**Inventor(s):**
**Werle; Donald K. , Hillside, IL**
**Kasparas; Romas , Riverside, IL**
**Katz; Sidney , Chicago, IL**
**Applicant(s):**
**The United States of America as represented by the Secretary of the Navy, Washington,**
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**Original: 244/136; 040/213; 116/114.F; 241/005;**
**Field of Search: 244/136 040/213 241/5,29 222/3;4 239/171 116/28 R,114**
**R,114 F,114 N,124 R,124 B,124 C**
**Legal Status: Gazette date Code Description (remarks) List all possible codes for US**
**Aug. 12, 1975 A Patent**
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**July 22, 1974 AE Application data**
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**Abstract**

**Light scattering pigment powder particles, surface treated to minimize inparticle cohesive forces, are dispensed from a jet mill deagglomerator as separate single particles to produce a powder contrail having maximum visibility or radiation scattering ability for a given weight material.**
**Attorney, Agent, or Firm: Sciascia; Richard S.; St. Amand; Joseph M.; Primary/Assistant Examiners: Blix; Trygve M.; Kelmachter; Barry L.**

**U.S. References: Show the 1 patent that references this one**
**Patent Issued Inventor(s)**
**Title**
**US1619183* 3 /1927 Bradner et al.**
**US2045865* 6 /1936 Morey**
**US2591988* 4 /1952 Willcox**
**US3531310 9 /1970 Goodspeed et al. PRODUCTION OF IMPROVED METAL OXIDE PIGMENT**
**USR0015771* 2 /1924 Savage**
*** some details unavailable**

**CLAIMS:**
**1. Contrail generation apparatus for producing a powder contrail having**
**maximum radiation**
**scattering ability for a given weight material, comprising:**

**a. an aerodynamic housing;**
**b. a jet tube means passing through said housing, said tube means having an inlet at a forward end of said housing and an exhaust at a rearward end thereof;**

**c. a powder storage means in said housing;**
**d. a deagglomeration means also in said housing;**
**e. means connecting said powder storage means with said deagglomeration means for feeding radiation scattering powder from said powder storage means to said deagglomeration means;**
**f. the output of said deagglomeration means dispensing directly into said jet tube means for exhausting deagglomerated powder particles into the atmosphere to form a contrail; and**
**h. means for controlling the flow of said powder from said storage means to said deagglomeration means.**

**2. Apparatus as in claim 1 wherein said jet tube means is a ram air jet tube.**
**3. Apparatus as in claim 1 wherein an upstream deflector baffle is provided at the output of said deagglomeration means into said jet tube means to produce a venturi effect for minimizing back pressure on said powder feeding means.**
**4. Apparatus as in claim 1 wherein said deagglomerator means comprises:**

**a. means for subjecting powder particles from said powder storage means to a hammering action to aerate and precondition the powder; and**
**b. a jet mill means to further deagglomerate the powder into separate particles.**

**5. Apparatus as in claim 4 wherein pressurized gas means is provided for operating said deagglomeration means.**
**6. Apparatus as in claim 1 wherein said radiation scattering powder particles are titanium dioxide pigment having a median particle size of about 0.3 microns.**
**7. Apparatus as in claim 1 wherein said radiation scattering powder particles have a coating of extremely fine hydrophobic colloidal silica thereon to minimize interparticle cohesive forces.**
**8. Apparatus as in claim 1 wherein the formulation of said powder consists of 85% by weight of $TiO_2$ pigment of approximately 0.3 micron media particle size, 10% by weight of colloidal silica of 0.007 micron primary particle size, and 5% by weight of silica gel having an average particle size of 4.5 microns.**
**9. The method of producing a light radiation scattering contrail, comprising:**

**a. surface treating light scattering powder particles to minimize interparticle cohesive forces;**
**b. deagglomerating said powder particles in two stages prior to dispensing into a jet tube by subjecting said powder particles to a hammering action in the first stage to aerate and precondition the powder, and by passing said powder through a jet mill in the second stage to further deagglomerate the powder;**
**c. dispensing the deagglomerated powder from the jet mill directly into a jet tube for exhausting said powder into the atmosphere, thus forming a contrail.**

**10. A method as in claim 9 wherein said light scattering powder particles is titanium dioxide pigment.**
**11. A method as in claim 9 wherein said powder particles are treated with a coating of extremely fine hydrophobic colloidal silica to minimize interparticle cohesive forces.**
**12. A method as in claim 11 wherein said treated powder particles are further protected with a silica gel powder.**

**Background/Summary:**

**BACKGROUND**

**The present invention relates to method and apparatus for contrail generation and the like. An earlier known method in use for contrail generation involves oil smoke trails produced by injecting liquid oil directly into the hot jet exhaust of an aircraft target vehicle. The oil vaporizes and recondenses being the aircraft producing a brilliant white trail. Oil smoke trail production requires a minimum of equipment; and, the material is low in cost and readily available. However, oil smoke requires a heat source to vaporize the liquid oil and not all aircraft target vehicles, notably towed targets, have such a heat source. Also, at altitudes above about 25,000 feet oil smoke visibility degrades rapidly.**

**SUMMARY**

**The present invention is for a powder generator requiring no heat source to emit a "contrail" with sufficient visibility to aid in visual acquisition of an aircraft target vehicle and the like. The term "contrail" was adopted for convenience in identifying the visible powder trail of this invention. Aircraft target vehicles are used to simulate aerial threats for missile tests and often fly at altitudes between 5,000 and 20,000 feet at speeds of 300 and 400 knots or more. The present invention is also suitable for use in other aircraft vehicles to generate contrails or reflective screens for any desired purpose. The powder contail generator is normally carried on an aircraft in a pod containing a ram air tube and powder feed hopper. Powder particles, surface treated to minimize interparticle cohesive forces are fed from the hopper to a deagglomerator and then to the ram air tube for dispensing as separate single particles to produce a contrail having maximum visibility for a given weight material. Other object, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawing.**

**Drawing Descriptions:**

**DESCRIPTION OF DRAWING**

**FIG. 1 is a schematic sectional side-view of a powder contrail generator of the present invention.**

**DESCRIPTION OF PREFERRED EMBODIMENT**

**The powder contail generator in pod 10, shown in FIG. 1, is provided with a powder feed hopper 12 positioned in the center section of the pod and which feeds a powder 13 to a deagglomerator 14 by means of screw conveyors 16 across the bottom of the hopper. The deagglomerator 14 produces two stages of action. In the first stage of deagglomeration, a shaft 18 having projecting radial rods 19 in compartment 20 is rotated by an air motor 21, or other suitable drive means. The shaft 18 is rotated at about 10,000 rpm, for example. As powder 13 descends through the first stage compartment 20 of the deagglomeration chamber, the hammering action of rotating rods 19 serves to aerate and precondition the powder before the second stage of deagglomeration takes place in the jet mill section 22. In the jet mill 22, a plurality of radial jets 24 (e.g., six 0.050 inch diamter radial jets) direct nitrogen gas (at e.g., 120 psig) inward to provide energy for further deagglomeration of the powder. The N2, or other suitable gas, is provided from storage tanks 25 and 26, for example, in the pod.**

**The jet mill 22 operates in a similar manner to commercial fluid energy mills except that there is no provision for recirculation of oversize particles. Tests with the deagglomerator show that at a feed rate of approximately 11/2 lb/min, treated titanium dioxide powder pigment is effectively dispersed as single particles with very few agglomerates evident.**

**The nitrogen gas stored in cylinder tanks 25 and 26 is charged to 1800 psig, for example. Two stages of pressure reduction, for example, by pressure reduction valves 28 and 29, bring the final delivery pressure at the radial jets 24 and to the air motor 21 to approximately 120 psig. A solenoid valve 30 on the 120 psig line is connected in parallel with the electric motor 32 which operates the powder feeder screws 16 for simultaneous starting and running of the powder feed, the air motor and the jet mill deagglomerator.**

**Air enters ram air tube 34 at its entrance 35 and the exhaust from the jet mill deagglomerator passes directly into the ram air tube. At the deagglomerator exhaust 36 into ram air tube 34, an upstream deflector baffle 38 produces a venturi effect which minimizes back pressure on the powder feed system. The powder is then jetted from the exhaust end 40 of the ram air tube to produce a contrail. A pressure equalization tube, not shown, can be used to connect the top of the closed hopper 12 to the deagglomeration chamber 14. A butterfly valve could be provided at the powder hopper outlet 39 to completely isolate and seal off the powder supply when not in use. Powder 13 could then be stored in hopper 12 for several weeks, without danger of picking up excessive moisture, and still be adequately dispensed.**

**Preparation of the light scatter powder 13 is of a critical importance to production of a powder "contrail" having maximum visibility for a given weight of material. It is essential that the pigment powder particles be dispensed as separate single particles rather than as agglomerates of two or more particles. The**

**powder treatment produces the most easily dispersed powder through the use of surface treatments which minimize interparticle cohesive forces. Titanium dioxide pigment was selected as the primary light scattering material because of its highly efficient light scattering ability and commercially available pigment grades. Titanium dioxide pigment (e.g., DuPont R--931) with a median particle size of about 0.3μ has a high bulk density and is not readily aerosolizable as a submicron cloud without the consumption of a large amount of deagglomeration energy. In order to reduce the energy requirement for deagglomeration, the TiO2 powder is specially treated with a hydrophobic colloidal silica which coats and separates the individual TiO2 pigment particles. The extremely fine particulate nature (0.007μ primary particle size) of Cobot S--101 Silanox grade, for example, of colloidal silica minimizes the amount needed to coat and separate the TiO2 particles, and the hydrophobic surface minimizes the affinity of the powder for absorbtion of moisture from the atmosphere. Adsorbed moisture in powders causes liquid bridges at interparticle contacts and it then becomes necessary to overcome the adsorbed-liquid surface tension forces as well as the weaker Van der Waals' forces before the particles can be separated.**

**The Silanox treated titanium dioxide pigment is further protected from the deleterious effects of adsorbed moisture by incorporation of silica gel. The silica gel preferentially adsorbs water vapor that the powder may be exposed to after drying and before use. The silica gel used is a powder product, such as Syloid 65 from the W. R Grace and Co., Davison Chemical Division, and has an average particle size about 4.5μ and a large capacity for moisture at low humidities.**

**A typical powder composition used is shown in Table 1. This formulation was blended intimately with a Patterson-Kelley Co. twin shell dry LB-model LB--2161 with intensifier. Batches of 1500 g were blended for 15 min. each and packaged in 5-lb cans. The bulk density of the blended powder is 0.22 g/cc. Since deagglomeration is facilitated by having the powder bone dry, the powder should be predried before sealing the cans. In view of long periods (e.g., about 4 months) between powder preparation and use it is found preferable to spread the powder in a thin layer in an open container and place in a 400°F over two days before planned usage. The powder is removed and placed in the hopper about 2 hours before use.**

**Table 1**

**CONTRAIL POWDER FORMULATION**

| Ingredient | % by Weight |
|---|---|
| TiO2 (e.g., DuPont R-931) | 85 |
| median particle size 0.3μ | |
| Colloidal Silica (e.g., Cabot S-101 Silanox) | 10 |
| primary particle size 0.007μ | |
| Silica gel (e.g., Syloid 65) | 5 |
| average particle size 4.5μ | |

**Other type powder compositions can also be used with the apparatus described herein. For example, various powder particles which reflect electromagnetic radiation can be dispensed as a chaff or the like from the contrail generator.**

**Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.**

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**Radio Communication Utilizing the Base of a Striated Barium Plasma**

**http://stinet.dtic.mil/cgi-bin/fulcrum_main.pl?database3DTR_U2&database3DFT_U
2
&numrecords3D25&search.DOC_TEXT3Dbarium**

**A0 (This is hit 16 of 25.) A0**

**AD Number: ADA072167
Subject Categories: RADIO COMMUNICATIONS
Corporate Author: MISSION RESEARCH CORP SANTA BARBARA CALIF
Title: Radio Communication Utilizing the Base of a Striated Barium Plasma.
Descriptive Note: Topical rept. Apr-Jul 78,
Personal Authors: Fulks,G. J. ;Scott,L. D. ;Sowle,D. H. ;Wortman,W. R. ;
Report Date: JUL 1978
Pages: 43 PAGES20
Report Number: MRC-R-401-R
Contract Number: DNA001-78-C-0237
Project Number: S99QAXH TASKNUMBER: B053
Monitor Acronym: DNA,SBI
Monitor Series: 4670T,AD-E300 465
Descriptors: *RADIO TRANSMISSION, *STRIATIONS, NUCLEAR EXPLOSIONS, HIGH
FREQUENCY, PLASMAS(PHYSICS), REFLECTION, NUCLEAR EXPLOSION SIMULATION, CROS
S
SECTIONS, HIGH ALTITUDE, NUCLEAR CLOUDS, COMMUNICATION AND RADIO SYSTEMS,
RADIO SIGNALS, BARIUM, BOTTOM, RADIO RECEPTION.
Identifiers: Avefria operations, Barium clouds, Cloud bases, Base
reflection, PE62704H, WU09**
**Abstract: In conjunction with the DNA barium releases, Avefria I and II, an experiment was undertaken to determine if radio communication was possible off the base of a striated plasma created by these barium releases. A transmitting station was set up to broadcast a steady signal at two HF frequencies toward the base of the barium striations and two receiving stations listened for signal returns on the two frequencies. (The chosen geometry prevented reflections off the sides of the barium cloud from affecting the experiment). One station heard substantial returns while the other heard nothing. Data from the first station provide an estimate of the reflection cross sections for the base of the striated barium cloud. The negative result from the second station arises partly from limited sensitivity of equipment but the upper limit on cross section was less than that seen from the first station. This suggests a directional character for the signal reflected from the base of the cloud.**
**Limitation Code: APPROVED FOR PUBLIC RELEASE
Source Code: 406548**

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**barium reference in haarp patent
[HAARP]
UNITED STATES PATENT
Eastlund
Patent Number: 4,686,605 Date of Patent: Aug. 11, 1987
METHOD AND APPARATUS FOR ALTERING A REGION IN THE EARTH'S
ATMOSPHERE, IONOSPHERE, AND/OR MAGNETOSPHERE**

**Other proposals which have been advanced for altering existing belts of trapped electrons and ions and/or establishing similar artificial belts include injecting charged particles from a satellite carrying a payload of radioactive beta-decay material or alpha emitters; and injecting charged particles from a**

**satellite-borne electron accelerator. Still another approach is described in U.S. Pat. No. 4,042,196 wherein a low energy ionized gas, e.g., hydrogen, is released from a synchronous orbiting satellite near the apex of a radiation belt which is naturally-occurring in the earth's magnetosphere to produce a substantial increase in energetic particle precipitation and, under certain conditions, produce a limit in the number of particles that can be stably trapped. This precipitation effect arises from an enhancement of the whistler-mode and ion-cyclotron mode interactions that result from the ionized gas or "cold plasma" injection.**

**It has also been proposed to release large clouds of barium in the magnetosphere so that photoionization will increase the cold plasma density, thereby producing electron precipitation through enhanced whistler-mode interaction.**

**However, in all of the above-mentioned approaches, the mechanisms involved in triggering the change in the trapped particle phenomena must be actually positioned within the affected zone, e.g., the magnetosphere, before they can be actuated to effect the desired change.**

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**Barium**

**Barium is a chemical element. It has the symbol Ba, and atomic number 56. Barium is a soft silvery metallic alkaline earth metal. It is never found in nature in its pure form due to its reactivity with air. Its oxide is historically known as baryta but it reacts with water and carbon dioxide and is not found as a mineral. The most common naturally occurring minerals are the very insoluble barium sulfate, BaSO4 (barite), and barium carbonate, BaCO3 (witherite). Benitoite is a rare gem containing barium.**
**Contents**
**[hide]**



**Notable characteristics**

**Barium is a metallic element that is chemically similar to calcium but more reactive. This metal oxidizes very easily when exposed to air and is highly reactive with water or alcohol, producing hydrogen gas. Burning in air or oxygen produces not just barium oxide (BaO) but also the peroxide. Simple compounds of this heavy element are notable for their high specific gravity. This is true of the most common barium-bearing mineral, its sulfate barite BaSO4, also called 'heavy spar' due to the high density.**

**Applications**

**Barium has some medical and many industrial uses:**

*** Barium compounds, and especially barite ($BaSO_4$), are extremely important to the petroleum industry. Barite is used in drilling mud, a weighting agent in drilling new oil wells.**
*** Barium sulfate is used as a radiocontrast agent for X-ray imaging of the digestive system ("barium meals" and "barium enemas").**
*** Barium carbonate is a useful rat poison and can also be used in making bricks. Unlike the sulfate, the carbonate dissolves in stomach acid, allowing it to be poisonous.**
*** An alloy with nickel is used in spark plug wire.**
*** Barium oxide is used in a coating for the electrodes of fluorescent lamps, which facilitates the release of electrons.**
*** The metal is a "getter" in vacuum tubes, to remove the last traces of oxygen.**
*** Barium carbonate is used in glassmaking. Being a heavy element, barium increases the refractive index and luster of the glass.**
*** Barite is used extensively in rubber production.**
*** Barium nitrate and chlorate give green colors in fireworks.**
*** Impure barium sulfide phosphoresces after exposure to the light.**
*** Lithopone, a pigment that contains barium sulfate and zinc sulfide, is a permanent white that has good covering power, and does not darken in when exposed to sulfides.**
*** Barium peroxide can be used as a catalyst to start an aluminothermic reaction when welding rail tracks together. It can also be used in green tracer ammunition.**
*** Barium titanate was proposed in 2007[2] to be used in next generation battery technology for electric cars.**
*** Barium Fluoride is used in infrared applications.**
*** Barium is a key element in YBCO superconductors.**

**History**

**Barium (Greek barys, meaning "heavy") was first identified in 1774 by Carl Scheele and extracted in 1808 by Sir Humphry Davy in England. The oxide was at first called barote, by Guyton de Morveau, which was changed by Antoine Lavoisier to baryta, from which "barium" was derived to describe the metal.**

**Occurrence**

**Because barium quickly becomes oxidized in air, it is difficult to obtain this metal in its pure form. It is primarily found in and extracted from the mineral barite which is crystallized barium sulfate. Because barite is so insoluble, it cannot be used directly for the preparation of other barium compounds. Instead, the ore is heated with carbon to reduce it to barium sulfide[1]**

**BaSO4 + 2C °ú BaS + 2CO2**

**The barium sulfide is then hydrolyzed or reacted with acids to form other barium compounds such as the chloride, nitrate, and carbonate.**

**Barium is commercially produced through the electrolysis of molten barium chloride ($BaCl_2$) Isolation (* follow):**

**(cathode) Ba2+* + 2e- °ú Ba**
**(anode) Cl-* °ú Å0Ü5Cl2 (g) + e-**

**Compounds**

**The most important compounds are barium peroxide, barium chloride, sulfate, carbonate, nitrate, and chlorate.**

**Isotopes**

**Main article: isotopes of barium**

**Naturally occurring barium is a mix of seven stable isotopes. There are twenty-two isotopes known, but**

**most of these are highly radioactive and have half-lives in the several millisecond to several minute range. The only notable exceptions are 133Ba which has a half-life of 10.51 years, and 137mBa (2.55 minutes).**

**Precautions**

**All water or acid soluble barium compounds are extremely poisonous. At low doses, barium acts as a muscle stimulant, while higher doses affect the nervous system, causing cardiac irregularities, tremors, weakness, anxiety, dyspnea and paralysis. This may be due to its ability to block potassium ion channels which are critical to the proper function of the nervous system.**

**Barium sulfate can be taken orally because it is highly insoluble in water, and is eliminated completely from the digestive tract. Unlike other heavy metals, barium does not bioaccumulate.[2] However, inhaled dust containing barium compounds can accumulate in the lungs, causing a benign condition called baritosis.**

**Oxidation occurs very easily and, to remain pure, barium should be kept under a petroleum-based fluid (such as kerosene) or other suitable oxygen-free liquids that exclude air.**

**Barium acetate could lead to death in high doses. Marie Robards poisoned her father with the substance in Texas in 1993. She was tried and convicted in 1996.**

**References**

**1. Toxicological Profile for Barium and Barium Compounds. Agency for Toxic Substances and Disease Registry, CDC. 2007. [1]**
**2. Toxicity Profiles, Ecological Risk Assessment | Region 5 Superfund | US EPA**

**External links**
**Wikimedia Commons has media related to:**
**Barium**
**Look up barium in**
**Wiktionary, the free dictionary.**

*** WebElements.com ®C Barium**
*** Elementymology & Elements Multidict**

**Periodic Table[show]**
**H He**
**Li Be B C N O F Ne**
**Na Mg Al Si P S Cl Ar**
**K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr**
**Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe**
**Cs Ba La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn**
**Fr Ra Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr Rf Db Sg Bh Hs Mt Ds Rg Uub Uut Uuq Uup Uuh Uus Uuo**

**Alkali metals Alkaline earth metals Lanthanides Actinides Transition elements Other metals Metalloids Other nonmetals Halogens Noble gases**



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**Chronic Barium Intoxication**
**http://www.ncbi.nlm.nih.gov/sites/entrez?cmdRetrieve&dbpubmed&doptAbstractPlus&list_uids15082100&query_hl2**
**Chronic barium intoxication disrupts sulphated proteoglycan synthesis: a hypothesis for the origins of multiple sclerosis.**
**Purdey M.**
**High Barn Farm, Elworthy, Taunton, Somerset TA43PX, UK. tsepurdey@aol.com**
**High level contamination by natural and industrial sources of the alkali earth metal, barium (Ba) has been identified in the ecosystems/workplaces that are associated with high incidence clustering of multiple sclerosis (MS) and other neurodegenerative diseases such as the transmissible spongiform encephalopathies (TSEs) and amyotrophic lateral sclerosis (ALS). Analyses of ecosystems supporting the most renowned MS clusters in Saskatchewan, Sardinia, Massachusetts, Colorado, Guam, NE Scotland demonstrated consistently elevated levels of Ba in soils (mean: 1428 ppm) and vegetation (mean: 74 ppm) in relation to mean levels of 345 and 19 ppm recorded in MS-free regions adjoining. The high levels of Ba stemmed from local quarrying for Ba ores and/or use of Ba in paper/foundry/welding/textile/oil and gas well related industries, as well as from the use of Ba as an atmospheric aerosol spray for enhancing/refracting the signalling of radio/radar waves along military jet flight paths, missile test ranges, etc. It is proposed that chronic contamination of the biosystem with the reactive types of Ba salts can initiate the pathogenesis of MS; due to the conjugation of Ba with free sulphate, which subsequently deprives the endogenous sulphated proteoglycan molecules (heparan sulfates) of their sulphate co partner, thereby disrupting synthesis of S-proteoglycans and their crucial role in the fibroblast growth factor (FGF) signalling which induces oligodendrocyte progenitors to maintain the growth and structural integrity of the myelin sheath. Loss of S-proteoglycan activity explains other key facets of MS pathogenesis; such as the aggregation of platelets and the proliferation of superoxide generated oxidative stress. Ba intoxications disturb the sodium-potassium ion pump--another key feature of the MS profile. The co-clustering of various neurodegenerative diseases in these Ba-contaminated ecosystems suggests that the pathogenesis of all of these diseases could pivot upon a common disruption of the sulphated proteoglycan-growth factor mediated signalling systems. Individual genetics dictates which specific disease emerges at the end of the day.**
**PMID: 15082100 [PubMed - indexed for MEDLINE]**

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**A Partial List Of Patents Pertaining to ENMOD**

**Thanks to Lorie Kramer the Seektress**

**1338343 - April 27, 1920 - Process And Apparatus For The Production of Intense Artificial Clouds, Fogs, or Mists**
**1619183 - March 1, 1927 - Process of Producing Smoke Clouds From Moving Aircraft**
**1631753 - June 7, 1927 - Electric Heater - Referenced in 3990987**
**1665267 - April 10, 1928 - Process of Producing Artificial Fogs**
**1892132 - December 27, 1932 - Atomizing Attachment For Airplane Engine Exhausts**
**1928963 - October 3, 1933 - Electrical System And Method**
**1957075 - May 1, 1934 - Airplane Spray Equipment**
**2097581 - November 2, 1937 - Electric Stream Generator - Referenced in 3990987**

**2409201 - October 15, 1946 - Smoke Producing Mixture**
**2476171 - July 18, 1945 - Smoke Screen Generator**
**2480967 - September 6, 1949 - Aerial Discharge Device**
**2550324 - April 24, 1951 - Process For Controlling Weather**
**2510867 - October 9, 1951 - Method of Crystal Formation and Precipitation**
**2582678 - June 15, 1952 - Material Disseminating Apparatus For Airplanes**
**2591988 - April 8, 1952 - Production of TiO2 Pigments - Referenced in 3899144**
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**2633455 - March 31, 1953 - Smoke Generator**
**2688069 - August 31, 1954 - Steam Generator - Referenced in 3990987**
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**2730402 - January 10, 1956 - Controllable Dispersal Device**
**2801322 - July 30, 1957 - Decomposition Chamber for Monopropellant Fuel - Referenced in 3990987**
**2881335 - April 7, 1959 - Generation of Electrical Fields**
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**2986360 - May 30, 1962 - Aerial Insecticide Dusting Device**
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**3534906 - October 20, 1970 - Control of Atmospheric Particles**
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**3564253 - February 16, 1971 - System And Method For Irradiation Of Planet Surface Areas**
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**3630950 - December 28, 1971 - Combustible Compositions For Generating Aerosols, Particularly Suitable For Cloud Modification And Weather Control And Aerosolization Process**
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**3899129 - August 12, 1975 - Apparatus for generating ice nuclei smoke particles for weather modification**
**3899144 - August 12, 1975 - Powder contrail generation**
**3940059 - February 24, 1976 - Method For Fog Dispersion**
**3940060 - February 24, 1976 - Vortex Ring Generator**
**3990987 - November 9, 1976 - Smoke generator**
**3992628 - November 16, 1976 - Countermeasure system for laser radiation**
**3994437 - November 30, 1976 - Broadcast dissemination of trace quantities of biologically active chemicals**
**4042196 - August 16, 1977 - Method and apparatus for triggering a substantial change in earth characteristics and measuring earth changes**
**RE29,142 - February 22, 1977 - Reissue of: 03630950 - Combustible compositions for generating aerosols, particularly suitable for cloud modification and weather control and aerosolization process**
**4035726 - July 12, 1977 - Method of controlling and/or improving high-latitude and other communications or radio wave surveillance systems by partial control of radio wave et al**
**4096005 - June 20, 1978 - Pyrotechnic Cloud Seeding Composition**
**4129252 - December 12, 1978 - Method and apparatus for production of seeding materials**
**4141274 - February 27, 1979 - Weather modification automatic cartridge dispenser**
**4167008 - September 4, 1979 - Fluid bed chaff dispenser**
**4347284 - August 31, 1982 - White cover sheet material capable of reflecting ultraviolet rays**
**4362271 - December 7, 1982 - Procedure for the artificial modification of atmospheric precipitation as well as compounds with a dimethyl sulfoxide base for use in carrying out said procedure**
**4402480 - September 6, 1983 - Atmosphere modification satellite**
**4412654 - November 1, 1983 - Laminar microjet atomizer and method of aerial spraying of liquids**
**4415265 - November 15, 1983 - Method and apparatus for aerosol particle absorption spectroscopy**
**4470544 - September 11, 1984 - Method of and Means for weather modification**
**4475927 - October 9, 1984 - Bipolar Fog Abatement System**
**4600147 - July 15, 1986 - Liquid propane generator for cloud seeding apparatus**
**4633714 - January 6, 1987 - Aerosol particle charge and size analyzer**
**4643355 - February 17, 1987 - Method and apparatus for modification of climatic conditions**
**4653690 - March 31, 1987 - Method of producing cumulus clouds**
**4684063 - August 4, 1987 - Particulates generation and removal**
**4686605 - August 11, 1987 - Method and apparatus for altering a region in the earth's atmosphere, ionosphere, and/or magnetosphere**
**4704942 - November 10, 1987 - Charged Aerosol**
**4712155 - December 8, 1987 - Method and apparatus for creating an artificial electron cyclotron heating region of plasma**
**4744919 - May 17, 1988 - Method of dispersing particulate aerosol tracer**
**4766725 - August 30, 1988 - Method of suppressing formation of contrails and solution therefor**
**4829838 - May 16, 1989 - Method and apparatus for the measurement of the size of particles entrained in a gas**
**4836086 - June 6, 1989 - Apparatus and method for the mixing and diffusion of warm and cold air for dissolving fog**
**4873928 - October 17, 1989 - Nuclear-sized explosions without radiation**
**4948257 - August 14, 1990 - Laser optical measuring device and method for stabilizing fringe pattern spacing**
**4948050 - August 14, 1990 - Liquid atomizing apparatus for aerial spraying**
**4999637 - March 12, 1991 - Creation of artificial ionization clouds above the earth**
**5003186 - March 26, 1991 - Stratospheric Welsbach seeding for reduction of global warming**
**5005355 - April 9, 1991 - Method of suppressing formation of contrails and solution therefor**
**5038664 - August 13, 1991 - Method for producing a shell of relativistic particles at an altitude above the earths surface**
**5041760 - August 20, 1991 - Method and apparatus for generating and utilizing a compound plasma configuration**

**5041834 - August 20, 1991 - Artificial ionospheric mirror composed of a plasma layer which can be tilted**
**5056357 - October 15, 1991- Acoustic method for measuring properties of a mobile medium**
**5059909 - October 22, 1991 - Determination of particle size and electrical charge**
**5104069 - April 14, 1992 - Apparatus and method for ejecting matter from an aircraft**
**5110502 - May 5, 1992 - Method of suppressing formation of contrails and solution therefor**
**5156802 - October 20, 1992 - Inspection of fuel particles with acoustics**
**5174498 - December 29, 1992 - Cloud Seeding**
**5148173 - September 15, 1992 - Millimeter wave screening cloud and method**
**5245290 - September 14, 1993 - Device for determining the size and charge of colloidal particles by measuring electroacoustic effect**
**5286979 - February 15, 1994 - Process for absorbing ultraviolet radiation using dispersed melanin**
**5296910 - March 22, 1994 - Method and apparatus for particle analysis**
**5327222 - July 5, 1994 - Displacement information detecting apparatus**
**5357865 - October 25, 1994 - Method of cloud seeding**
**5360162 - November 1, 1994 - Method and composition for precipitation of atmospheric water**
**5383024 - January 17, 1995 - Optical wet steam monitor**
**5425413 - June 20, 1995 - Method to hinder the formation and to break-up overhead atmospheric inversions, enhance ground level air circulation and improve urban air quality**
**5434667 - July 18, 1995 - Characterization of particles by modulated dynamic light scattering**
**5441200 - August 15, 1995 - Tropical cyclone disruption**
**5486900 - January 23, 1996 - Measuring device for amount of charge of toner and image forming apparatus having the measuring device**
**5556029 - September 17, 1996 - Method of hydrometeor dissipation (clouds)**
**5628455 - May 13, 1997 - Method and apparatus for modification of supercooled fog**
**5631414 - May 20, 1997 - Method and device for remote diagnostics of ocean-atmosphere system state**
**5639441 - June 17, 1997 - Methods for fine particle formation**
**5762298 - June 9, 1998 - Use of artificial satellites in earth orbits adaptively to modify the effect that solar radiation would otherwise have on earth's weather**
**5912396 - June 15, 1999 - System and method for remediation of selected atmospheric conditions**
**5922976 - July 13, 1999 - Method of measuring aerosol particles using automated mobility-classified aerosol detector**
**5949001 - September 7, 1999 - Method for aerodynamic particle size analysis**
**5984239 - November 16, 1999 - Weather modification by artificial satellite**
**6025402 - February 15, 2000 - Chemical composition for effectuating a reduction of visibility obscuration, and a detoxifixation of fumes and chemical fogs in spaces of fire origin**
**6030506 - February 29, 2000 - Preparation of independently generated highly reactive chemical species**
**6034073 - March 7, 2000 - Solvent detergent emulsions having antiviral activity**
**6045089 - April 4, 2000 - Solar-powered airplane**
**6056203 - May 2, 2000 - Method and apparatus for modifying supercooled clouds**
**6110590 - August 29, 2000 - Synthetically spun silk nanofibers and a process for making the same**
**6263744 - July 24, 2001 - Automated mobility-classified-aerosol detector**
**6281972 - August 28, 2001 - Method and apparatus for measuring particle-size distribution**
**6315213 - November 13, 2001 - Method of modifying weather**
**6382526 - May 7, 2002 - Process and apparatus for the production of nanofibers**
**6408704 - June 25, 2002 - Aerodynamic particle size analysis method and apparatus**
**6412416 - July 2, 2002 - Propellant-based aerosol generation devices and method**
**6520425 - February 18, 2003 - Process and apparatus for the production of nanofibers**
**6539812 - April 1, 2003 - System for measuring the flow-rate of a gas by means of ultrasound**
**6553849 - April 29, 2003 - Electrodynamic particle size analyzer**
**6569393 - May 27, 2003 - Method and device for cleaning the atmosphere**

**Below are the first 50 results of a random patent search utilizing the keywords WIRELESS and ANTENNA**

**1 6,999,795 System and method utilizing dynamic beam forming for wireless communication signals**
**2 6,999,780 Method and system for determining the altitude of a mobile wireless device**
**3 6,999,724 Slowing the observed rate of channel fluctuations in a multiple antenna system**
**4 6,999,044 Reflector antenna system including a phased array antenna operable in multiple modes and related methods**

**5 6,999,041 Dual frequency antennas and associated down-conversion method**
**6 6,999,040 Transverse device array phase shifter circuit techniques and antennas**
**7 6,999,036 Mobile antenna system for satellite communications**
**8 6,998,937 Controlling a phase delay line by adding and removing a fluidic dielectric**
**9 6,998,843 RF coil and magnetic resonance imaging apparatus**
**10 6,997,934 Atherectomy catheter with aligned imager**
**11 6,997,923 Method and apparatus for EMR treatment**
**12 6,997,876 Ultrasound clutter filtering with iterative high pass filter selection**
**13 6,997,863 Thermotherapy via targeted delivery of nanoscale magnetic particles**
**14 6,997,555 Method for determining vision defects and for collecting data for correcting vision defects of the eye by interaction of a patient with an examiner and apparatus therefor**
**15 6,996,480 Structural health monitoring system utilizing guided lamb waves embedded ultrasonic structural radar**
**16 6,996,372 Mobility management-radio resource layer interface system and method for handling dark beam scenarios**
**17 6,995,884 Fluorinated crosslinked electro-optic materials and electro-optic devices therefrom**
**18 6,995,728 Dual ridge horn antenna**
**19 6,995,726 Split waveguide phased array antenna with integrated bias assembly**
**20 6,995,712 Antenna element**
**21 6,995,705 System and method for doppler track correlation for debris tracking**
**22 6,995,561 Multiple channel, microstrip transceiver volume array for magnetic resonance imaging**
**23 6,995,560 Chemical species suppression for MRI imaging using spiral trajectories with off-resonance correction**
**24 6,995,559 Method and system for optimized pre-saturation in MR with corrected transmitter frequency of pre-pulses**
**25 6,995,557 High resolution inductive sensor arrays for material and defect characterization of welds**
**26 6,993,898 Microwave heat-exchange thruster and method of operating the same**
**27 6,993,394 System method and apparatus for localized heating of tissue**
**28 6,993,361 System and method utilizing dynamic beam forming for wireless communication signals**
**29 6,993,315 Super-regenerative microwave detector**
**30 6,993,064 Multi-user receiving method and receiver**
**31 6,992,639 Hybrid-mode horn antenna with selective gain**
**32 6,992,638 High gain, steerable multiple beam antenna system**
**33 6,992,632 Low profile polarization-diverse herringbone phased array**
**34 6,992,621 Wireless communication and beam forming with passive beamformers**
**35 6,992,539 Method and apparatus of obtaining balanced phase shift**
**36 6,992,321 Structure and method for fabricating semiconductor structures and devices utilizing piezoelectric materials**
**37 6,991,917 Spatially directed ejection of cells from a carrier fluid**
**38 6,990,360 Pattern detection using the Bragg Effect at RF frequencies**
**39 6,990,338 Mobile wireless local area network and related methods**
**40 6,990,314 Multi-node point-to-point satellite communication system employing multiple geo satellites**
**41 6,990,223 Adaptive data differentiation and selection from multi-coil receiver to reduce artifacts in reconstruction**
**42 6,989,991 Thermal management system and method for electronic equipment mounted on coldplates**
**43 6,989,799 Antenna assembly including a dual flow rotating union**
**44 6,989,797 Adaptive antenna for use in wireless communication systems**
**45 6,989,795 Line-replaceable transmit/receive unit for multi-band active arrays**
**46 6,989,791 Antenna-integrated printed wiring board assembly for a phased array antenna system**
**47 6,989,787 Antenna system for satellite communication and method for tracking satellite signal using the same**
**48 6,989,673 Method and apparatus to reduce RF power deposition during MR data acquisition**
**49 6,988,411 Fluid parameter measurement for industrial sensing applications using acoustic pressures**
**50 6,988,026 Wireless and powerless sensor and interrogator**