vehicle.

Application US343197A events:

1973-03-21: Application filed by Individual

1973-03-21: Priority to US343197A

1975-06-24: Application granted

1975-06-24: Publication of US3891160A

Laser Rocket

Patent number: US 3/825,211 A

Abstract:

This space vehicle carries a vaporizable propellant and energy is transmitted to the vehicle while in space by a laser beam originating on the ground or some other body or satellite. The space vehicle has replaceable propellant tanks and propellant flow from them through a transparent tube on the focal axis of a parabolic cylindrical reflector. A high energy laser beam concentrated by the reflector heats the propellant which then travels through a swivel to a rocket nozzle aligned with the vehicle center of mass. The reflector and tube form an energy gathering assembly that is mounted for pivoting about an axis transverse to the vehicle axis for maintaining alignment with a remote laser station. Several incremental operations of the laser rocket can sequentially boost it to more energetic orbits and eventually to escape velocities. Such a vehicle can be conveniently used as a "tug" for other space vehicles.

Inventor: Michael A. Minovitch

Application US00263987A events:

1972-06-19: Application filed by PHASER TELEPROPULSION LLC¹

1972-06-19: Priority to US00263987A

1974-07-23: Application granted

1974-07-23: Publication of US3825211A

¹Phaser Telepropulsion, LLC was a company formed by Mr. Noah Diedrich and Dr. Michael Minovitch. Phaser Telepropulsion, LLC, Los Angeles, CA.

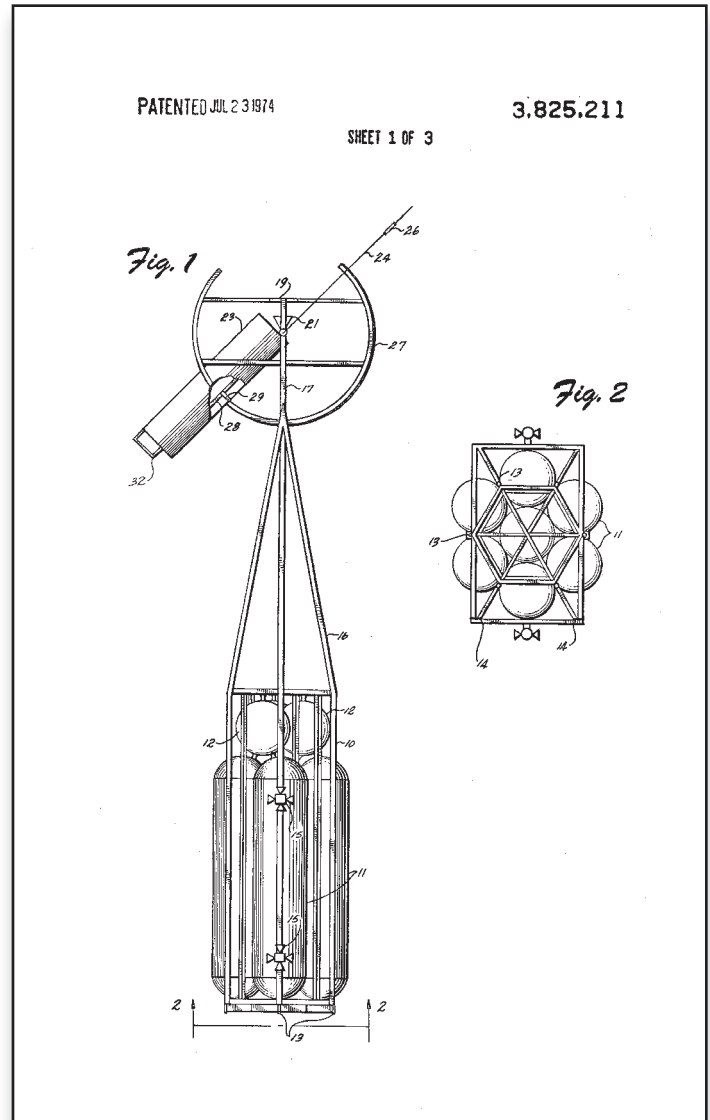


FIG. 1 illustrates in side-view a laser rocket space vehicle constructed according to principles of this invention and FIG. 2 is a front view of the vehicle of FIG. 1.

2832 St. George Street, #6
Los Angeles, Calif. 90027
November 30, 1973

Mr. Noah Dietrich
1901 Avenue of the Stars, Suite 277
Los Angeles, Calif. 90067

Dear Mr. Dietrich:

I am forwarding a technical report entitled "An Orbiting High Power Laser Weapon System For Defense Against Hostile ICBMs" that I wrote last summer. I believe the system could have a significant impact on strategic weapons development and should not be viewed as "science fiction." You may (if you wish) have the report reviewed by an independent specialist who is familiar with recent developments in laser technology. However, great care should be taken to keep it secret until we can determine whether it could generate any business for PTI in the form of military contracts. Your connections with important people in the military may be very valuable in this regard. (I could, on very short notice, assemble an extremely talented technical staff to perform basic scientific and systems studies.) Since this weapon system could not be deployed economically without a high performance reusable orbiting space tug, it may give added impetus for the development of our laser (or microwave) tugs.

I am hoping we can get together soon to discuss these matters.

Sincerely,



Dr. Michael A. Minovitch

MAM:rc

P.S.: I am also enclosing a copy of an article that appeared in the New York Times on my invention of gravity thrust space travel. How do you like the beard!

Encl.

Minovitch, Dr. Michael A. to Noah Dietrich. Cover letter for a technical report, "An Orbiting High Power Laser Weapon System for Defense Against Hostile ICBMs". Los Angeles, CA. November 30, 1973. On page 36, following, is a copy of Pg. 1 of the technical report.

PHASER TELEPROPULSION, INC.

Technical Report 201-2
August 13, 1973

AN ORBITING HIGH POWER LASER WEAPON SYSTEM
FOR DEFENSE AGAINST HOSTILE ICBM'S

by

Michael Minovitch

Introduction

High power laser beams can be utilized to produce the most effective long range precision weapon system ever conceived. While nuclear weapons are essentially area weapons, the laser can deliver high levels of energy in extremely concentrated form with precision never before attained. Moreover, a laser beam can focus its power onto a very small area over extremely long distances with the highest attainable velocity--the speed of light.

This report investigates the feasibility of placing an ultrahigh power laser generator on board a large manned orbiting satellite in geosynchronous orbit and using it as an ultraprecise strategic weapon system against targets on the surface of the Earth, in or above its atmosphere, or in geocentric orbits. The laser would be powered by a very large array of solar cells.

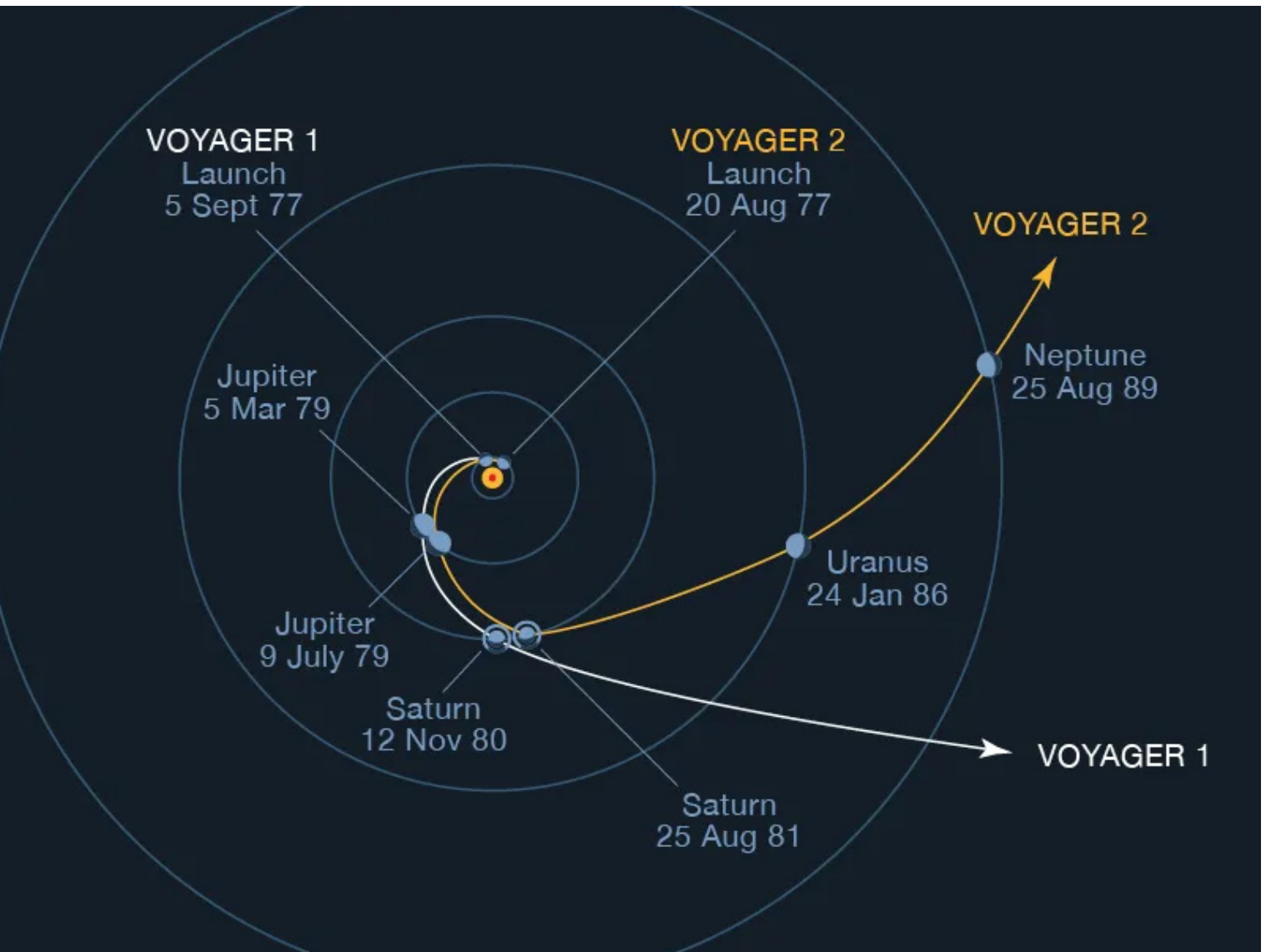


At left, Michael Minovitch working as an intern at the Jet Propulsion Laboratories (JPL) during the Mariner II mission, August, 1962. Excited by UCLA's new IBM 7090 computer, below, the fastest on Earth at the time, Minovitch decided to take on the hardest problem in celestial mechanics: the "Three Body Problem".



Dr. Michael A. Minovitch, Inventor

An illustration of the trajectories of Voyager 1 and Voyager 2. In a gravity-assist trajectory, angular momentum is transferred from the orbiting planet to a spacecraft approaching from behind the planet in its progress about the sun. Gravity Assist was invented solely by Dr. Michael Minovitch as was the process of and name of Gravity Propelled Interplanetary Space Travel!¹



¹ From the Basics of Space Flight, Chapter 4: Trajectories. <https://science.nasa.gov/learn/basics-of-space-flight/chapter4-1/>, NASA.

Dr. Michael Minovitch of Los Angeles, California discovered and invented the Gravity Assist technique in 1961 (<http://www.gravityassist.com>). This groundbreaking process has enabled the exploration of the entire solar system and remains the fundamental method for planning and executing interplanetary missions across all space agencies. Gravity Assist is one of Michael's most significant contributions to space science.

Dr. Minovitch solely invented Gravity Assist, as well as the concept and term "Gravity Propelled Interplanetary Space Travel." I can affirm this with certainty, based on my over 30-year relationship with Michael. He uniquely recognized the potential of harnessing gravity for propulsion, aware of an unsolved problem: the Restricted Three Body Problem needed to be solved to utilize this free energy effectively. Michael was the first scientist/mathematician to solve this problem, a challenge that had confounded the scientific community for ages. His solution enabled precise calculations for approach trajectories necessary for planetary flybys.

The theory was an exceptionally sophisticated application of analytical mechanics and one of the most mathematically challenging problems to solve. In 1961, the easier Restricted Three-Body Problem remained unsolved and was considered one of the most difficult issues in celestial mechanics. By April 1962, Michael received confirmation that he had solved the more complex problem of determining gravity-propelled interplanetary trajectories, thus establishing his new space travel theory. Missions such as Mariner 10, Pioneer 10, Pioneer 11, Voyager 1, Voyager 2, Ulysses, Galileo, and many others were made possible by Michael's discovery.

In 2013, at a conference hosted by Icarus Interstellar, where I served as a director, Michael received an Interstellar Award, attended by numerous top dignitaries from the space community.

Throughout his career, Michael made numerous technological breakthroughs, gaining many inventions and patents. He was truly one of the world's greatest scientists. As the executor of his estate, I am responsible for commercializing some of his inventions and creating a museum in his honor in Pasadena, California. His inventions are available for sale or lease to organizations or individuals who recognize their potential value. I am willing to collaborate with or assist interested parties.

Please contact me if you are interested in any of Dr. Michael A. Minovitch's discoveries.

Bill Cress
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Dr. Michael A. Minovitch, Inventor

Eagle Horizon Group is proud to support Dr. Michael Minovitch's sister Vivian and best friend William Cress in their mission to honor the genius of this remarkable American. We aim to bring Dr. Minovitch's visionary ideas about the future of science, engineering, industry, and human progress to life. This endeavor is not just a business or engineering project; it is a mission to extend the brilliance of a great mind beyond our planet and our imaginations, into the very universe where our Earth resides.

Dr. Minovitch's inventions, though challenging, are entirely feasible, with a well-documented path laid out for us. To those who might doubt this, we ask, "How far have our gravity-assisted Voyager probes traveled? How have they expanded our knowledge and fueled our dreams of the future?" The challenge before us is to gather the best talents across various fields, understand the inventions Dr. Minovitch has gifted us, and bring them to fruition.

We invite our great museums and institutions to join us in celebrating Dr. Michael Minovitch's personality, humor, brilliance, and vision, to share them with our world and future generations. We encourage everyone, including our children, to get to know Dr. Minovitch through the rare videos available.

If there is one critical message for all of us, it is this: "There is no Final Frontier."

V/r.,



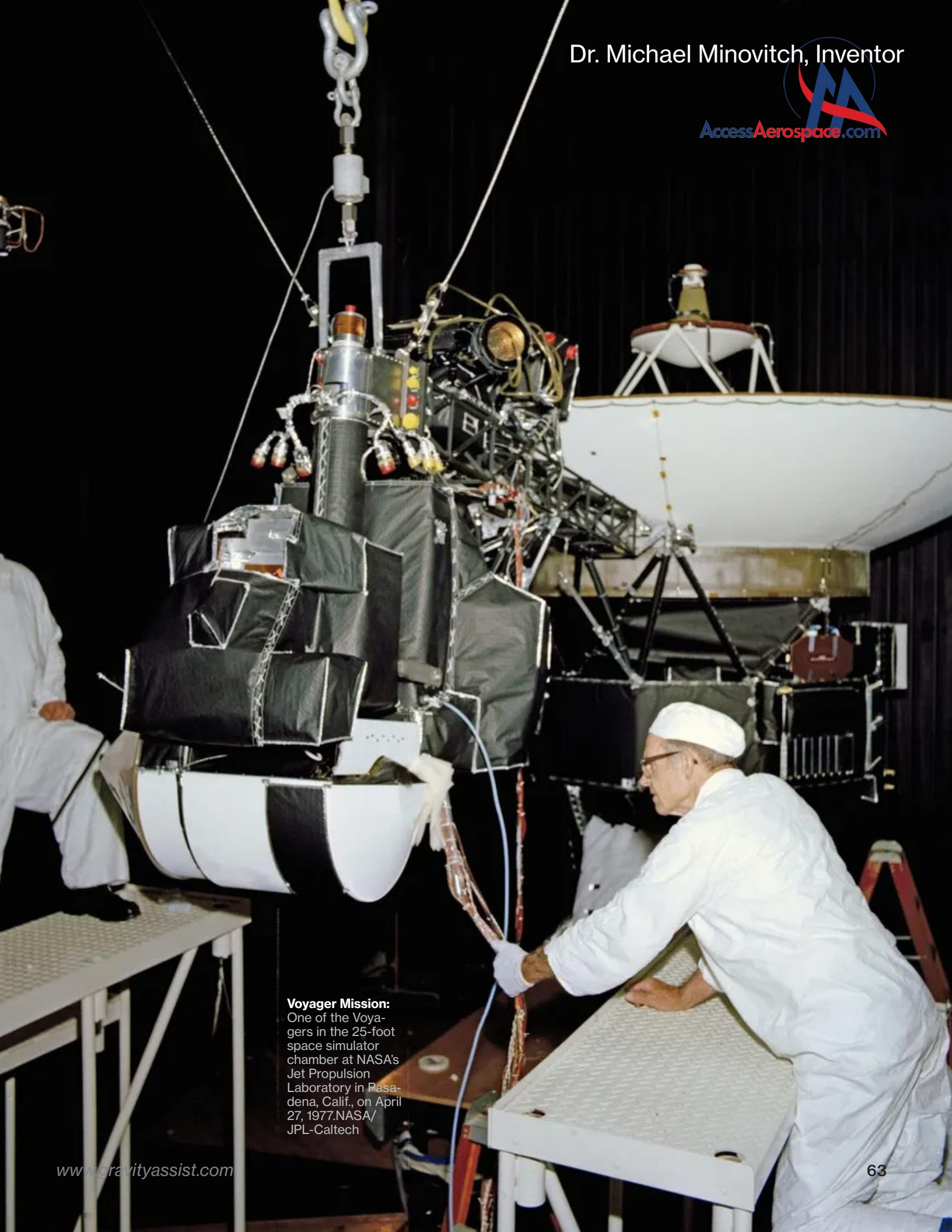
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Voyager Mission:
One of the Voyagers in the 25-foot space simulator chamber at NASA's Jet Propulsion Laboratory in Pasadena, Calif., on April 27, 1977. NASA/JPL-Caltech

Index

AMMUNITION RELOADING SYSTEMS

- ~ 5103712: Ammunition reloading system and operating method – p. 32

CONDENSING SYSTEMS AND METHODS

- ~ EP0598723A4: Condensing system and operating method – p. 26
- ~ US 4/624,109 A: Condensing system and operating method – p. 27
- ~ WO/1993/004325A1: Condensing system and operating method – p. 31
- ~ 5040373: Condensing system and operating method – p. 35
- ~ EP0267992A1: Condensing atmospheric engine and method – p. 40
- ~ 4624109: Condensing atmospheric engine and method – p. 42

CONVEYING AND TRANSPORTATION SYSTEMS

- ~ 4601389: Tubular conveyor system and operating method – pp. 43-44
- ~ DE3307361A1: Tubular conveyor system and its operating method – p. 45
- ~ 4361202: Automated road transportation system – pp. 46-47
- ~ 4075948: Rapid transit system – p. 48
- ~ 3954064: Rapid transit system – p. 49
- ~ 4148260: High speed rapid transit system – pp. 50-51

CRYOGENIC ENGINES

- ~ 9334854: Closed-cycle cryogenic engine and operating method for propelling vehicles and generating electricity – p. 13
- ~ US 2015/0369221: Closed-cycle cryogenic engine and operating method for propelling

vehicles and generating electricity – p. 14

- ~ US20110277476: Low Temperature High Efficiency Condensing Heat Engine for Propelling Road Vehicles – p. 15

FUSION REACTORS

- ~ US20170062078: Linear converging/diverging fusion reactor and operating method for achieving clean fusion reactions – pp. 11-12

GOLF BALL LOCATING SYSTEMS

- ~ 5447314: Golf ball locating system and operating method – p. 25

LIGHT GUNS

- ~ 5641284: Flash bulb cartridge for light guns – p. 23
- ~ 5641222: Light gun – p. 24
- ~ WO/1993/025862A1: Light gun – p. 28
- ~ 5243894: Light gun – p. 30

MAGNETIC CONDENSING SYSTEMS

- ~ 6739137: Magnetic condensing system for cryogenic engines – pp. 16-17
- ~ EP1367340A3: Magnetic condensing system for cryogenic engines – p. 18
- ~ WO/2003/100330A1: Magnetic condensing system for cryogenic engines – p. 19
- ~ EP1367340A2: Magnetic condensing system for cryogenic engines – p. 20
- ~ US20030218852: Magnetic condensing system for cryogenic engines – p. 21

MAGNETIC PROPULSION SYSTEMS

- ~ 6193194: Magnetic propulsion system and operating method – p. 22

SPACE PROPULSION AND CONSTRUCTION

- ~ 5271583: Automatic method and operating system for space construction – p. 29
- ~ 5093313: Electromagnetic ground to orbit propulsion method and operating system for high mass payloads – p. 33
- ~ 5052638: Electromagnetic ramjet – p. 34
- ~ 4939976: Electromagnetic ground to orbit propulsion method and operating system for high mass payloads – p. 36
- ~ 4795113: Electromagnetic transportation system for manned space travels – p. 37
- ~ 4791850: Electromagnetic launching system for long-range guided munitions – p. 38
- ~ 4754601: Self-refueling space propulsion system and operating method – p. 39
- ~ 4730797: Inflatable core orbital construction method and space station – p. 41

SPACE STATIONS AND TUGS

- ~ 4078747: Orbiting solar power station – p. 52
- ~ 3891160: Microwave powered reusable orbiting space tug – p. 53
- ~ 3825211A: Laser Rocket – pp. 54-56

Attached: Curriculum Vitae for Dr. Michael Andrew Minovitch

Biography & Curriculum Vitae of Dr. Michael Andrew Minovitch

Mathematician, Physicist, Inventor

Dr. Michael Andrew Minovitch, born June 7, 1935, in Yonkers, New York, son of Michael Andrew Minovitch (Austrian background) and Viola Gruzdlovitch (French/Russian/Polish background), was a mathematician, physicist, and inventor renowned for his pioneering work in celestial mechanics and space travel. He held a BA in Mathematics from UCLA (1958) and a Ph.D. in Mathematics from UC Berkeley (1970).

Minovitch's career included work as a technical computer/aerospace engineer at Douglas Aircraft Corp., laboratory technician at Research Chemicals Co., and research engineer at NASA's Jet Propulsion Laboratory (JPL). He developed the Gravity Propelled Interplanetary Space Travel (gravity-assist trajectories), solved the Restricted Three-Body Problem, and made space exploration possible without the reliance on traditional rocket propulsion. Minovitch's invention of gravity-propelled interplanetary space travel (also known as "gravity-assist trajectories") in the early 1960s broke the high-energy barrier of classical space travel based on reaction propulsion, and made possible the exploration of the entire solar system with instrumented spacecraft.

His notable roles include Research Aid at Linus Pauling's Chemistry Laboratory, Member of the Technical Staff at NASA's JPL, and co-founder of Phaser Telepropulsion Inc., focusing on advanced propulsion systems, including laser-heated rocket propulsion.

Dr. Minovitch has received several accolades, including nominations for NASA's highest award (1971) and was nominated for the Nobel Prize in Physics (1991 or later). He has authored influential research articles and holds numerous patents for innovations in propulsion and energy systems. Despite significant contributions, his work faced challenges related to proper recognition and credit within the space research community.

Education

- BA in Mathematics, UCLA 1958.
- UCLA Graduate School 1959-1964.
- Individual Studies, Harvard University, Summer 1965.
- Ph.D. in Mathematics and Ph. D. in Physics, UC Berkeley, 1970.

Work

Technical Computer / Aerospace Engineer, Douglas Aircraft Corp., El Segundo, California, Summer 1956

Work involved computing the theoretical weight of various metal components of fighter aircraft from their density and geometrical shapes.)

Technical Computer / Aerospace Engineer, Douglas Aircraft Corp., El Segundo, California, Summer 1957

Work involved computing the theoretical weight of various metal components of fighter aircraft from their density and geometrical shapes.

Laboratory Technician, Research Chemicals Co., Burbank, California, Summer 1959.

Work involved determining the magnetic susceptibilities of various rare-earth compounds using a high-field electromagnet. Unassigned work involved the formulation of a new method for determining the crystal structure of various molecules from X-ray diffraction data.

Research Aid, Linus Pauling's Chemistry Laboratory at California Institute of Technology, Summer 1960

Work involved investigating the crystal structures of various chemical compounds.

Research Engineer, Jet Propulsion Laboratory (JPL) at California Institute of Technology, Pasadena, California, Summer 1961

Work assignment involved developing a new analytical method for computing free-fall interplanetary trajectories under the gravitational influence of the Sun passing between two given points with a given flight time. (See Ref. 1.)

Minovitch's achievements in self-initiated work are outstanding:

- Solved, on his own initiative, the famous unsolved **Restricted Three-Body Problem** of celestial mechanics for motion through the solar system.
- Originated, on his own initiative, a new method of space travel called **Gravity Propelled Interplanetary Space Travel** (also known as **Gravity-assist Trajectories**) by applying his solution of the **Restricted Three Body Problem** serially with one or more planetary encounters to achieve unlimited space travel throughout the entire solar system without rocket propulsion. This new method of space travel broke the traditional high-energy barriers of classical space travel based on

reaction propulsion and made the exploration of the entire solar system possible. It resulted in all of NASA's gravity-assist missions. (See Refs. 2-5.)

- Began, on his own initiative, on January 18, 1962, a major research project-at the UCLA Computing Facility funded by research grants from the University of California, that ran through September 1964 to numerically investigate his invention of **Gravity Propelled Interplanetary Space Travel**. (See Refs. 3-5 and 6-9.)
- Began, on his own initiative, in June 1962, a major research project at the JPL Computing Facility using their IBM 7090 and 7094 computers on a time available basis when they were not being used for JPL projects to numerically investigate his invention of **Gravity Propelled Interplanetary Space Travel**. This research project ran simultaneously with his UCLA research project. (See Refs. 3-5 and 10-23.)
- Began, on his own initiative in November 1966, another gravity propulsion project at the University of California Berkeley Computing Facility funded by research grants from the University of California that ran approximately five months. The purpose, in part, was to numerically prove that this invention made it possible to reach any target body or region in the entire solar system using only the small amount of launch energy needed to reach Venus. (See Figs. 1 & 2, Ref. 24.) These low launch energy gravity propelled trajectories were used several years later in the **Galileo and Cassini Missions**.

Teacher's Aid for Graduate Courses in Advanced Physics; Physics Department, UC Berkeley 1968-1970

Work assignment involved reading and grading homework papers in graduate courses and seminars in theoretical physics. Subjects included advanced graduate courses and seminars in quantum field theories, relativistic quantum mechanics, and mathematical physics.

Member of the Technical Staff (MTS), National Aeronautics and Space Administration (NASA)'s Jet-Propulsion Laboratory (JPL), Pasadena California, 1971-1972

Developed a new method of achieving long-lasting satellite-encounter orbiter trajectories around Jupiter and Saturn by applying his invention of gravity propelled interplanetary. Space travel by replacing the sun as the central body with the planet and replacing the moving planets with the moving satellites. This resulted in the famous **Galileo Jupiter Orbiter Mission** for exploring the Galilean satellites around Jupiter. (See Refs. 25-27).

Significant Achievements

- Started a new advanced propulsion research corporation in Los Angeles, CA based on his invention of **Laser Heated Rocket Propulsion** using long-range beamed laser power in February 1971. (See Ref. 28-37.) Company was Incorporated as **Phaser Telepropulsion, Inc.** with **Partner Noah Dietrich** in 1972.
- Began work on orbiting long-range laser thermal weapon systems in 1972. (See Refs. 38-42.) This work was made known to **Governor Ronald Regan** while he was Governor of California and became known several years later as **SDI or the Strategic Defense Initiative** after he became President.

Subsequent advanced propulsion research led to the formulation of a generalized theory of classical rocket propulsion thereby enabling interplanetary space vehicles to be self-refueling. Other advanced propulsion research led to the development of magnetic propulsion based on static and traveling magnetic fields for achieving ultra high-speed commercial interplanetary space travel. Other research in the field of low temperature physics led to the invention of closed-cycle cryogenic engines using the free and unlimited natural thermal energy in the environment as replacement power source for internal combustion engines.

Honors and Awards

- Nominated by the Dean of UCLA's Graduate Division to represent UCLA College of Letters Sciences in the First Annual Graduate Academy of the University of California. Presented a research paper describing his invention of Gravity Propelled Interplanetary Space Travel and how it enabled unlimited interplanetary space travel throughout the entire solar system without rocket propulsion, April 1963. (See Ref. 43 and Refs. 4, 8.)
- Elected Life Membership in Sigma Pi Sigma National Physics Honor Society by the UCLA Department of Physics, 1963. (See Ref. 4.)
- First Place Award for Most Original Research, Ph.D. Category, American Institute of Astronautics & Aeronautics (AIAA) Student Competition, Western Region, 1963. Presented a paper describing his invention of Gravity Propelled Interplanetary Space Travel and how it made space travel possible without rocket propulsion, May 1963. (See Refs. 4, 9; 44-48.)
- Nominated by NASA's JPL's Systems Division, August 1971 for NASA's highest

award for his invention of **Gravity Propelled Interplanetary Space Travel** and solving the **Restricted Three Body Problem** for motion through the solar system that made the invention possible. (See Refs. 57., 58.) Despite the Systems Division at JPL nominating Minovitch for an award recognizing him as the inventor, certain individuals in JPL upper management refused to accept this nomination, preventing it from being sent to NASA. This decision was not grounded in technical arguments, as the technical expertise required to evaluate the nomination resided within JPL's Systems Division, not upper management. Instead, JPL management desired to attribute the invention to someone else, aiming to claim credit for Minovitch's work to enhance JPL's reputation as a leading space research center. This intent to misappropriate Minovitch's invention, one of the most significant in the history of space travel, was unknown to him in 1971.

- **Nominated for the Nobel Prize in Physics, 1992** or later, for his invention of **Gravity Propelled Interplanetary Space Travel** and for solving the famous unsolved **Restricted Three Body Problem** of celestial mechanics for motion through the solar system that made it possible. This invention broke the high-energy barriers of classical space travel based on reaction propulsion and made it possible to explore the entire solar system with instrumented spacecraft. (See Ref. 60.)

Major Innovations & Inventions

The claims in this section are based on either first issued patents or the traditional criterion of the earliest documented paper describing the innovation or invention. Typically, awards given to individuals for significant discoveries or innovations are based on documented evidence of originality, meaning the person who authored the first documented paper with the earliest date detailing the innovation or discovery. The absence of an award for an innovation, discovery, or invention often indicates that the management of the research center where the original work was conducted seeks to falsely attribute credit to someone who did not make the discovery or invention. This is done to enhance that individual's reputation and, consequently, the reputation of the research center.

1. **Gravity Propelled Interplanetary Space Travel**, also known as “**Gravity-assist Trajectories**”, broke the high-energy barriers of classical rocket propulsion based on the reaction principle. This innovation made it possible to explore the entire solar system with instrumented spacecraft using very little launch energy. (See Refs. 2-5 and 61- 69.)

2. Invented and patented **Laser Heated Rocket Propulsion**. (See Refs. 28, 30, 32.)
3. Regenerative **High-speed Underground Gravity Propelled Rapid Transit System** that generates its own propulsive energy. (Refs. 70-72.)
4. An **Orbiting Laser Thermal Weapon System** that eventually became known as **SDI** or “**Star Wars**.”. (Ref. 38-42.)
5. **Self-refueling Rocket propulsion for interplanetary space travel**. Proposed and formulated a generalized theory of classical rocket propulsion whereby deceleration is achieved by ingesting gas from a planet's atmosphere and acceleration is achieved by expelling the ingested atmospheric gas. (See Refs. 73-76.)
6. **Inflatable-core automated construction method for constructing large rotating toroidal structures in orbit having un-limited size at low cost**. (Refs. 77-79.)
7. **Electromagnetic ramjet** to achieve high velocity flight through the atmosphere. (Ref. 80.)
8. **Regenerative-magnetic propulsion system for orbiting high-mass payloads**. (Ref. 81, 82.)
9. **Traveling-field, beamed-power, magnetic propulsion system for achieving ultra-high-speed commercial interplanetary space travel**. (See Refs. 83-86.)
10. **Magnetic Condensing System for Cryogenic Engines**. This revolutionary invention harnesses the infinite thermal energy available in the natural ambient temperature to produce mechanical work at high power densities. It provides propulsion for road vehicles and propeller-driven airplanes without using combustible fuels or generating pollution, effectively at zero cost. Additionally, it can generate substantial amounts of electricity for both industrial and residential use.

If the details of this invention are accurate and it functions as claimed in the issued U.S. patent (Ref. 87), it has the potential to replace traditional energy sources such as combustible fuels, hydroelectric dams, and nuclear reactions. By utilizing natural thermal energy at ambient temperatures, this system could generate unlimited mechanical work with high power densities, free of charge and without pollution. This breakthrough could transform industrialized society from one that harms and pollutes the environment to one that exists in harmony with nature.

Membership in Organizations (Past)

- Sigma Pi Sigma (National Physics Honor Society.)
- American Mathematical Society
- American Physics Society
- American Institute of Aeronautics and Astronautics
- Smithsonian Associates Club
- Town Hall
- Planetary Society

Past Contact Information

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Phone: (323) 662 0256; FAX: (123) 644-0375

Breakthrough Technologies Corporation

3225 McLeod Drive

Las Vegas, NV 89121

Phone: (702) 871-8535

Chairman, Chief Physicist, Scientist, and

Technology Officer

References and Notes

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5. Dowling, R.L. et al, “*The Effect of Gravity Propelled Interplanetary Space Travel on the Exploration of the Solar System, Historical Survey, 1061 To 2000*”, 50th International Astronautical Congress, Oct 4-8, 1999, Amsterdam, The Netherlands, IAA Paper No. IAA - 99-IAA2.1 .08.
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Interplanetary Trajectories”, Paper presented to the Thirteenth Annual AIAA Western Region Student Conference, May 2-3, 1963. (An altered version of this May 1963 paper containing a reference to an imaginary “master’s thesis” was published in the AIAA Student Journal, Vol. 2, No. 1, May 1964, pp. 23-29. It can be found in many large engineering libraries.)

10. Letter from A.E. Locke (NASA Jet Propulsion Laboratory (JPL)) to Michael Minovitch, May 3, 1962.
11. Clarke, V., “Interplanetary Round-Trip Program”, JPL Section 312 RFP No. 71, June 21, 1962.
12. Urgent message from Gene Bollman (Mariner 2's Project Manager) to Michael Minovitch requesting the Venus approach trajectory that Mariner 2 should take such that the gravitational field of Venus, superimposed on the gravitational field of the sun, will return Mariner 2 back to Earth. (Request written during the Aug. - Sept. 1962 time period.) At that time Minovitch’s gravity propelled trajectory program that he developed at UCLA's Computing Facility was the only one capable of numerically solving the famous unsolved Restricted Three Body Problem of celestial mechanics for motion through the solar system. It was the technical means that made all gravity-assist missions possible. This crucial technical fact had been kept hidden by JPL for over 40 years. (See pages 20 - 22, Ref. 5, and Refs. 11, 13, 14, 19.)
13. Szebehely, V. G. J., “Astrodynamics - State of the Art 1962”, *Astronautics*, Nov.1962, p. 55.
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15. Announcement of seminars on multiplanetary gravity propelled space travel given by Minovitch to JPL Section 312 Engineers (Systems Analysis Section), Feb. 1963.
16. Minovitch, M. A., “The Determination, Analysis, and Potentialities of Advanced Free-Fall Interplanetary Trajectories”, JPL TM 312-280, March 4, 1963.
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21. Minovitch, M. A., 'Utilizing Large Planetary Perturbations for the Design of Deep-Space, Solar-Probe, and Out-of-Ecliptic Trajectories.', JPL, TM312-514, Feb.15,1965.
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23. Letter from Cutting to Minovitch, May 21, 1965. His later documents show the growing interest in the concept of Gravity Propelled Interplanetary Space Travel at JPL and Cutting's plans initiating detailed trajectory studies involving the outer planets. This letter was written before Cutting assigned Flandro the task of computing these trajectories-during the summer of 1965 using Minovitch's JPL papers and computer program. These papers described the concept and contained numerous planetary configuration diagrams of the outer solar system for identifying possible encounter sequences, and the corresponding Earth - Jupiter launch periods. The computer program was used to numerically compute the trajectories identified from the planetary configuration diagrams. These relative planetary position showing all the planetary alignments for all the outer planets for all the Earth - Jupiter launch windows from 1967 through 1978 were shown on pages 58-76 of Ref. 21. The particular alignment: Earth - Jupiter - Saturn - Uranus - Neptune used for the Voyager 2 trajectory that was possible for the 1977 Earth - Jupiter launch window

was shown on page 74. The fact that Flandro had these diagrams that identified all possible planetary encounter sequences for outer planet missions was given by Flandro himself. It was in the second reference listed in his 1966 paper. The computation of these trajectories using Minovitch's UCLA computer program and planetary configuration drawing was exceedingly simple and explained on pages 18, 19 of Ref. 5.

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30. Minovitch, M. A., "Laser-Rocket", U.S. Patent 3/825,211 filed June 19, 1972.
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32. Minovitch, M. A., "Reactorless Nuclear Propulsion - The Laser Rocket", AIAA/SAE 5th Joint Propulsion Specialist Conference, New Orleans, Louisiana, November 29 - December 1, 1972, AIAA Paper No. 72-1095.
33. Letter from Noah Dietrich to Michael Minovitch, August.15, 1972.
34. Letter from H Thomas Fehn to Noah Dietrich, January 9, 1973.
35. Minovitch, M. A., "Performance Analysis of a Laser Propelled interorbital Transfer Vehicle", Phaser Telepropulsion Inc., Technical Report NASACR-134966, February 1976.

36. Minovitch, M. A., "Laser Propulsion History", *Astronautics & Aeronautics*, October 1980, pp. 7-69.
37. Letter from Dr. Michael Minovitch to Professor Leilc Myrabo, August 19, 1985.
38. Letter from Dr. Michael Minovitch to Dr. Eberhardt Rechtin, Deputy Director Telecommunications, Department of Defense, June.8, 1972.
39. Letter from Herbert D. Benington (U. S. Department of Defense) to Dr. Michael Minovitch, June 27, 1972.
40. Minovitch, M. A., "An Orbiting High Power Laser Weapon System for Defense Against Hostile ICBMs", Phaser Telepropulsion Inc., Technical Report 201-2, August 13, 1973.
41. Minovitch, M. A., "A Flywheel Powered Orbiting Laser Thermal Weapon System", Phaser Telepropulsion Inc., Technical Report 201-3, November 10, 1973.
42. Minovitch, M. A., "Orbiting Solar Power Station," U.S. Patent No. 4/078,747, filed June 2, 1975.
43. Letter from Dr. Franklin D. Murphy (Chancellor, UCLA) to Minovitch inviting Minovitch to represent UCLA in the First Meeting of the Graduate Academy of the University of California, March 20, 1963.
44. Program Schedule, AIAA Student Competition, Western Region, Los Angeles, California.
45. Pickering, W, "Certificate of Merit", Graduate First Prize (with \$100 check) 13th Annual Western Region Student Conference May 3, 1963 for presenting the most original paper in Ph.D. Category. This paper was sent to the national judges to compete in the national competition for the National AIAA Award Ph.D. category papers. After Minovitch was given the first place Western Region award, he was advised that because of the revolutionary nature of his paper, it was an almost certainty that he would win the prestigious first place National Award for best Ph.D. level paper. There was great interest in his paper after he delivered it in Los Angeles at that conference given in the very large Pan Pacific Auditorium. (See Ref. 4.)
46. Letter from Kaufman (Manager, AIAA Student Activities) to Minovitch, May 29, 1963.

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47. Letter from Kaufman (Manager, AIAA Student Activities) to Minovitch, June 13, 1963.
 48. "Grad Wins Prize," UCLA Daily Bruin, May 10, 1963, page 2. After Minovitch's Ph.D. paper was submitted to the national judges for a competition, it was altered to appear as if it was based on a fictitious "master's thesis" at UCLA. This reclassification rendered it ineligible for the prestigious National Award. Winning the award would have officially recognized Minovitch for his invention of Gravity Propelled Interplanetary Space Travel by the AIM in 1963. However, Minovitch had never been in a master's program at UCLA and did not possess a master's degree. He started his graduate studies at UCLA in 1959 as a Ph.D. student working towards degrees in both mathematics and physics. This deceitful act, perpetrated by certain high-level individuals at JPL (excluding Dr. Pickering, JPL's Director), aimed to credit a JPL manager with the invention to enhance JPL's reputation with NASA and the world. The theft of Minovitch's invention by these individuals continues through numerous publications that provide false historical and technical information about the invention. These details are provided here to inform science historians researching Minovitch's work and achievements, especially when seeking information from JPL or other associated sources.
 49. Letter from Gordon O. Boles (JPL Personnel Representative) to Minovitch's Draft Board, Selective Service System Local Board, 120, Los Angeles, California dated November 23, 1966. Since it is a felony crime to give false information to a government agency, this letter indicates that Minovitch's official employment records at JPL were altered to show that he had a "Master's Degree".
 50. Bane, D., "First Stop: Jupiter", Los Angeles Herald-Examiner, Sept. 10, 1969, page A-12. In this full-page article, JPL took the credit for the invention of Gravity Propelled Interplanetary Space Travel away from Minovitch and gave it to Dr. Homer J. Stewart who was manager of JPL's Advanced Projects Office.
 51. "Mariner-Venus '73 Flight Genesis", NASA News Release No, 70-112, July 5, 1970. This was an official JPL/NASA News Release issued from JPL management that identified Victor C. Clarke, Minovitch's 1961 supervisor, as the person who originated gravity-assist trajectories. In actuality, Clarke believed the concept represented a violation of the law of conservation of energy and refused to assign anyone to work on it at JPL when Minovitch presented it. The details are described in Ref. 3.

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52. Parker, P. J., “Grand Tour Spacecraft Computer”, *Spaceflight* (British Interplanetary Society) Vol. 13, No.3, March 1971, pp. 88,120.
 53. Kerrod, R., “The Journeys of Voyager: NASA Reaches for The Planets”, Mallard Press, London, 1990, pp.8 and 80.
 54. Heppenheimer, T. A., “Countdown: A History of Space Flight”, John Wiley & Sons, Inc., New York 1997, p. 300.
 55. Anderson, J., “Gravity-Assist Navigation”, *Encyclopedia of Planetary Sciences*, 1997, pp. 287-289.
 56. Oberg, J., “The Spacecraft's Got Swing”, *Astronomy*, August 1999, pp. 48-53.
 57. Gates, C. R., Proposed Citation: NASA EXCEPTIONAL SCIENTIFIC ACHIEVEMENT AWARD - 1971.
 58. Minovitch, M. A., “NASA Exceptional Performance Award”, JPL Interoffice Memorandum 393, 1-213, August 11, 1971.
 59. Bourke, R., Directive to Minovitch stating that JPL's "Award's Committee” will not give credit to Minovitch for the invention but will only give him credit for working on it which the Committee believes was invented by some other individual that was not identified, JPL IOM, August 13,1971.
 60. Professor Mieczyslaw Subotowicz, Institute of Physics, M. Curi Sklodowska University, PROPOSAL for AWARD of the NOBEL PRIZE for PHYSICS for 1992 or LATER to Dr. Michael A. MINOVITCH, Nobel Committee for Physics and Chemistry, The Royal Swedish Academy for Sciences, August 21,1991.
 61. Stavro, W., “Origin of Gravity Assist Trajectories”, JPL IOM, April 20,1971.
 62. Letter from Mr. Victor Clarke Jr. (Head of JPL's Trajectory Group during 1960-1964 and Minovitch's supervisor at JPL during the summer of 1961) to Professor Norris Hetherington, Professor of the History of Science, University of Kansas, July 22, 1974. This letter is important because Clarke identifies Minovitch as the person who originated Gravity Propelled Interplanetary Space Travel.
 63. “Slingshot Magic”, Chapter 7 in *The Voyager Neptune Travel Guide*, edited by Charles Kohlbase, JPL Publication 89-24, June 1, 1989, pp. 103-109. This publication is important because it shows that only a few high-level JPL managers

were involved in covering up Minovitch 's invention.

64. Pickering, W. H., “The Grand Tour”, *American Scientist*, Vol. 58, March/April 1970, pp. 148-155. Pickering knew that Minovitch invented Gravity Propelled Interplanetary Space Travel and tried to give him proper credit. But he did not realize the fanatical determination of a few of his subordinates to deny Minovitch this credit.
1. Letter from Geoff Haines-Stiles and Ann Druyan to Minovitch, August 1, 1989.
2. Letter from Professor Roger Broucke (University of Texas) to Res Ridenoure, November 20, 1990.
65. Burrows, W. E., “This New Ocean: The Story of The First Space Age”, Random House, New York, 1997, pp. 455-460.
66. Obituary of Maxwell Hunter (*EducationGuardian.co.uk*).
67. “Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Volume V: Exploring the Cosmos”, Logsdon, J. M. (ed.), *The NASA History Series*, National Aeronautics and Space Administration, NASA History Office, Washington, D.C., page 285.
68. Minovitch, M. A., “Rapid Transit System”, U.S. Patent No. 4/075,948, filed Jan. 31, 1974.
69. Minovitch, M. A., “Rapid Transit System”, U.S. Patent No. 3/954,064, filed May 3, 1974.
70. Minovitch, M. A., “High-Speed Transit System”, U.S. Patent No. 4/148,260, filed April 30, 1976.
71. Minovitch, M. A., “Self-Refueling Space Propulsion System and Operating Method”, U.S. Patent No. 4/754,601, filed December 18, 1984.
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73. Minovitch, M. A., “A Generalized Theory of Classical Rocket Propulsion for Future Space Travel”, *Journal of the British Interplanetary Society*, Vol. 40, No. 8, August 1987, pp.341- 352.

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76. Marinovich, M. A., “Automatic Method And Operating System For Space Construction”, U.S. Patent No. 5/271,583, filed May 12, 1992.
77. Minovitch, M. A., “Machine-Made Gravity-Propelled Interplanetary Space Stations and The Exploration of Mars”, *Journal of the British Interplanetary Society*, Vol. 44, No. 12, December 1991, pp 598-610.
78. Minovitch, M.A, "Electromagnetic Ramjet", U.S. Patent No. 5/052,638, filed March 30, 1989.
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80. Minovitch, M. A., “Electromagnetic Ground to Orbit Propulsion Method and Operating System for High Mass Payloads”, U.S. Patent No. 5/093,313, filed July 10, 1990.
81. Minovitch, M. A., “Space Travel by Microwave Generated Traveling Magnetic Fields”, Phaser Telepropulsion Inc., Technical Report No. 101- 707, Feb 21, 1994.
82. Minovitch, M. A., “Magnetic Propulsion System and Operating Method”, U.S. Patent No. 6/193,194}31, filed September 1, 1998.
83. Minovitch, M. A., “A Propulsion Method for Achieving Commercial Space Travel, Part 1”, *Journal of the British Interplanetary Society*, Vol 50, No. 4, April 1997, pp. 137-148.
84. Minovitch, M. A., “A Propulsion Method for Achieving Commercial Space Travel, Part 2”, *Journal of the British interplanetary Society*, Vol. 50, No. 4, April 1997, pp. 137-148.
85. Minovitch, M. A., “Magnetic Condensing System for Cryogenic Engines”, U.S. Patent No. 6/739,137 B2, issued May 25, 2004.

Dr. Michael A. Minovitch, Inventor



Dr. Michael A. Minovitch passed away on September 16, 2022. His close friend, Bill Cress, is now responsible for ensuring that Minovitch's patents and discoveries are used for the betterment of all.

